The Health System Costs of Postabortion Care in Senegal

CONTEXT: *Unsafe abortion is common in Senegal, but postabortion care (PAC) is not accessible to some women who need it, and the cost to the health care system of providing PAC is unknown.*

METHODS: *The cost to Senegal's health system of providing PAC in 2016—at existing service levels and if access were hypothetically expanded—was estimated using the Post-Abortion Care Costing Methodology, a bottom-up, ingredients-based approach. From September 2016 to January 2017, face-to-face interviews were conducted with PAC providers and facility administrators at a national sample of 41 health facilities to collect data on the direct and indirect costs of care provision, as well as the fees charged to patients. A sensitivity analysis was conducted to examine the precision of the results.*

RESULTS: *In total, 1,642 women received PAC at study facilities in 2016, which translates to 18,806 women receiving PAC nationally. Public facilities provided nearly all services. The average cost per patient at study facilities was US$26.68; nationally, the estimated cost was US$24.72. The estimated total national cost of providing PAC at existing levels was US$464,928; direct costs accounted for more than three-quarters of the cost. Charges to PAC patients amounted to 20% of all incurred costs. If service provision had been expanded to meet all PAC needs, estimated total costs to the health system would have been US$804,518.*

CONCLUSION: *The annual costs of PAC are substantial in Senegal. Greater investment in ensuring access to contraceptives could lower these costs by reducing the number of unintended pregnancies that often lead to unsafe abortion.*

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African countries have made significant progress toward meeting their development goals during the past two decades. Living standards are improving, and gender gaps in education and health are closing as countries strive to achieve their Sustainable Development Goal targets.[1] However, sexual and reproductive health and rights remain a priority for further attention and investment across the continent. The maternal mortality ratio in Sub-Saharan Africa (546 maternal deaths per 100,000 live births in 2015) is higher than that in any other global region.[2] Unsafe abortion—which occurs most frequently where laws are restrictive and access to safe services is limited[3]—is a significant contributor to maternal mortality, and accounted for at least 10% of maternal deaths in the region from 2003 to 2012.[4]

Although the maternal mortality ratio in Senegal—the setting for this study—declined by 1.4% between 2000 and 2015, it remains high (454 per 100,000 live births).[5] Abortion is prohibited in Senegal under all circumstances,[6] but evidence suggests that it still occurs, often under unsafe conditions. Sedgh and colleagues estimated that in 2012, the country's abortion rate was 17 per 1,000 women aged 15–44.[7] Estimates further suggest that more than two-thirds of abortions in 2012 were performed by untrained professionals, and that 55% resulted in complications; 58% of women with complications, or more than 16,700 women, received medical treatment.[8]

Treatment of complications resulting from spontaneous or induced abortion is referred to as postabortion care (PAC). For incomplete abortion, the World Health Organization (WHO) recommends use of vacuum aspiration—including manual vacuum aspiration (MVA)—or misoprostol to remove the products of conception, as well as nondirective counselling and voluntary postabortion contraception.[9,10] In more serious cases, such as those involving vaginal and cervical lacerations or uterine perforations, PAC may also entail more intensive interventions and require inpatient hospital care.[11] PAC has been championed—globally and in Senegal—as a harm reduction strategy for reducing mortality from unsafe abortion.[12] For this reason, PAC is legal in Senegal, and efforts have been made to expand access to the service nationwide.[13] As early as the late 1990s, the Senegalese Ministry of Health facilitated development of national standards for the provision of PAC, including guidance on the use of MVA by midwives.[13–15]

Research in low- and middle-income countries where unsafe abortion is prevalent has shown that providing PAC services can be costly for health systems.[16–20] Further, the need for PAC services often exceeds actual provision of

care, meaning that costs could be higher if health systems were able to accommodate all need for the service. The average (i.e., per woman) and total costs of offering PAC in Senegal is not known, nor is the cost of meeting the country's scaled-up commitments for provision of this care.

Although provision of PAC can be costly for health systems, these costs are largely avoidable. Improving access to contraceptives has been shown to reduce rates of unintended pregnancy and abortion in many settings globally.[21] In the absence of more permissive abortion laws, increased contraceptive uptake could mitigate a significant portion of PAC costs by reducing the unintended pregnancies that so often lead to unsafe abortion.[21]

The Senegalese health system includes both public- and private-sector care, though access to private care is limited. In 2012, only 4% of the facilities thought to be offering PAC services were private facilities.[7] In the public and private sectors, out-of-pocket payments for health services are commonplace;[22] although public, private and community-based health insurance schemes (including a national scheme) are available to defray costs,[23,24] some segments of the population continue to face catastrophic care costs due to inaccessibility of these insurance schemes.[22]

To help local policymakers better understand the opportunity cost of spending on PAC, we estimated the cost to the Senegalese health system in 2016 of providing PAC for complications of induced abortion—both at the existing service provision level and at the level that would occur if access were expanded to meet all need for PAC services. We also documented patients' monetary contributions toward their care, to highlight the magnitude of out-of-pocket spending for PAC, an important component in discussion of affordability. Finally, because PAC costs can be averted and maternal health improved through reductions in unintended pregnancy, we discuss how our findings compare with global and regional estimates of costs associated with expanding contraceptive access.

DATA AND METHODS

We used a pretested methodology—the Post-Abortion Care Costing Methodology (PACCM)—to estimate PAC costs from the health provider perspective; PACCM has been used to estimate the costs of PAC following induced abortion in a number of countries.[16–18,25,26] The methodology is a bottom-up "ingredients" approach to costing in which information on the resources used in providing care is collected through interviews; the costs of the various types of resources are then assessed and added together. Ethical clearance for the study was obtained from the Guttmacher Institute's institutional review board and the National Ethics Committee for Health Research at the Ministry of Health and Social Action in Senegal.

Sample Selection and Fieldwork

In 2012, Sedgh and colleagues established a list of all public and private health facilities in Senegal that were staffed and equipped to provide PAC.[7] From that list, they selected 168 of the facilities, which represented primary, secondary and tertiary care facilities in all of the country's 14 regions. Specifically, they first randomly selected one rural, one urban and one "intermediate" department (administrative subdivision) in each of the country's four zones. Then, within each chosen department, they selected 100% of health centers, district hospitals and private clinics, and a random sample of 50% of health posts. They also selected all teaching hospitals and regional hospitals (except military hospitals) that offered reproductive health services. They then checked with each facility and eliminated any that reported not currently offering PAC services.

For this costing study, we selected a subset of the 168 facilities included in the earlier study. With the assistance of a panel of Senegalese medical experts, which was assembled based on direction from the Senegalese Ministry of Health, we purposively selected 44 health facilities that provided PAC. The aims during selection were to include facilities representing a range of geographic locations and types (e.g., national- and district-level hospitals; public and private health centers), to capture variation in PAC patients and the treatment they receive and to ensure efficiency in data collection. Three facilities were later excluded because they no longer provided PAC services or because they were deemed too remote to reach during the short duration of this study. The final sample consisted of 41 facilities located in five of Senegal's 14 regions, including Dakar Region, where the country's capital is located. Most (85%) of the facilities were public, and 41% were located in Dakar (Table 1).

Costing

Between September 2016 and January 2017, we conducted face-to-face interviews with purposively selected respondents—facility administrators and PAC service providers—at the 41 selected facilities. Interviewers collected information on resource usage (e.g., personnel time, drugs, supplies) and service volume, as well as some cost data, during the interviews using two structured questionnaires, which we refer to as A and B.

Questionnaire A elicited information on annual service volume, personnel costs, and capital and overhead costs (see Appendix Table 1 for a detailed description of the

TABLE 1. Study sample of health facilities that provided postabortion care services, by type, according to region, Senegal, 2016

Facility type	All		Dakar		Other regions*	
	No.	%	No.	%	No.	%
Public	**35**	**85**	**15**	**88**	**20**	**83**
Tertiary hospitals	4	10	4	24	0	0
Secondary hospitals	8	20	1	6	7	29
Department hospitals	1	2	0	0	1	4
Health centers	9	22	5	29	4	17
Health posts	13	32	5	29	8	33
Private	**6**	**15**	**2**	**12**	**4**	**17**
Total	**41**	**100**	**17**	**100**	**24**	**100**

*Thies, Tamba, Saint Louis and Kaolack.

cost data collected). The interviewer asked respondents to provide estimates of the number of PAC patients who received care at the facility each year and the proportion who were treated as inpatients. Respondents were also asked to estimate the proportion who were treated for five types of complications, which together account for the vast majority of PAC cases: incomplete abortion, shock, sepsis, lacerations and perforations. In addition, we asked about the proportion of PAC patients treated for other, rare complications, though we did not assess the costs of managing those complications.

To estimate the personnel costs for treating complications in each of the five main categories, the interviewer used Questionnaire A to collect information on the proportion of cases that would be attended by various types of clinical staff (e.g., nurse, doctor, gynecologist, pharmacist, sonographer). This was followed by questions on the average number of minutes spent by each staff type during the full course of a patient's treatment for each complication category. Questionnaire A also included questions on the number of support staff (e.g., receptionists, cleaners, cooks) at the facility, the amount of time spent by clinical staff on PAC-related administrative responsibilities, and the estimated value of monthly remuneration packages for clinical and support staff.

Finally, Questionnaire A asked for information on capital and overhead costs. Respondents were asked to estimate the cost of constructing a facility similar to the one where they worked, the cost of equipping the facility (including the costs of furniture, vehicles, and specialized machines and equipment) and annual costs for various operational services (electricity, security, waste removal).

Questionnaire B included detailed questions about per-patient use of additional medical resources. These resources, which we refer to as "supplies" for ease of reference, included small equipment, laboratory tests, medications and consumable supplies. For each of the five main complication types, respondents were asked to estimate the proportion of patients who required each supply item and, if used, the quantity of the item. The list of possible supplies was established prior to the interviews and was based on experience implementing the PACCM in other countries, on the WHO's mother-baby package costing spreadsheet[27] and on input from the panel of experts knowledgeable about PAC service provision in Senegal. The questionnaire also prompted respondents to provide information about additional supplies used for PAC that were not included in the list.

We determined the purchase price for the supplies included in Questionnaire B using a number of sources. We primarily used the Senegalese Ministry of Health and Social Actions' product information bulletin,[28] which is a listing of prices that facilities must pay to acquire supplies from a central distribution facility. If costs for required supplies were not listed in the product bulletin, we turned to the International Medical Products Price Guide (IMPPG) maintained by Management Sciences for Health.[29] If a price was not available on the IMPPG website, we turned to product catalogs distributed by regional health commodity wholesalers listed on the website.[30,31]

Costs reported in this article are presented in 2016 U.S. dollars in the text and tables, and in 2016 Senegalese francs (officially called West African CFA francs, or XOF) in the text only. Where required, we inflated or deflated costs to 2016 values using currency-specific consumer price indices,[32] and then converted non-dollar currencies to dollars using the average annual exchange rate for 2016.[33] We annualized building and equipment costs using locally recommended depreciation periods[34] and a discount rate of 5% (in accordance with generally accepted practice).[35,36]

Questionnaire data were entered into an Excel-based data collection tool that used Visual Basic for Applications programming to guide the interviewer and restrict entries to values within valid ranges. The data were then exported to a separate Excel model built for this analysis.

Estimates of Study Facility Costs

For each facility, we estimated direct, indirect and total costs, as well as fees paid by patients for management of each of the five main complication types. We defined direct (or incremental) costs as the sum of costs for clinical personnel time and those for other medical resources (small equipment, diagnostic tests, medication and consumable supplies). Indirect costs were defined as capital and overhead costs, costs for support staff (e.g., receptionists, security staff) and administrative costs incurred by clinical staff (e.g., for record keeping, stock taking, attending meetings).

• *Direct costs: clinical personnel.* To estimate clinical staff costs, we first calculated the cost per minute per staff type at each facility using data on reported annual salaries and monthly working hours. Then, we calculated the average cost per minute per staff type at each facility level, separately for public and private facilities. At each facility and for each complication type, study respondents had noted the proportion of PAC patients seen by clinical staff of each type. If clinical staff of a particular type saw any proportion of PAC patients, we multiplied that proportion by the number of minutes spent per patient, and multiplied that by the average cost per minute of the staff's time to produce the direct personnel cost per PAC patient. Finally, we summed the costs of time spent treating a patient by all health workers involved in a patient's care, which yielded the total direct personnel cost for managing patients with each type of complication at each facility.

• *Direct costs: supplies.* To estimate the direct costs of supplies (consumables, small equipment, laboratory tests and medications) required for PAC, we followed an approach similar to that used for direct personnel costs. Information on unit costs for each supply item were gathered as noted earlier; the individual supply costs were assumed to be constant across all facilities. At each facility and for each type of complication, we multiplied the proportion of patients requiring the item by the volume required and multiplied that by the unit cost. We then summed all

supply costs to estimate the total direct cost per patient for each complication type at each facility.

• *Direct costs: total.* Total direct costs were the sum of personnel and supply costs for all complication types, as one PAC patient could have more than one type of complication. We first present average total direct costs by complication type, and then by region and facility type. The costs per complication type represent the average costs for treating only that type of complication. For the estimates by region and facility type, the average costs represent the weighted average cost for managing any patient (including those with multiple complications) within the facility or region category.

• *Indirect costs: capital costs and overhead.* To attribute capital costs to individual PAC patients, we divided the annualized cost of constructing and equipping each facility by the number of patients seen for any service in the facility per year. Similarly, for overhead costs, we divided the annual cost of operations at each facility (Appendix Table 1) by the number of patients seen for any service in the facility per year. The resulting average per patient capital and overhead costs were assumed to be constant for any patient, including PAC patients.

• *Indirect costs: administrative staff.* We estimated the costs of support staff by summing the annual wage bill for all support staff at each facility and dividing that by the total number of patients seen annually. We also collected information on the administrative time spent per week by clinical personnel (e.g., reviewing files, in ward meetings). That time was multiplied by the average cost per minute per health care worker to produce the total cost of administrative support provided by clinical staff per week. The resulting cost was divided by the number of maternal and child health patients seen weekly at each facility to produce the cost per patient; we assumed the cost would be constant for all such patients, including PAC patients.

• *Indirect costs: total.* Total indirect costs represent the sum of capital, overhead and administrative personnel costs. We present these costs by region and facility type. Note that although direct costs were calculated per complication type, and that a patient could have more than one complication requiring care, indirect costs were assumed to apply per patient regardless of the number of complications managed.

• *Total costs for costing-study patients.* Finally, we summed the direct and indirect costs to produce estimates of the total costs for management of complications of induced abortion in the study facilities.

Estimates of National-Level Costs

Sedgh and colleagues estimated the national abortion rate for Senegal in 2012.[8] They also estimated the number of women who received PAC at various types of facilities for complications of induced abortion and the number of women who required PAC but did not receive it. To estimate the number of women who received PAC for abortion-related complications nationally in 2016, we inflated the 2012 estimates by 3% per year to reflect the rate of population growth.[37] We then distributed these patients across facility types and regions, using the distributions seen in 2012. Note that using the population growth rate for this adjustment implies that no changes occurred in the abortion rate, in the rates at which women experienced complications and received care, and in the distribution of PAC cases across facility and region categories.

After estimating the total number of women who received PAC for abortion-related complications within each facility or region category, we estimated the numbers and types of complications expected in the various facility categories, using the distributions obtained from facilities in this study. Finally, we multiplied the estimated cost to treat each type of complication by the estimated number of cases at the national level to produce estimates of the national costs for PAC service provision in 2016. The direct costs were applied per complication type, and indirect costs were applied per patient. The same calculations were repeated to estimate the additional costs that would incur to the health system if women who needed but did not obtain PAC services in 2016 had obtained such services.

Payments by Patients

Some facilities reported charging patients for each night spent in the hospital as an inpatient or for each outpatient consultation. To estimate patient fees, we first determined the annual number of PAC patients managed as inpatients or outpatients at each facility. For the inpatients, we then summed the estimated number of nights of hospitalization for all inpatients (for management of all complications) and multiplied the fees paid per night by the total number of nights hospitalized. For outpatient fees, we multiplied the number of patients managed as outpatients by the fee per outpatient consultation. We present the average fees paid per inpatient and outpatient; we also present the fees paid per PAC patient (for which the outcome is weighted according to the representation of inpatients and outpatients at each facility) and the total fees paid by patients annually by facility type.

Missing Data and Sensitivity Analysis

Although PACCM is meant to generate reliable estimates, it is a low-cost, rapid-turnaround approach that trades a certain amount of precision for reductions in the time and cost of collecting data. In some cases, the respondents in our sample could not estimate or had difficulty estimating the values requested. When necessary, missing values were imputed during the analysis using the mean value of nonmissing responses within the appropriate type (public or private) and level of facility.

In addition, although we know that women with vaginal and uterine perforations present for PAC with some frequency in Senegal,[38,39] no respondent in the sample reported that their facility had managed a case of perforation in 2016. The respondents provided information on the

personnel time required for managing vaginal and uterine perforations; however, because they did not report treating any patients for perforations, preprogrammed skip patterns in the questionnaires prevented them from providing estimates of the volume of supplies required for such patients. Rather than omit the cost of managing perforations, we decided to assume that the rate of perforations was the same rate as that of other rare complications, and that the costs of supplies for perforation care is equivalent to facility-specific costs for management of cervical and vaginal lacerations. Respondents did provide information on staff time required for perforation management, so those estimates are included in our results.

Finally, we conducted univariate and multivariate sensitivity analyses to test the sensitivity of our cost projections to uncertainty in the analytic inputs. Specifically, we conducted analyses in which we varied the estimates of the number of PAC cases expected in the country in 2016, the amount of time spent providing PAC by the types of clinical staff who most often provided PAC, the costs of the most expensive supplies, and certain indirect cost components (which are often difficult to estimate). We also varied inputs related to our assumptions regarding the frequency and costs of managing perforations. Each variable was varied independently, and all variables were adjusted at the same time. The results are presented in terms of the impact of these variations on patient-level and national-level costs.

RESULTS

Service Volume

In total, 1,642 women received PAC in the 41 sampled facilities in 2016 (Table 2). Secondary-level hospitals, which had an average annual caseload of 125 PAC patients, provided the bulk of PAC services. As expected, incomplete abortion was the most commonly seen type of complication in the sampled facilities (76%), and complicated cases accounted for a greater proportion of the

TABLE 2. Service statistics for selected outcomes at study facilities, and nationally, by facility type, 2016

Condition	All	Public						Private
		All	Tertiary hospitals	Secondary hospitals	Department hospitals	Health centers	Health posts	
STUDY FACILITIES	(N=41)	(N=35)	(N=4)	(N=8)	(N=1)	(N=9)	(N=13)	(N=6)
Mean no. of patients seen for any condition	22,951	25,309	47,500	34,875	30,000	29,333	9,446	9,200
No. of women treated for any PAC complication*	1,642	1,621	76	996	32	412	104	21
Dakar	159	na	na	na	na	na	na	na
Other regions†	1,482	na	na	na	na	na	na	na
Mean no. of PAC patients	40	46	19	125	32	46	8	4
% of MNH patients receiving PAC	0.5	0.5	0.2	0.7	0.2	0.4	0.5	0.3
Mean % of PAC patients with specified complication*								
Incomplete abortion	75.8	72.0	70.0	88.0	80.0	61.1	69.6	98.3
Sepsis	25.9	30.0	21.3	18.3	70.0	40.0	30.0	1.7
Shock	3.9	4.6	7.5	15.0	0.0	0.0	0.8	0.0
Lacerations	2.7	3.2	10.0	8.8	0.0	0.0	0.1	0.0
Perforations‡	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.0
Mean % of PAC patients with rare complications	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.0
Mean % of PAC patients admitted	23.7	24.6	19.2	38.4	86.0	24.3	13.2	18.8
No. of PAC patients with specified complication*								
Incomplete abortion	1,304	1,284	34	902	25	267	54	20
Sepsis	289	288	14	58	22	146	47	1
Shock	142	142	19	121	0	0	2	0
Lacerations	79	79	25	54	0	0	0	0
Perforations‡	6	6	1	6	0	0	0	0
NATIONALLY	(N=856)	(N=819)	(N=2)	(N=14)	(N=6)	(N=81)	(N=716)	(N=37)
No. of women treated for any PAC complication*	18,806	17,877	116	2,144	1,082	7,434	7,101	929
Dakar	4,232	na	na	na	na	na	na	na
Other regions†	14,574	na	na	na	na	na	na	na
No. of PAC patients with specified complication*								
Incomplete abortion	13,234	12,320	81	1,887	866	4,543	4,943	914
Sepsis	6,293	6,277	25	391	758	2,974	2,130	15
Shock	385	385	9	322	0	0	55	0
Lacerations	205	205	12	188	0	0	5	0
Perforations‡	5	5	0	3	0	2	0	0

*Women could have more than one type of complication. †Thies, Tamba, Saint Louis and Kaolack. ‡Facilities reported having no cases in the last year. For this analysis, we assumed that the number of perforations in the last year was equivalent to the number of PAC patients with rare complications. *Notes:* Numbers may not add up to totals because of rounding. PAC=postabortion care. MNH=maternal and newborn health. na=not applicable.

caseload at higher-level facilities than at lower-level facilities. Slightly fewer than one-quarter of PAC patients were admitted for inpatient care.

Extrapolating to the national level, we estimate that 18,806 women in Senegal received PAC in 856 health facilities in 2016. The vast majority of these women (95%) received care in public facilities.

Clinical Personnel Time

According to respondents' estimates, women who received PAC at the study facilities were attended by a range of health care workers (Table 3). Midwives provided PAC at all facility levels and spent an average of 22 minutes on each patient, although the amount of time varied widely across facility types, ranging from 13 minutes at health posts to 46 minutes at secondary hospitals. As expected, higher-level cadres of staff, such as obstetrician-gynecologists, also contributed to care at secondary and tertiary facilities (14–23 minutes), although they accounted for little or none of the time staff time spent with patients at lower-level facilities (which typically did not employ doctors).

TABLE 3. Mean number of minutes spent per postabortion care patient, by selected types of health care worker, according to facility type

Type of worker	All facilities (N=41)	Public facilities						Private facilities (N=6)
		All public (N=35)	Tertiary hospitals (N=4)	Secondary hospitals (N=8)	Department hospitals (N=1)	Health centers (N=9)	Health posts (N=13)	
Obstetrician-gynecologist	9.6	8.1	14.0	23.1	0.0	4.9	0.0	18.3
Anesthetist	2.8	3.3	4.6	12.0	0.0	0.0	0.0	0.0
Doctor	0.6	0.4	0.0	0.0	0.0	0.0	1.2	1.7
Nurse	1.1	1.3	0.4	0.4	0.0	0.0	3.2	0.0
Midwife	22.2	22.5	16.7	46.2	34.5	17.1	12.6	20.0
Nurse anesthetist	2.5	2.9	4.6	10.6	0.0	0.0	0.0	0.0
Nurse assistant	1.6	1.9	2.1	7.2	0.0	0.0	0.0	0.0
Lab technician	3.3	3.7	4.1	6.1	7.5	4.2	1.5	0.8
Sonographer	7.5	6.9	12.6	10.8	12.0	7.9	1.7	10.7
Pharmacy technician	4.2	4.6	3.9	3.3	7.5	5.1	5.1	1.7
Dispensing pharmacist	1.0	0.9	1.6	3.2	0.0	0.0	0.0	1.7
Counselor	2.8	3.0	6.1	10.2	0.0	0.0	0.0	1.7
Community health worker	6.4	7.5	0.0	3.3	15.0	9.4	10.4	0.0

Notes: All values are weighted by the representation of complication types at each facility and then averaged within facility types. A value of 0.0 could mean that the specified type of health care worker was not employed at the facility or that such workers did not see postabortion care patients.

Direct Costs

For the full set of facilities in the study sample, the average direct cost of personnel time per complication managed was $3.05, or XOF 1,810 (Table 4). Although staff salaries were similar across the various types of public facilities (not shown), average clinical staff costs were greatest in public secondary hospitals—$6.89, or XOF 4,084 per patient (Table 4)—because of the large amount of time staff at those facilities spent with patients. The average per-patient cost of supplies (i.e., consumables, small equipment, medications, and laboratory tests) was also greater in higher-level facilities (notably department hospitals) than in health centers or health posts.

The total direct costs per patient ranged from $8.31 (XOF 4,928) in health posts to $34.44 (XOF 20,415) in public secondary hospitals. In private facilities, the direct cost per PAC patient was $11.79 (XOF 6,987). This figure was lower than the average public sector facility cost of $18.09 (XOF 10,724), likely because private facilities tend to refer severe PAC cases to higher-level public facilities.

The direct costs of managing relatively severe complications were higher than those of managing less severe complications (Table 5). For example, the average personnel cost per PAC patient with a perforation was $14.50 (XOF 8,594), compared with $2.31 (XOF 1,370) for a patient with an uncomplicated incomplete abortion. The cost of supplies was highest for shock ($29.79, or XOF 22,084, per patient); whole blood and polygeline (an intravenous solution administered when there has been significant blood loss) were the largest contributors to supply costs for shock patients (not shown).

TABLE 4. Average direct, indirect and total costs (in US$) per postabortion care patient, and percentage distribution of those costs, by facility type

Type of cost	All facilities		Public facilities												Private facilities	
			All public		Tertiary hospitals		Secondary hospitals		Department hospitals		Health centers		Health posts			
	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%
DIRECT																
Personnel	3.05	11	2.95	13	3.94	13	6.89	18	1.93	5	1.75	9	1.12	11	3.69	7
Supplies*	14.11	53	15.15	68	19.65	66	25.22	65	32.51	87	13.74	71	7.19	68	8.10	15
Total direct	**17.17**	**64**	**18.09**	**81**	**23.59**	**79**	**32.11**	**82**	**34.44**	**92**	**15.49**	**80**	**8.31**	**79**	**11.79**	**23**
INDIRECT																
Capital	2.76	10	0.57	3	0.49	2	0.56	1	1.05	3	0.53	3	0.60	6	15.49	30
Overhead	2.19	8	1.32	6	2.00	7	2.39	6	0.38	1	1.30	7	0.54	5	7.28	14
Administrative staff	4.56	17	2.29	10	3.67	12	3.90	10	1.48	4	2.13	11	1.05	10	17.82	34
Total indirect	**9.51**	**36**	**4.18**	**19**	**6.16**	**21**	**6.85**	**18**	**2.90**	**8**	**3.95**	**20**	**2.19**	**21**	**40.59**	**77**
TOTAL	**26.68**	**100**	**22.27**	**100**	**25.75**	**100**	**38.96**	**100**	**37.34**	**100**	**19.44**	**100**	**10.50**	**100**	**52.38**	**100**

*Supplies refers to consumable supplies, small equipment, medications and laboratory tests. *Notes:* All costs are in 2016 U.S. dollars, and are weighted by the representation of complication types at each facility and then averaged within facility level. Indirect costs are considered constant across all patients.

TABLE 5. Average direct, indirect and total costs (in US$) per postabortion care patient, and percentage distribution of those costs, by complication type and region

Type of cost	Complication type										Region			
	Incomplete abortion		Sepsis		Shock		Laceration		Perforation		Dakar		Other regions*	
	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%
DIRECT														
Personnel	2.31	9	2.29	7	7.47	16	12.44	28	14.50	32	2.11	8	3.72	14
Supplies†	12.55	51	21.97	65	29.79	64	21.80	50	21.80‡	48	11.56	44	15.92	59
Total direct	**14.86**	**61**	**24.26**	**72**	**37.25**	**80**	**34.24**	**78**	**36.30**	**79**	**13.68**	**53**	**19.64**	**72**
INDIRECT														
Capital	2.76	11	2.76	8	2.76	6	2.76	6	2.76	6	3.70	14	2.09	8
Overhead	2.19	9	2.19	6	2.19	5	2.19	5	2.19	5	2.94	11	1.65	6
Administrative staff	4.56	19	4.56	14	4.56	10	4.56	10	4.56	10	5.71	22	3.75	14
Total indirect	**9.51**	**39**	**9.51**	**28**	**9.51**	**20**	**9.51**	**22**	**9.51**	**21**	**12.35**	**47**	**7.49**	**28**
TOTAL	**24.37**	**100**	**33.77**	**100**	**46.76**	**100**	**43.75**	**100**	**45.81**	**100**	**26.03**	**100**	**27.14**	**100**

*Thies, Tamba, Saint Louis and Kaolack. †Refers to consumable supplies, small equipment, medications and laboratory tests. ‡Imputed cost based on the cost of treating lacerations. *Notes:* All costs are in 2016 U.S. dollars, and are weighted by the representation of complication types at each facility and then averaged within facility level. Indirect costs are considered constant across all patients.

Indirect Costs

Study respondents provided estimates of the cost of constructing and equipping a facility similar to the one where they worked. The estimated average cost of constructing and equipping a tertiary or secondary public hospital was approximately $319,000, or XOF 11.7 million (not shown). At the other end of the spectrum, building and equipping health posts reportedly cost an average of $51,000 (XOF 1.8 million). Although the private facilities in the study sample were not hospitals, the average cost of constructing and equipping such facilities was estimated to be approximately $360,000 (XOF 13.2 million).

These capital costs translated to large differences in costs per patient. Among public facilities, the average capital cost ranged from $0.49 (XOF 289) per patient in tertiary facilities, which had large annual patient volumes, to $1.05 (XOF 622) per patient at department hospitals (Table 4). For health posts, whose patient volumes were lower than those of tertiary facilities, the average capital cost per patient was $0.60 (XOF 357). For private facilities, which also had relatively low caseloads, the cost per patient was $15.49 (XOF 9,183), compared with $0.57 (XOF 338) among all public facilities.

Similarly, overhead and administrative staff costs per patient were higher for private facilities than for public facilities. For example, the average cost of overhead per patient was $7.28 (XOF 4,314) for private facilities, versus $1.32 (XOF 781) for public facilities. However, the per-patient costs of overhead and administrative staff were greater for higher-level public facilities than for lower-level ones. Administrative staff costs, which included wages for support staff and the costs of administrative time spent by clinical staff, were the largest component of per-patient indirect costs for all types of facilities; they were higher for private facilities than public ones—$17.82 (XOF 10,563) vs. $2.29 (XOF 1,357)—because the number of support staff was larger and wages were higher at the former than at the latter.

Total Costs

The total average cost per PAC patient among all study facilities was $26.68 (XOF 15,814). On average, personnel and supply costs contributed 11% and 53% of total costs, respectively, so that these direct costs accounted for 64% of the total costs per PAC patient. Indirect costs contributed the remaining 36% of the cost per PAC patient. Interestingly, the combined direct cost of clinical personnel and supplies was lower in private facilities ($11.79, or XOF 6,989) than in public facilities ($17.17, or XOF 10,178). However, indirect costs per patient were much higher in private facilities ($40.59, or XOF 24,062) than in public facilities ($4.18, or XOF 2,478), so that the average total cost per patient was greater in private facilities ($52.38, or XOF 31,048) than in public ones ($22.27, or XOF 13,202).

In the regional analysis (Table 5), direct costs per patient were lower in Dakar ($13.68, or XOF 8,107) than in other areas ($19.64, or XOF 11,643). But since average indirect costs were higher in Dakar—likely because private and higher-level facilities were disproportionately located there—the total per-patient cost in Dakar ($27.14, or XOF 16,086) was similar to that in other regions ($26.03, or XOF 15,430).

Total Costs to the Health System

For the 41 health facilities we sampled in 2016, the total cost of providing PAC to the 1,642 women who received care was $58,629, or XOF 34.8 million (Table 6). Eighty-three percent of this cost, or $48,902 (XOF 29.0 million), was for clinical personnel and supplies, while the remainder was for indirect costs. Medical supplies accounted for the largest share (71%) of the total costs.

Building on these data, we estimate that in 2016, the total cost to the Senegalese health system of offering PAC services to the 18,806 women who received care was $464,928 (XOF 275.6 million). The vast majority of the total costs were incurred in public facilities. If the health system had provided PAC to the estimated 13,736 women

TABLE 6. Annual costs (in US$) of providing PAC in study facilities and nationally, and percentage distribution of those costs, by facility type

Type of cost	All facilities		Public facilities												Private facilities	
			All public		Tertiary hospitals		Secondary hospitals		Department hospitals		Health centers		Health posts			
	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%
Study facilities																
DIRECT																
Personnel	7,177	12	7,107	12	614	18	5,683	14	62	5	636	6	113	9	70	8
Supplies*	41,725	71	41,517	72	2,058	61	29,257	72	1,036	87	8,236	75	930	72	209	25
Total direct	**48,902**	**83**	**48,624**	**84**	**2,671**	**79**	**34,940**	**85**	**1,098**	**92**	**8,871**	**80**	**1,044**	**81**	**278**	**33**
INDIRECT																
All indirect	**9,727**	**17**	**9,171**	**16**	**698**	**21**	**5,976**	**15**	**93**	**8**	**2,160**	**20**	**244**	**19**	**556**	**67**
TOTAL	**58,629**	**100**	**57,794**	**100**	**3,370**	**100**	**40,916**	**100**	**1,190**	**100**	**11,031**	**100**	**1,287**	**100**	**835**	**100**
National—existing care levels																
DIRECT																
Personnel	39,972	9	36,562	9	523	13	13,706	14	2,092	5	12,945	7	7,296	8	3,410	7
Supplies*	317,305	68	309,875	74	2,587	67	65,563	67	35,186	84	143,158	77	63,381	73	7,430	15
Total direct	**357,277**	**77**	**346,437**	**83**	**3,111**	**80**	**79,269**	**81**	**37,278**	**89**	**156,103**	**84**	**70,677**	**82**	**10,840**	**22**
INDIRECT																
All indirect	**107,650**	**23**	**69,927**	**17**	**775**	**20**	**19,105**	**19**	**4,713**	**11**	**29,728**	**16**	**15,606**	**18**	**37,723**	**78**
TOTAL	**464,928**	**100**	**416,364**	**100**	**3,886**	**100**	**98,374**	**100**	**41,990**	**100**	**185,831**	**100**	**86,283**	**100**	**48,564**	**100**
National—additional required care																
DIRECT																
Personnel	29,196	9	26,706	9	382	13	10,011	14	1,528	5	9,455	7	5,329	8	2,491	7
Supplies*	231,765	68	226,337	74	1,890	67	47,888	67	25,700	84	104,565	77	46,294	73	5,427	15
Total direct	**260,961**	**77**	**253,043**	**83**	**2,272**	**80**	**57,899**	**81**	**27,228**	**89**	**114,020**	**84**	**51,624**	**82**	**7,918**	**22**
INDIRECT																
All indirect	**78,630**	**23**	**51,076**	**17**	**566**	**20**	**13,955**	**19**	**3,442**	**11**	**21,714**	**16**	**11,399**	**18**	**27,554**	**78**
TOTAL	**339,590**	**100**	**304,119**	**100**	**2,839**	**100**	**71,854**	**100**	**30,670**	**100**	**135,734**	**100**	**63,022**	**100**	**35,472**	**100**

*Supplies refers to consumable supplies, small equipment, medications and laboratory tests. *Notes:* All costs are in 2016 U.S. dollars, and are weighted by the representation of complication types at each facility level. Indirect costs are considered constant across all patients. Study facility costs are for 1,642 women treated at 41 facilities; national costs are for 18,806 women (current levels of care) or 13,736 women (additional required care) treated at 856 facilities.

who required PAC but did not receive it, the additional cost of providing care would have been $339,590 (XOF 201.3 million). Thus, the cost of meeting all need for PAC services nationally in 2016 would have been $804,518 (XOF 476.9 million).

The distribution of facilities by type at the national level differed slightly from the distribution in our sample. Because we extrapolated costs to the national level using facility-specific costs, the average cost per woman in the sample differed from that at the national level. Given the 18,806 women estimated to have received care at the national level, the average cost for PAC provision was $24.72 (XOF 14,655) per woman, including $19.00 (XOF 11,261) in direct costs and $5.72 (XOF 3,393) in indirect costs (not shown).

Patient Contributions

Nearly all of the facilities surveyed charged fees for PAC services (Table 7). Roughly three-quarters of facilities charged fees for each night of inpatient PAC, and 98% charged for each outpatient PAC visit. For PAC patients who were charged, the estimated average fee was $11 (XOF 6,581) per night of inpatient care and $4 (XOF 2,490) per outpatient visit; the overall average fee paid by patients who received PAC in a study was $6 (XOF 3,796). Average fees were higher in private facilities ($14, or XOF 8,555) than in public facilities ($5, or XOF 2,965).

We estimate that in total, PAC patients paid $11,909 (XOF 7.1 million) toward their care at study facilities in 2016. At the national level, we estimate that patient contributions totaled $94,907 (XOF 56.3 million). If PAC provision had been expanded to meet all need for the service, national patient contributions would have totaled $164,228 (XOF 97.3 million) or 20% of the overall health system cost of PAC provision. Patients may have financed their contributions in different ways. The fees paid do not include health insurance premiums that patients might have paid to defray their expenses for private sector medical care, or the cost of interest they may have paid on any private loans used as a financing mechanism.

Sensitivity Analysis

Finally, we present the results of sensitivity analyses examining the impact on per-patient and total national costs of varying each parameter individually through the specified range and adjusting all parameters simultaneously

TABLE 7. Percentage of facilities charging fees for postabortion care, and amount of fees paid, by facility type

Measure	All facilities	Public facilities						Private facilities
		All public	Tertiary hospital	Secondary hospital	Department hospital	Health center	Health post	
STUDY FACILITIES	(N=41)	(N=35)	(N=4)	(N=8)	(N=1)	(N=9)	(N=13)	(N=6)
% that charge for PAC								
Inpatient services	76	74	100	100	100	100	31	83
Outpatient services	98	97	100	100	100	100	92	100
Mean fee paid for PAC*								
Inpatient night	11	7	12	5	8	6	5	34
Outpatient visit	4	3	5	6	1	1	1	13
Mean total fee paid per PAC patient†	6	5	7	9	19	4	1	14
Total annual fees paid by PAC patients	11,909	11,666	757	8,335	611	1,853	110	243
NATIONALLY	(N=856)	(N=819)	(N=2)	(N=14)	(N=6)	(N=81)	(N=716)	(N=37)
Total annual fees paid by PAC patients	94,907	81,494	816	20,241	20,761	31,657	8,020	13,412
Total annual fees paid by PAC patients if all need were met‡	164,228	141,019	1,412	35,025	35,924	54,780	13,879	23,209

*Among patients who paid a fee. †For all patients (inpatient or outpatient); includes multiple night fees for some inpatients. ‡Includes fees paid by women currently receiving care plus fees that would be paid if all women requiring PAC received it. *Notes:* All fees are in 2016 U.S. dollars. PAC=postabortion care.

(Table 8). In the univariate analysis, the impact on per-patient costs was minimal. No parameter adjustment resulted in an increase or decrease of more than 5% from the base case cost of $26.68 (XOF 15,814) per patient. In the multivariate analysis, setting all parameters to their highest possible values increased the estimated per-patient cost by nearly 19%, while setting all parameters to their lowest values reduced the cost by nearly 12%. Thus, we estimate that the average per-patient cost ranged from $23.49 (XOF 13,925) to $31.68 (XOF 18,783; not shown).

When we examined the impact of parameter adjustments on total national costs, the most influential variables, as expected, were the estimates of the numbers of women receiving PAC and those needing but not receiving PAC. Univariate adjustments to these parameters resulted in changes of 13–20% each. No other parameter produced more than a 3% change in the outcome. However, when combined in the multivariate analysis, adjusting all of the parameters simultaneously up or down produced a range of $504,901 (XOF 299.3 million) to $1,212,784 (XOF 718.9 million) for the total national costs of providing PAC for all women who needed the service.

DISCUSSION

We estimated that the cost to the Senegalese health system of providing PAC to the 18,806 women who received it in 2016 was nearly $500,000, of which direct costs accounted for roughly three-quarters. The average cost per patient in the study sample was $26.68 (XOF 15,814); at the national level it was slightly lower—$24.72 (XOF 14,655)—because the distribution of facility types at the national level differed slightly from that of the study sample. Most care was provided in public health facilities, and severe complications usually were managed at higher-level facilities. Among the various types of providers, midwives spent the most time with each patient.

The estimated national cost of current PAC provision in Senegal is lower than costs estimated using the same methodology in two other Sub-Saharan African countries. In Uganda, the total cost of treating PAC patients was roughly $13.9 million in 2010.[17] In Rwanda, the estimated cost of PAC provision in 2012 totaled $1.7 million.[16] In examining the differences in costs across countries, it is important to consider the number of women receiving PAC and the cost per patient. In Uganda, an estimated 105,900 women received PAC services in 2010; the average cost per patient was $131.93, and indirect costs accounted for 68% of total per patient costs.[17] In Rwanda, an estimated 18,300 women received PAC in 2012; the average cost per patient was $92.81, of which 49% was for indirect costs.[16] Per-patient costs were much lower in Senegal than in these two countries because of lower personnel costs (resulting from generally low wages and much less time spent per patient) and lower indirect costs (resulting from lower construction and overhead costs). Senegal's long-term commitment to offering PAC using recommended approaches (including use of MVA) and lower-level cadres of staff may have also contributed to lower costs.[40–42]

The total cost of PAC service provision would have been higher if Senegal were meeting all need for the service. We estimated that 32,542 women needed PAC services in Senegal in 2016, but that just 58% received care. If the additional 13,736 women who required but did not receive PAC had been able to obtain care, the total national cost (assuming no changes in service delivery patterns) would have been more than $800,000 (XOF 476.9 million). Senegal is not the only country in the region for which access to PAC services needs to be improved. In Uganda and Rwanda, respectively, only 68% and 67% of women who needed PAC received care in 2010 and 2012.[16,17]

It is important to keep in mind that PAC services are one of many services offered by the Senegalese health system, and the country's ability to pay for health care affects the availability of all types of services. In 2016, Senegal spent 5.5% of its national gross domestic product—or roughly $1.04 billion[43]—on health care, which translates to an annual health expenditure of $53 per capita.[44] In

TABLE 8. Parameters that were varied during sensitivity analyses and resulting change in per-patient and national cost estimates

Parameter	Estimate in base case	Range varied	% change in mean cost per patient in study sample		% change in total national cost	
			Low	High	Low	High
SERVICE VOLUME						
No. of PAC patients receiving care nationally	18,806	12,834–25,337*	nc	nc	−18.35	20.07
No. of women needing but not receiving PAC nationally	13,736	9,374–18,507*	nc	nc	−13.40	14.66
Estimated % of patients with perforation (all facilities)	0.06	±25%	nc	nc	−0.01	0.01
DIRECT COSTS						
Mean no. of minutes providers spent per PAC patient†						
Obstetrician-gynecologist	9.62	±25%	−0.79	0.79	−0.44	0.44
Midwife	22.15	±25%	−0.62	0.62	−0.60	0.60
Nurse	1.13	±25%	−0.13	0.13	−0.16	0.16
Mean cost per minute of provider time						
Obstetrician-gynecologist	0.11	±25%	−0.96	0.96	−0.52	0.52
Midwife	0.03	±25%	−0.71	0.71	−0.69	0.69
Nurse	0.03	±25%	−0.05	0.05	−0.06	0.06
Cost per 500 ml of whole blood	2.91	1.43–6.15‡	−0.32	0.32	−0.22	0.22
Cost per 500 ml of polygeline	6.01	4.89–7.56§	−0.32	0.32	−0.21	0.21
Total supply cost for perforations (all facilities)†	21.80	±25%	−0.02	0.02	0.00	0.00
INDIRECT COSTS						
Cost of constructing and equipping facilities†	Varies	±25%	−2.58	2.58	−1.40	1.40
Lifetime of buildings (yrs.)	30	30–60	nc	−1.94	0.00	−1.05
Discount rate	5%	5–10%	nc	5.75	0.00	3.11
Annual overhead costs (all facilities)†	2.19	±25%	−2.05	2.05	−1.50	1.50
Annual wage bill for support staff (all facilities)†	4.56	±25%	−3.76	3.76	−2.50	2.50
ALL	**na**	**na**	**−11.95**	**18.77**	**−37.24**	**50.75**

*The range for current PAC patients was based on the range estimated by Sedgh et al. in 2012 (reference 7). The range for women requiring but not obtaining PAC was estimated using the size of the range for current PAC patients relative to the base case estimate. †Variation in this input item was done at the facility level; the base case value presented here is the average across all facilities. ‡This range represents the range of prices supplied by the Senegalese government in 2014, inflated to 2016 values. §This range represents the range of prices supplied by Management Sciences for Health in 2015, inflated to 2016 values. *Notes:* All costs are in 2016 U.S. dollars. PAC=postabortion care. nc=no change to outcome when input was varied. na=not applicable.

comparison, Rwanda and Uganda spent $48 and $38 per capita, respectively, on overall health care in 2016. Looking only at PAC services, we estimate that Senegal spent $0.05 per capita in 2016,[37,45] while Rwanda and Uganda spent $0.15 and $0.38, respectively.[16]

However, national per-capita spending figures can mask who actually pays for services. In 2016, individual households paid out-of-pocket for 52% of all health care costs in Senegal, compared with 40% in Uganda and just 6% in Rwanda.[44] For PAC service costs in particular, we estimate that women paid an average of $6 (XOF 3,796) for their care. At the national level, this translates to women and their households covering roughly 20% of the total health system costs for PAC provision as fees paid to facilities. Interestingly, this aligns with information provided by the national government about costs expected under the national health insurance system, which advertises that for an annual fee of XOF 3,500–7,000 (roughly $6–12), patients will be covered for up to 80% of service costs in public facilities.[24] It is unclear what patients pay for membership in the many other medical insurance schemes in the country,[23] but the full costs of obtaining care were likely higher than the fees paid. Costs for missed work, transportation, child care and other needs have been identified as expenses associated with obtaining PAC in other settings.[46,47] It should also be noted that the legal minimum wage in Senegal in 2014 was just XOF 209 per hour,[48] or roughly XOF 7,240 per month. Although many individuals likely earn more than the minimum wage, the cost of obtaining PAC (including fees paid to facilities, health insurance premiums and additional costs) is high given the expected monthly income for minimum wage earners.

Limitations

This study has limitations. The validity of the data depends heavily on the accuracy of the estimates provided by our study respondents. We attempted to mitigate the risk of bias by selecting individuals with enough experience in providing PAC services to be able to discuss the details of provision. We also used average costs (rather than facility-specific estimates) for staff salaries and supply costs. We were not able to assess the costs of managing very rare complications, because their infrequency makes recall of the resources required extremely difficult. Fortunately, such complications, although expensive when they occur, likely contribute only a small amount to total national costs because of their rarity. Another limitation is that extrapolating data from Sedgh and colleagues' 2012 study[7] to produce cost estimates for 2016 required assuming that the country's rates of abortion and PAC treatment had not changed. We attempted to estimate the impact of uncertainty in a number of model inputs, including the volume of PAC services provided, using univariate and multivariate sensitivity analyses, and indeed, our national cost estimates were sensitive to variation in the estimated number of women treated.

To explore this issue further, we note that the prevalence of modern contraceptive use among women of reproductive age in Senegal increased from 10% to 17% between 2012 and 2016; among married women, the prevalence increased from 14% to 23%.[49] In addition, the gap between the total fertility rate and the wanted total fertility rate diminished between 2011 and 2016.[50,51] These changes may have contributed to a reduction in the abortion rate and consequently fewer women requiring PAC services. However, the country has been working

simultaneously toward improving access to PAC,[12] which could have resulted in a greater proportion of women who needed PAC being able to obtain such care.

Conclusion

Spending on PAC is a large investment for many countries, especially low- and middle-income countries with significantly constrained health care budgets. Fortunately, spending on PAC is preventable. Investing in improving access to contraceptive services and in public education, to improve acceptance and uptake of effective contraceptive methods, could reduce the need for PAC. In fact, not only does increasing contraceptive use reduce the number of unintended pregnancies and unsafe abortions,[52] it may also produce cost savings. A 2017 analysis concluded that meeting women's needs for modern contraceptives in all developing countries would cost roughly $1.93 per capita per year, including both direct and indirect costs.[53] The same study found that for each $1 invested in contraceptive services in Africa, the cost of pregnancy-related care (including PAC services) would decrease by $1.79.[54]

Finally, Senegal has committed to improving access to contraceptive services, including as part of the Ouagadougou Partnership,[55] and the country has made progress in this effort.[49] Local government authorities have added line items for family planning to their annual budgets.[56] However, donor and domestic commitments will continue to be required to improve health outcomes and achieve the country's longer term goals.

The government of Senegal has been working toward universal health coverage, financed through insurance schemes, for nearly a decade.[58] Strategies for improving sexual and reproductive health indicators under the universal health coverage rubric in the long term should include careful evaluation of the degree to which the various spending options achieve the desired health outcomes. PAC is but one option. Research in other settings has highlighted the financial and health benefits of offering alternatives that address women's right to access sexual and reproductive health services, including those that prevent unsafe abortion.[59–61] In the short term, for PAC in particular, a closer examination of patient fee structures in health facilities is required to ensure that cost is not a barrier to obtaining services.

REFERENCES

1. World Bank, *Women: The Future of Africa*, Washington, DC: World Bank Group, 2018.

2. Alkema L et al., Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group, *Lancet*, 2016, 387(10017):462–474, http://dx.doi.org/10.1016/S0140-6736(15)00838-7.

3. Sedgh G et al., Abortion incidence between 1990 and 2014: global, regional, and subregional levels and trends, *Lancet*, 2016, 388(10041):258–267, http://dx.doi.org/10.1016/S0140-6736(16)30380-4.

4. Say L et al., Global causes of maternal death: a WHO systematic analysis, *Lancet Global Health*, 2014, 2(6):e323–e333, http://dx.doi.org/10.1016/S2214-109X(14)70227-X.

5. Kassebaum NJ et al., Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015, *Lancet*, 2016, 388(10053):1775–1812, http://dx.doi.org/10.1016/S0140-6736(16)31470-2.

6. Center for Reproductive Rights, Senegal's abortion provisions, no date, https://reproductiverights.org/world-abortion-laws/senegals-abortion-provisions.

7. Sedgh G et al., Estimates of the incidence of induced abortion and consequences of unsafe abortion in Senegal, *International Perspectives on Sexual and Reproductive Health*, 2015, 41(1):11–19, doi:10.1363/4101115.

8. Guttmacher Institute, Abortion in Senegal, *Fact Sheet*, New York: Guttmacher Institute, 2015, https://www.guttmacher.org/fact-sheet/abortion-senegal.

9. World Health Organization (WHO), *Safe Abortion: Technical and Policy Guidance for Health Systems*, second ed., Geneva: WHO, 2012, http://apps.who.int/iris/bitstream/handle/10665/70914/9789241548434_eng.pdf?sequence=1.

10. WHO, *Medical Management of Abortion*, Geneva: WHO, 2018, http://www.ncbi.nlm.nih.gov/books/NBK536779/.

11. Ipas, *Woman-Centered Postabortion Care Reference Manual*, second ed., Chapel Hill, NC, USA: Ipas, 2013, https://ipas.azureedge.net/files/PACREFE13-WomenCenteredPostabortionCareReferenceManual.pdf.

12. Suh S, What post-abortion care indicators don't measure: global abortion politics and obstetric practice in Senegal, *Social Science & Medicine*, 2020, 254:112248, http://dx.doi.org/10.1016/j.socscimed.2019.03.044.

13. Thiam FT, Siri S and Moreira P, Scaling up postabortion care services: results from Senegal, *Occasional Papers*, Cambridge, MA, USA: Management Sciences for Health, 2006, No. 5, http://expandnet.net/PDFs/MSH_Postabortion_Senegal.pdf.

14. Suh S, "Right tool," wrong "job": Manual vacuum aspiration, post-abortion care and transnational population politics in Senegal, *Social Science & Medicine*, 2015, 135:56–66, http://dx.doi.org/10.1016/j.socscimed.2015.04.030.

15. Le Ministre de la Santé de l'Hygiène Publique et de la Prévention (MdSHPP) Senegal, *Politiques et Normes de Services de Santé de la Reproduction, Partie I*, Dakar, Senegal: MdSHPP Senegal, https://advancefamilyplanning.org/sites/default/files/resources/PMP%202nd%20Version-1_Part1_pp1-95.pdf.

16. Vlassoff M et al., The health system cost of post-abortion care in Rwanda, *Health Policy and Planning*, 2015, 30(2):223–233, http://dx.doi.org/10.1093/heapol/czu006.

17. Vlassoff M et al., The health system cost of post-abortion care in Uganda, *Health Policy and Planning*, 2014, 29(1):56–66, http://dx.doi.org/10.1093/heapol/czs133.

18. Vlassoff M et al., The health system cost of postabortion care in Ethiopia, *International Journal of Gynecology & Obstetrics*, 2012, 118(S2):S127–S133, http://dx.doi.org/10.1016/S0020-7292(12)60011-3.

19. Vlassoff M, Singh S and Onda T, The cost of post-abortion care in developing countries: a comparative analysis of four studies, *Health Policy and Planning*, 2016, 31(8):1020–1030, http://dx.doi.org/10.1093/heapol/czw032.

20. Shearer JC, Walker DG and Vlassoff M, Costs of post-abortion care in low- and middle-income countries, *International Journal of Gynecology & Obstetrics*, 2010, 108(2):165–169, http://dx.doi.org/10.1016/j.ijgo.2009.08.037.

21. Sedgh G, Singh S and Hussain R, Intended and unintended pregnancies worldwide in 2012 and recent trends, *Studies in Family Planning*, 2014, 45(3):301–314, http://dx.doi.org/10.1111/j.1728-4465.2014.00393.x.

22. Leive A and Xu K, Coping with out-of-pocket health payments: empirical evidence from 15 African countries, *Bulletin of the*

World Health Organization, 2008, 86(11):849–856, http://dx.doi.org/10.2471/BLT.07.049403.

23. Preker AS et al., Effectiveness of community health financing in meeting the cost of illness, *Bulletin of the World Health Organization*, 2002, 80(2):143–150, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2567719/pdf/11953793.pdf.

24. Sunu CMU, La couverture maladie pour vos proches partout au Senegal, 2020, https://www.sunucmu.com/home/index.

25. Guttmacher Institute, *Pilot Study of the Economic and Social Costs of Unsafe Abortion in Ethiopia, Mexico and Pakistan: Design, Instruments and Lessons Learned*, New York: Guttmacher Institute, 2008.

26. Prada E, Maddow-Zimet I and Juarez F, The cost of postabortion care and legal abortion in Colombia, *International Perspectives on Sexual and Reproductive Health*, 2013, 39(3):114–123, http://dx.doi.org/10.1363/3911413.

27. WHO Maternal Health and Safe Motherhood Programme, *Mother-Baby Package: Implementing Safe Motherhood in Countries*, Geneva: WHO, 1996.

28. Pharmacie Nationale d'Approvisionement (PNA), *Bulletins d'Informations Produit*, Dakar, Senegal: PNA, September 2014.

29. Management Sciences for Health, *International Medical Products Price Guide*, 2018, http://mshpriceguide.org/en/home/.

30. Foundation IDA, IDA Foundation e-products price guide, 2016, https://www.idafoundation.org/en/products.

31. Joint Medical Store, E-Shop: Uganda, 2012, https://www.jms.co.ug/index.php/e-shop.

32. International Monetary Fund, World economic outlook database, October 2017, 2017, https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx.

33. XE Currency Converter, Average annual exchange rates 2016, 2016, http://www.xe.com/currencyconverter/.

34. L'Organisation pour l'Harmonisation en Afrique du Droit des Affaires, Acte uniforme portant organisation et harmonisation des comptabilites des entreprises [Uniform act of organizing and harmonizing business accountability], 2000, http://www.ohada.com/actes-uniformes/693/742/compte-29-provisions-pour-depreciation.html.

35. Drummond MF et al., *Methods for the Economic Evaluation of Health Care Programmes*, fourth ed., Oxford, UK: Oxford University Press, 2015.

36. Attema AE, Brouwer WBF and Claxton K, Discounting in economic evaluations, *PharmacoEconomics*, 2018, 36(7):745–758, http://dx.doi.org/10.1007/s40273-018-0672-z.

37. World Bank, Subnational population database: data & resources, 2019, https://datacatalog.worldbank.org/dataset/subnational-population-database.

38. Suh S, Rewriting abortion: deploying medical records in jurisdictional negotiation over a forbidden practice in Senegal, *Social Science & Medicine*, 2014, 108:20–33, http://dx.doi.org/10.1016/j.socscimed.2014.02.030.

39. Ka I et al., Péritonite aigue généralisée par perforation utérine post abortum à propos d'une observation [Acute generalized peritonitis due to uterine perforation following abortion: case study observation], *Pan African Medical Journal*, 2016, 24:98, http://dx.doi.org/10.11604/pamj.2016.24.98.9307.

40. Levin C et al., Exploring the costs and economic consequences of unsafe abortion in Mexico City before legalisation, *Reproductive Health Matters*, 2009, 17(33):120–132, http://dx.doi.org/10.1016/S0968-8080(09)33432-1.

41. Hu D et al., Cost-effectiveness analysis of alternative first-trimester pregnancy termination strategies in Mexico City, *BJOG*, 2009, 116(6):768–779, http://dx.doi.org/10.1111/j.1471-0528.2009.02142.x.

42. Seidman G and Atun R, Does task shifting yield cost savings and improve efficiency for health systems? A systematic review of evidence from low-income and middle-income countries, *Human Resources for Health*, 2017, 15:29, http://dx.doi.org/10.1186/s12960-017-0200-9.

43. World Bank, Data: Senegal, 2019, https://data.worldbank.org/country/senegal.

44. World Health Organization, Current health expenditure (CHE) per capita in US$: data by country, 2019, https://apps.who.int/gho/data/node.main.GHEDCHEpcUSSHA2011?lang=en.

45. Special tabulation from estimates of 2016 PAC costs and the 2016 national population.

46. Sundaram A et al., Documenting the individual- and household-level cost of unsafe abortion in Uganda, *International Perspectives on Sexual and Reproductive Health*, 2013, 39(4):174–184, http://dx.doi.org/10.1363/3917413.

47. Vlassoff M et al., *Economic Impact of Unsafe Abortion-Related Morbidity and Mortality: Evidence and Estimation Challenges*, Brighton, UK: Institute of Development Studies, 2008.

48. Senegal Ministry of Labor and Employment, Decree No. 96–154, February 19, 1996, http://www.ilo.org/dyn/travail/docs/849/D%C3%A9cret%20no.96-154.pdf.

49. FP2020, Senegal: commitment maker since 2012, 2019, https://www.familyplanning2020.org/senegal.

50. Agence Nationale de la Statistique et de la Démographie (ANSD) *Sénégal : Enquête Démographique et de Santé Continue (EDS-Continue 2017)*, Rockville, MD, USA: ANSD and ICF, 2018, http://www.ansd.sn/ressources/rapports/Rapport%20Final%20EDS%202017.pdf.

51. ANSD and ICF International, *Senegal Demographic and Health and Multiple Indicator Cluster Survey (EDS-MICS) 2010–2011*, Rockville, MD, USA: ANSD and ICF International, 2012, https://dhsprogram.com/pubs/pdf/FR258/FR258_English.pdf.

52. Scoggins S and Bremner J, *FP2020: Catalyzing Collaboration 2017–2018*, Washington, DC: Family Planning 2020, 2018, http://2017-2018progress.familyplanning2020.org/.

53. Guttmacher Institute, *Adding It Up: Investing in Contraception and Maternal and Newborn Health, 2017*, New York: Guttmacher Institute, 2017, https://www.guttmacher.org/fact-sheet/adding-it-up-contraception-mnh-2017.

54. Guttmacher Institute, Adding It Up: Investing in contraception and maternal and newborn health in Africa, *Fact Sheet*, New York: Guttmacher Institute, 2017, https://www.guttmacher.org/sites/default/files/factsheet/adding-it-up-contraception-mnh-2017-africa.pdf.

55. Le Partenariat de Ouagadougou, Senegal, no date, https://partenariatouaga.org/en/country/senegal/.

56. Advance Family Planning, Réseau Siggil Jigéen and Planned Parenthood Global, *Door Opens to Increase Access to Contraception: First-Time Contributions from 64 Mayors Total $125,000*, Baltimore, MD, USA: Advance Family Planning, 2017, http://www.gatesinstitute.org/sites/default/files/AFP_Brief_Senegal2017.pdf.

57. Cavallaro FL et al., Examining trends in family planning among harder-to-reach women in Senegal 1992–2014, *Scientific Reports*, 2017, 7(1):41006, http://dx.doi.org/10.1038/srep41006.

58. Tine J et al., *Universal Health Coverage Measurement in a Lower-Middle-Income Context: A Senegalese Case Study*, Bethesda, MD, USA: Health Finance & Governance Project and Abt Associates, 2014.

59. Johnston HB, Gallo MF and Benson J, Reducing the costs to health systems of unsafe abortion: a comparison of four strategies, *Journal of Family Planning and Reproductive Health Care*, 2007, 33(4):250–257, http://dx.doi.org/10.1783/147118907782101751.

60. Goldie SJ et al., Alternative strategies to reduce maternal mortality in India: a cost-effectiveness analysis, *PLoS Medicine*, 2010, 7(4):e1000264, doi:10.1371/journal.pmed.1000264.

61. Hu D et al., The costs, benefits, and cost-effectiveness of interventions to reduce maternal morbidity and mortality in Mexico, *PLoS One*, 2007, 2(8):e750, http://dx.doi.org/10.1371/journal.pone.0000750.

RESUMEN

Contexto: *El aborto inseguro es una práctica común en Senegal, pero la atención postaborto (APA) no es accesible para algunas mujeres que la necesitan y se desconoce el costo de proveer APA para el sistema de atención a la salud.*

Métodos: *Se estimó el costo de proveer APA para el sistema de salud de Senegal en 2016 –a los niveles de servicio existentes y si, hipotéticamente, el acceso se expandiera–mediante el uso de la Metodología de Costeo de la Atención Postaborto, un enfoque ascendente basado en componentes. De septiembre de 2016 a enero de 2017 se condujeron entrevistas personales con proveedores de APA y administradores de instituciones de salud en una muestra nacional de 41 instituciones de salud, con el fin de recolectar datos sobre los costos directos e indirectos de la provisión de atención, así como sobre las cuotas que se cobran a las pacientes. Se llevó a cabo un análisis de sensibilidad para examinar la precisión de los resultados.*

Resultados: *En total, 1,642 mujeres recibieron APA en las instituciones de salud del estudio en 2016, lo que se traduce en 18,806 mujeres que recibieron APA a nivel nacional. Las instituciones de salud pública proveen casi la totalidad de los servicios. El costo promedio por paciente en las instituciones del estudio fue de US$26.68; a nivel nacional, el costo estimado fue de US$24.72. El costo total estimado a nivel nacional de proveer APA a los niveles existentes fue de US$464,928; los costos directos representaron más de las tres cuartas partes del costo. Los cargos cobrados a las pacientes de APA ascendieron al 20% del total de costos incurridos. Si la provisión del servicio se hubiera expandido para satisfacer todas las necesidades de APA, los costos estimados para el sistema de salud habrían sido de US$804,518.*

Conclusión: *Los costos anuales de la APA son cuantiosos en Senegal. Una mayor inversión para garantizar el acceso a anticonceptivos podría disminuir estos costos al reducir el número de embarazos no planeados que, con frecuencia, conducen al aborto inseguro.*

RÉSUMÉ

Contexte: *L'avortement non médicalisé est courant au Sénégal, mais les soins après avortement (SAA) ne sont pas accessibles à certaines femmes qui en ont besoin et le coût de la prestation de ces soins, au niveau du système de santé, est inconnu.*

Méthodes: *Le coût pour le système sanitaire sénégalais de la prestation de SAA en 2016 – aux niveaux existants et si l'accès était hypothétiquement élargi – a été estimé selon l'approche ascendante par élément PACCM (Post-Abortion Care Costing Methodology). De septembre 2016 à janvier 2017, des entretiens en personne ont été menés avec des prestataires de SAA et des administrateurs d'établissement dans un échantillon national de 41 structures de santé, dans le but de collecter des données sur les coûts directs et indirects de la prestation de soins, ainsi que sur les frais imposés aux femmes. La précision des résultats a été examinée par analyse de sensibilité.*

Résultats: *Au total, 1 642 femmes avaient reçu des SAA dans les structures soumises à l'étude en 2016, ce qui équivaudrait à 18 806 femmes à l'échelle nationale. Presque tous les services étaient fournis dans des structures publiques. Le coût moyen par patiente dans les structures de l'étude était de 26,68 dollars américains. À l'échelle nationale, ce coût était estimé à 24,72 dollars. Le coût national total estimé de la prestation de SAA aux niveaux existants a été calculé à 464 928 dollars. Les coûts directs représentent plus de trois quarts de ce montant. Les frais imposés aux patientes de SAA s'élevaient à 20% de la totalité des coûts encourus. Si la prestation de services avait été étendue pour satisfaire à la totalité des besoins de SAA, les coûts totaux estimés, pour le système de santé, auraient atteint 804 518 dollars.*

Conclusion: *Les coûts annuels des SAA sont considérables au Sénégal. Un investissement accru dans l'assurance de l'accès à la contraception permettrait de faire baisser ces coûts par réduction du nombre de grossesses non planifiées qui mènent souvent à un avortement non médicalisé.*

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APPENDIX TABLE 1. Types of data collected

Data type	Data collected
Direct costs	
Clinical personnel	Clinical staff salaries, monthly hours of work and average minutes spent with each patient type. These staff included obstetrician-gynecologists, anesthesiologists, other doctors, nurses, laboratory technicians and pharmacists
Other clinical resources	Average per patient quantities required for consumables (e.g., syringes, needles, gloves), small equipment (e.g., sheets, forceps, aspirator), medications, and laboratory and diagnostic tests (e.g., sonograms, x-rays)
	Purchase prices for all resources used
Indirect costs	
Capital	Costs of constructing and equipping a similar facility
Overhead	Annual building maintenance, utilities, vehicle maintenance, travel expenses, audio/visual materials, education/reference materials and printed materials
Indirect personnel	Salaries and number of staff for supporting positions (guards, cleaners, receptionists, record keepers, supply clerks, maintenance workers, drivers, food preparers, health inspectors, and health educators) and administrative time spent by clinical personnel
Fees	
Hospitalization	Fees per day paid by admitted PAC patients
Outpatient	Fees paid by PAC patients per outpatient consultation/treatment session

All data were obtained from interviews conducted with health care providers and facility administrators, except for the information on purchase prices, which was obtained from the Senegalese Ministry of Health, Management Sciences for Health's *International Medical Products Price Guide* and other regional commodity suppliers (references 28–31). *Note:* PAC=postabortion care.