

Original research article

Doing more for less: identifying opportunities to expand public sector access to safe abortion in South Africa through budget impact analysis[☆]

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Abstract

Objective(s): To estimate the costs of public-sector abortion provision in South Africa and to explore the potential for expanding access at reduced cost by changing the mix of technologies used.

Study design: We conducted a budget impact analysis using public sector abortion statistics and published cost data. We estimated the total costs to the public health service over 10 years, starting in South Africa's financial year 2016/17, given four scenarios: (1) holding service provision constant, (2) expanding public sector provision, (3) changing the abortion technologies used (i.e. the method mix), and (4) expansion plus changing the method mix.

Results: The public sector performed an estimated 20% of the expected total number of abortions in 2016/17; 26% and 54% of all abortions were performed illegally or in the private sector respectively. Costs were lowest in scenarios where method mix shifting occurred. Holding the proportion of abortions performed in the public-sector constant, shifting to more cost-effective service provision (more first-trimester services with more medication abortion and using the combined regimen for medical induction in the second trimester) could result in savings of \$28.1 million in the public health service over the 10-year period. Expanding public sector provision through elimination of unsafe abortions would require an additional \$192.5 million.

Conclusions: South Africa can provide more safe abortions for less money in the public sector through shifting the methods provided. More research is needed to understand whether the cost of expanding access could be offset by savings from averting costs of managing unsafe abortions.

Implications: South Africa can provide more safe abortions for less money in the public sector through shifting to more first-trimester methods, including more medication abortion, and shifting to a combined mifepristone plus misoprostol regimen for second trimester medical induction. Expanding access in addition to method mix changes would require additional funds.

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1. Introduction

The Millennium Development Goals (MDGs) and now the Sustainable Development Goals (SDGs), include a commitment to ensuring universal access to sexual and reproductive health services [1,2]. Safe abortion is a vital component of these services and should be considered when planning and monitoring universal access. Unfortunately, however, a lack of published cost data on the provision of safe abortion services — for health systems and women's costs — complicates planning efforts.

South Africa's progressive abortion law provides for abortion on demand up to 12 weeks gestation and for reasons including socioeconomic hardship through 20 weeks of gestation [3]. Both medical and surgical methods are available in the public sector. In the first trimester, manual vacuum aspiration (MVA) is the dominant method. Since 2011, medication abortion has been introduced in six provinces; three provinces still do not offer the service. In the second trimester, dilation and evacuation (D&E) is available in a limited number of high volume settings, most, if not all, in one province. Medical induction services performed with misoprostol only are the standard nationwide, although, in 2014, one province changed their medical induction regimen to include mifepristone [4].

South Africa adopted both the MDGs and the SDGs, and its local laws and policies are supportive of rights-based service provision [5]. Yet, access to safe, affordable abortion services remains a challenge for many women [6,7]. A quarter of all abortion services are provided in the second trimester for reasons including late presentation by women and structural barriers to earlier access [8]. In some instances women attempt self-induction [9] or seek help from illegal providers [10]. South Africa is one of few countries globally where women continue to die from the consequences of unsafe abortion despite the service being permitted under broad legal criteria [11–13]. Expansion of public sector abortion provision could help to address these critical problems.

In this analysis, we aim to estimate the current total costs of public-sector abortion service provision in the country, and to explore the potential for expanding public sector access through improved technical efficiency, which conceptually implies providing a set quantity of goods or services for the least cost. We also estimate the costs to the public health service resulting from shifting illegally provided abortions to safe abortions performed by the public sector.

2. Materials and methods

2.1. Budget impact analysis

We conducted a budget impact analysis using public sector service statistics and published cost data. Budget impact analysis is a type of economic evaluation that allows

for assessment of the financial implications of introducing a new technology or changes in the technological method mix over a period of time [14,15]. The budget holder or payer is the target audience, and the affordability of the intervention and the required financial streams over time are considered [14]. For this analysis, the basic design includes multiplying service volume by unit costs per procedure to estimate the total costs over a 10-year period (Fig. 1), starting in a “base” year defined as South Africa's financial year April 2016 to March 2017 (2016/17).

2.2. Service volume and method mix

We obtained data on abortion services provided in the public sector in South Africa from the country's District Health Information Software (DHIS), which contains data on health services provided in all public sector facilities [16,17]. The DHIS tracks only the number of abortions provided. We estimated the current proportions of first- versus second-trimester procedures and the method mix for each gestational period based on other sources, including government reports, published literature, and consensus expert opinion (Table 1).

In 2016, Sedgh et al. estimated that for countries globally where abortion is permitted legally on socioeconomic grounds (such as South Africa), the underlying total abortion rate is 31 (90% uncertainty interval 23–47) per 1000 women aged 15–44 [18]. This rate was estimated through construction of a “Bayesian hierarchical time series model” which predicted total abortion rates for global regions and country categories. The formula for predicting abortion rates considered several factors, including contraceptive prevalence and fertility rates. The total abortion rate captures all procedures – safe and unsafe, documented and undocumented. We used South African census data to determine the number of women aged 15–44 in 2016 [19], and applied the estimated total abortion rate to obtain the total number of abortions expected in South Africa in that year. For projections over time, we assumed a constant total abortion rate of 31 per 1000 women aged 15–44, plus population growth at an annual 1.62% [19].

Next, we used local and published data to estimate the proportion of procedures performed in the public, private and illegal sectors in South Africa in the model base year. We consider the “illegal sector” to represent provision of unsafe abortions by unskilled providers, in unsafe/illegal settings, or both. We first used 2015/16 South African DHIS abortion and census data to establish a “public sector abortion rate,” or the number of abortions per 1000 women performed in the public sector. We assumed the proportion of abortions provided in the illegal sector was 8 per 1000 women aged 15–44 based on a 2006 publication by Singh et al. indicating the rate of admissions to South African hospitals for complications of unsafe abortion [20]. We then added the public sector rate to the illegal sector rate and subtracted the total from the total abortion rate to obtain the rate in the private sector.

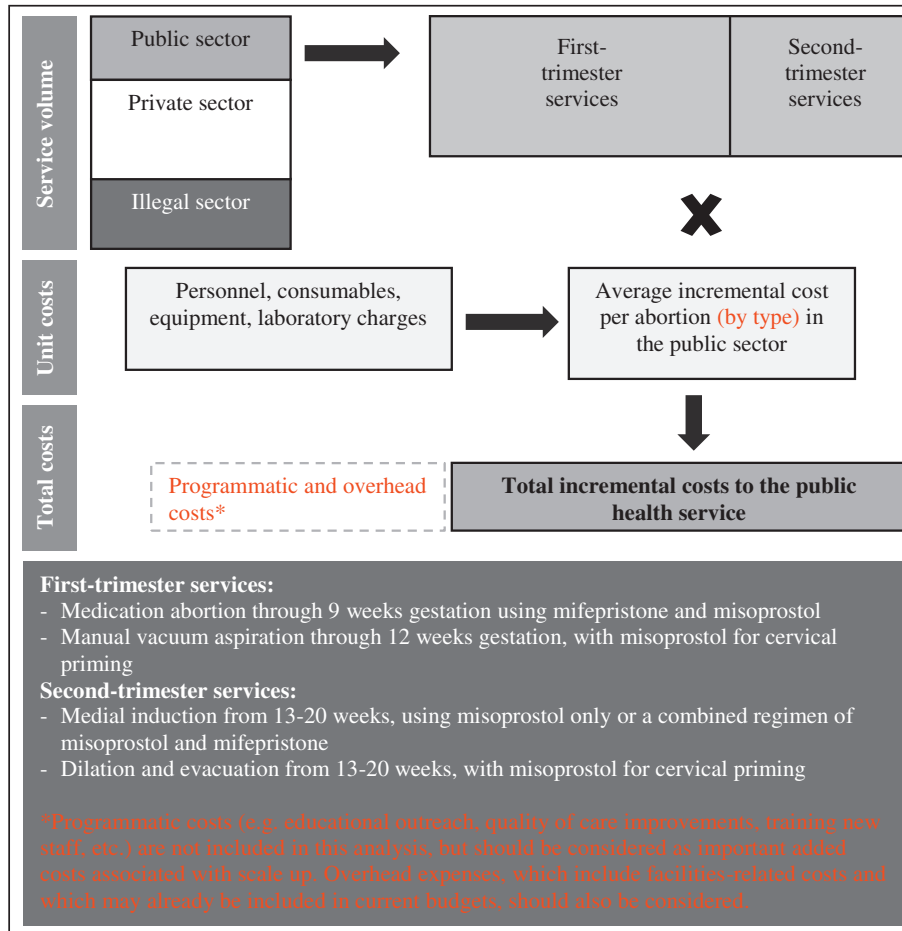


Fig. 1. Estimating total costs for public-sector abortion service provision in South Africa.

2.3. Costs and cost effectiveness

We obtained health-service costs per abortion type from two prior economic evaluations conducted in South Africa [21,22]. The first evaluation presented the costs and cost-effectiveness of first-trimester services: MVA and medication abortion using mifepristone and misoprostol [22]. The economic evaluation was performed as part of a larger cohort study conducted at public hospitals in KwaZulu-Natal Province from 2009–2011 [23]. For second-trimester services, the economic evaluation presented health service costs and cost-effectiveness for D&E and medical induction with and without mifepristone [21]. The clinical data for the second-trimester economic evaluation were collected in hospitals in Western Cape Province as part of a clinical trial in 2012–2013 [24] and a separate cross-sectional study that included observations in 2008, 2010, and 2014 [4,25].

Both economic evaluations used micro-costing to estimate the costs of abortion service provision. Costs were presented in 2015 US dollars and included personnel, consumables, equipment, laboratory and medication. Both evaluations also included hospitalization costs for complications. Costs for training and offering contraceptives were

excluded. The estimated total average costs per procedure were incremental in that they largely excluded overhead costs (i.e. buildings, utilities, general receptionists, security guards, etc.). For first-trimester services, because the presented costs were incremental and performed by nurses in the economic evaluation, we assumed the incremental costs would be the same whether procedures were provided in a clinic or a hospital setting. Finally, both economic evaluations used uncertainty analysis to produce “uncertainty ranges” around the cost estimates per procedure. The ranges represented ±25% variation in personnel time and the costs of consumables, equipment, and hospitalization.

For this analysis, we inflated the published procedural costs to 2016 South African Rands using the International Monetary Fund’s (IMF’s) Consumer Price Index [26]. Then we projected costs forward from 2016/17 to 2025/26 assuming an average annual inflation rate of 6.4% (based on a previous 10-year average) [26]. Costs are reported here in US dollars (\$) based on an average exchange rate for 2016 [27].

2.4. Scenario analysis

Using the estimated service volume and cost inputs as noted above, we calculated the total costs to the health

Table 1
Model parameters

	Base year (2016/17)			Target year (2025/26)		
	Base	Range ^a	Source	Base	Range ^a	Source
Population and total abortions						
Total population of women aged 15–44	13,820,100	–	[19]	15,970,698	–	[19]
Annual population growth rate	1.62%	–	[19]	1.62%	–	[19]
Abortion rate, share of procedures						
Abortion rate — all sectors	31.0	(23.0–47.0)	[18]	31.0	(23.0–47.0)	[18]
Public sector, abortion rate	6.1	(6.1–7.6)	^b	24.8	(18.4–37.6)	Target
Public sector, proportion of all abortions	19.7%	(16.3–26.6)	^c	80%	–	
Illegal sector, abortion rate	8.0	(6.0–10.0)	[20]	0.00	(0.0–0.0)	Target
Illegal sector, proportion of all abortions	25.8%	(21.3–26.1)	^c	0.00%	(0.0–0.0)	
Private sector, abortion rate	16.9	(10.9–29.4)	^d	6.2	(4.6–9.4)	Target
Private sector, proportion of all abortions	54.5%	(47.3–62.5)	^c	20.0%	–	
Technological method mix						
Performed in first trimester	75%	(70–80)	[41]	85%	–	Target
Proportion medication abortion	30%	(24–37)	^e	65%	–	Target
Proportion MVA	70%	(63–76)	^e	35%	–	Target
Performed in second trimester	25%	(20–30)	[41]	15%	–	Target
Proportion MI w/ combined regimen	8%	(6–10)	^f	70%	–	Target
Proportion MI w/ misoprostol alone	74%	(68–81)	^g	0%	–	Target
Proportion D&E	18%	(13–22)	^h	30%	–	Target
Average incremental health service cost per abortion						
Medication abortion	\$63.91	(52.35–75.51)	[22]	\$113.91	(93.26–134.59)	Inflated
MVA	\$69.60	(52.62–86.57)	[22]	\$124.06	(93.79–154.30)	Inflated
D&E	\$88.89	(67.43–110.35)	[21]	\$158.44	(120.19–196.69)	Inflated
MI with combined regimen	\$298.03	(231.93–364.12)	[21]	\$531.21	(413.39–649.01)	Inflated
MI with misoprostol alone	\$364.08	(277.08–451.09)	[21]	\$648.94	(493.87–804.02)	Inflated

D&E, dilation and evacuation; MVA, manual vacuum aspiration; MI, medical induction; w/, with; Abortion rate, X per 1000 women aged 15–44.

^a If no range is provided, no high or low estimates were available or the base case was a target, or goal, with no range.

^b Calculated for this analysis based on total population figures and District Health Information Software reports for 2015/16 [42,43]. The low value in the range represents the actual figures; the high value represents inflation of the actual figures by 25% to account for underreporting.

^c Proportions are calculated by dividing the public sector abortion rate by the total abortion rate.

^d Calculated based on total abortion rate (31.0) less public and illegal sectors.

^e Medication abortion volume was estimated using sales data from the only supplier of mifepristone in South Africa.

^f Estimated based on mifepristone sales data and service data from facilities in Western Cape Province.

^g Calculated by subtracting combined-regimen and D&E services from the total second-trimester procedures.

^h Estimated based on service data from facilities in Western Cape Province and assumptions for other provinces.

service over 10 years under four scenarios: 1) No change, 2) Expanded public provision, 3) Method mix changes, and 4) Expansion and method mix changes (Table 2). Table 2 summarizes all scenario attributes.

Scenario 1, “No change,” reflects the expected natural increase in costs and abortions over time given population growth and inflation and represents the expected budget for

services given no formal increases or policy changes prior to 2025/26. This scenario assumes that abortion service provision in the public sector does not increase or decline from current rates, that the method mix does not change, and the proportion of first- versus second-trimester procedures remains constant.

For scenario 2, “Expanded public provision,” we increased the public sector abortion rate until it represented

Table 2
Scenario attributes

Changes to proportion of abortions performed ... over a 10-year period	Scenario			
	1 No change (budget)	2 Expanded public provision	3 Method mix changes	4 Expansion & method mix changes
In public sector (vs. private or informal/unsafe)	No	Yes	No	Yes
In first trimester (vs. second)	No	No	Yes	Yes
With medication abortion (vs. MVA)	No	No	Yes	Yes
With D&E (vs. medical induction)	No	No	Yes	Yes
With combined regimen for medical induction (vs. misoprostol alone)	No	No	Yes	Yes

D&E, dilation and evacuation; MVA, manual vacuum aspiration.

80% of all abortion services provided in the country in model Year 10. This is congruent with current data indicating that 80% of South Africa's population does not have health insurance and relies on the public sector for health care [28]. While increasing the public-sector share, we optimistically reduced abortions in the illegal sector to 0% in Year 10, eliminating unsafe abortion in the country. We then attributed the balance of abortion services (i.e. 20%) to the private sector.

For scenario 3, "Method mix changes," we held the public sector abortion rate constant at the current rate and instead changed the method mix. We decreased the proportion of second-trimester procedures from 25% to 15% over the 10-year period. For first-trimester procedures, we also increased the proportion of services provided via medication abortion (from an estimated 30% to 65%) because medication abortion has been shown to be more cost-effective than MVA in South Africa [22]. We did not eliminate MVA services in the model as they are required as a backup for medication abortion, and because offering women a choice of services has been shown to be important for acceptability [29,30].

In the second trimester, D&E services have been shown to be most cost-effective in terms of the cost per complete abortion when comparing surgical and medical methods [21]. Medical induction with a combined regimen of mifepristone and misoprostol is also more cost-effective than misoprostol alone [21]. Based on this evidence and known challenges in South Africa with increasing D&E service capacity, for second-trimester services in scenario 3, we scaled up D&E moderately from 18% to 30% of procedures, and we eliminated medical induction with misoprostol alone by 2025/26. The remaining 70% of second-trimester services were then attributed to medical induction with a combined regimen. Finally, in scenario 4, we combined the changes described for scenarios 2 (expansion only) and 3 (method mix changes only).

Table 1 provides detailed listings of the base year and target year proportions for all parameters. Table 1 also includes uncertainty ranges for most parameters. South Africa's DHIS data may underrepresent actual service provision due to problems with reporting mechanisms in the country. For the public sector abortion rate, we calculated the rate based on reported DHIS figures. Then we established a range for the rate that assumes the lowest possible figure represents the reported data, and the highest possible figure represents 25% more procedures than are reported. To address uncertainty in the published rate of hospitalization from unsafe abortion (8 per 1000 women aged 15–44), which is now over 10 years old [20], we assumed 25% lower and higher figures to establish a plausible range. Ranges for the current proportions of first versus second-trimester services and the three second-trimester methods were similarly established using estimates 25% higher and lower than our base estimates. For medication abortion, we also reviewed national mifepristone sales data and estimated annual wastage or non-use in the public sector.

For each of the four scenarios, we estimated total costs to the public health service and the total number of abortions performed in the public, private and illegal sectors. We created plausible ranges for abortion service volumes using univariate variation of the input parameters. For example, for the public sector abortion service volume in year one, we calculated the minimum estimate in the range using the low estimate for the public sector abortion rate (noted in Table 1) and the expected population of women aged 15–44 in year one. For the maximum in the range, we used the high estimate of the public sector abortion rate and the female population aged 15–44 in year one. For the total cost outcomes, we created plausible ranges using multivariate variation of the input parameters. For example, for the total costs to the health service for public sector abortion provision in year one, we calculated the low cost estimate using the low service volume estimate for the public sector and the lowest cost estimate for each procedure (noted in Table 1). We also included the lowest estimate of second trimester service provision, the highest estimate of current medication abortion service provision (because medication abortion is less costly than MVA), the highest estimate of D&E provision (which is less costly than medical induction) and the highest estimate of medical induction with mifepristone (which is less costly than the procedure performed with misoprostol alone).

3. Results

3.1. Abortion rate by sector and total abortions

The national population of women aged 15–44 for financial year 2016/17 (April 2016 to March 2017) was roughly 13.8 million (Table 1), and we estimate that 84,516 abortions or 6.1 per 1000 women aged 15–44 were performed in the public sector (Table 3). This was an estimated 20% of all expected abortions. We estimated that 26% of abortions took place in the illegal sector, and that the remaining 54%, or 16.9 abortions per 1000 women aged 15–44, were performed in the private sector.

The total estimated number of abortions provided in the public, private and illegal sectors for three time periods (2016/17, 2025/26 and 2016/17 to 2025/26) are provided in Table 3. In Year 10 (2025/26) alone, we estimate that roughly 495,000 abortions will be performed across all sectors. For Scenarios 1 and 3, where there is no expansion of public sector provision beyond the current 20% of the total share, the public sector will provide approximately 98,000 abortions. In addition, we estimate that 128,000 and 270,000 abortions will take place in the illegal and private sectors respectively. For scenarios 2 and 4, which allow for expansion of public-sector provision to 80% of all abortions, in Year 10, roughly 396,000 abortions will be provided in the public sector, and 99,000 abortions will be provided in the private sector. Also in scenarios 2 and 4, by Year 10 illegal abortions are dropped to zero, resulting in an estimated total

Table 3

Total abortions performed (in thousands) in all sectors and total costs to the public health service (in millions) for safe abortions in years 1, 10 and total of all 10 years^a

	Scenario 1 No change (budget)	Scenario 2 Expanded public sector provision	Scenario 3 Method mix changes	Scenario 4 Expansion & method mix changes		
Year 1 (2016/17)						
Abortions	428 (318–650)	Same as scenario 1	Same as scenario 1	Same as scenario 1	Same as scenario 1	
Public	85 (85–106)	20% Same as scenario 1	Same as scenario 1	Same as scenario 1	Same as scenario 1	
Private	233 (150–406)	54% Same as scenario 1	Same as scenario 1	Same as scenario 1	Same as scenario 1	
Illegal	111 (83–138)	26% Same as scenario 1	Same as scenario 1	Same as scenario 1	Same as scenario 1	
Total public sector costs ^b	\$11.4 (7.8–19.9)	Same as scenario 1	Same as scenario 1	Same as scenario 1	Same as scenario 1	
Year 10 (2025/26)						
Abortions	495 (367–751)	495 (367–751)	495 (367–751)	495 (367–751)	495 (367–751)	
Public	98 (98–122)	20% 396 (294–600)	80% 98 (98–122)	20% 396 (294–600)	80% 98 (98–122)	
Private	270 (174–469)	54% 99 (73–150)	20% 270 (174–469)	54% 99 (73–150)	20% 270 (174–469)	
Illegal	128 (96–160)	26% 0 (0–0)	0% 128 (96–160)	26% 0 (0–0)	0% 128 (96–160)	
Total public sector costs ^b	\$22.4 (15.2–38.9)	\$90.6 (45.7–191.4)	\$15.9 (12.5–24.1)	\$64.5 (37.7–118.5)		
Years 1–10 (2016/17–2025/26)						
Abortions	4610 (3421–6990)	4610 (3421–6990)	4610 (3421–6990)	4610 (3421–6990)	4610 (3421–6990)	
Public	910 (910–1137)	2340 (1850–3430)	51% 910 (910–1137)	20% 2340 (1850–3430)	51% 910 (910–1137)	
Private	2511 (1618–4366)	54% 1693 (1137–2838)	37% 2511 (1618–4366)	54% 1693 (1137–2838)	37% 2511 (1618–4366)	
Illegal	1190 (892–1487)	26% 577 (433–722)	13% 1190 (892–1487)	26% 577 (433–722)	13% 1190 (892–1487)	
Total public sector costs ^b	\$163.6 (111.2–284.9)	\$447.4 (237.8–918.7)	\$135.5 (99.8–219.5)	\$356.2 (209.5–666.1)		

^a Line items may not add up to total due to rounding.

^b Low estimate in range = low public sector service volume estimate × low cost estimates for methods. High estimate = high public sector volume × high costs for methods. For scenarios 1 and 3, method mix reflects current mix. For scenarios 2 and 4, method mix shifts to cost effective method targets by Year 10.

of 613,000 fewer unsafe abortions during the 10-year period when compared to scenarios 1 and 3 where public sector expansion does not take place.

3.2. Total costs to the public sector

The total estimated costs over the projected 10-year period for abortion service provision in the public sector, assuming no changes to the current share or method mix (i.e. Scenario 1), are estimated to be \$163.6 million (Table 3).

Fig. 2 illustrates total costs, service volume and method mix over time for all four scenarios. Comparing scenarios with more cost-efficient method mixes to scenarios where the method mix is held constant, total costs are lower in scenarios with the method mix adjustments. When the proportion of procedures performed in the public sector is held constant at 20% of all abortions, shifting to a more cost-effective method mix could result in savings of \$28.1 million in the health service over the 10-year period. Similarly, shifting to more cost-effective methods while increasing the share of abortions provided in the public sector to 80% of total abortions could result in savings of \$91.2 million in the public health service over the 10-year period.

Expanding service provision in the public sector, to potentially eliminate unsafe abortions, together with shifts to more cost-effective approaches, would require an additional \$192.5 million over the next 10 years at base case costs and service volume estimates.

Fig. 3 provides the results of one-way sensitivity analysis for the model's baseline parameter estimates. The vertical line representing the “expected difference with baseline estimates” is the \$192.5 million noted above, i.e., the 10-year cumulative difference between scenario 1 (no change) and scenario 4 (expansion and method mix changes). The “low” series represents changes to that difference when the lower estimate for each parameter is assumed in year one of the model. The “high” series likewise represents changes assuming the highest estimate for the parameter in year one. The total abortion rate is held constant throughout the 10 years, so the high and low series represent a constant higher or lower estimate (i.e. at year one and at Year 10). Movement from the “expected difference” line to the right means that the difference in costs would be greater with the parameter; movement to the left indicates a smaller difference (i.e. less additional costs to finance).

Overall Fig. 3 illustrates that the model is most sensitive to the estimate of the total abortion rate. If the rate is currently higher than the baseline estimate of 31 per 1000 women aged 15–44, South Africa's public sector will need to expand further (and invest more) to reach 80% of all service provision. Similarly, the model is sensitive to the estimate of the public sector abortion rate, which is dependent on South Africa's DHIS data. For example, at baseline the public sector abortion rate is estimated at 6.1 per 1000 women aged 15–44. The range for that parameter in the model is 6.1–7.6. Fig. 3 indicates that if the public sector rate is actually 7.6 (i.e. the high estimate) in year 1, the difference

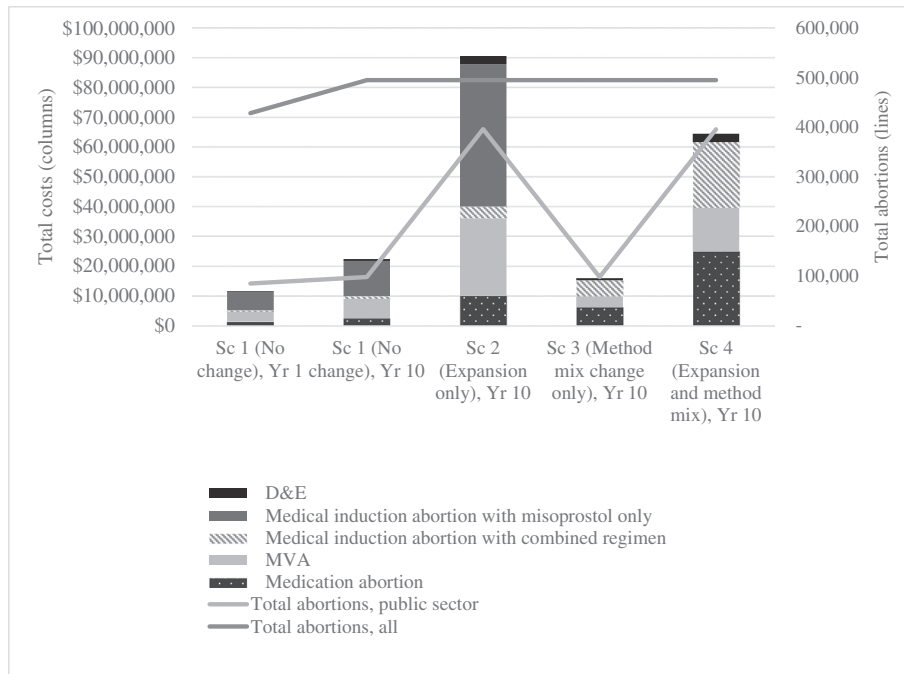


Fig. 2. Total abortions and total annual costs (\$) to the public health service for abortion service provision by abortion method and scenario*.

in costs between scenario 1 and scenario 4 over the 10 years would decrease to just over \$150.0 million (holding all other parameters constant at their baseline estimates).

4. Discussion

According to routinely reported data, the public health sector in South Africa, which serves 80% of the population, provided just 20% of the total estimated number of abortions in the model base year, leaving many women to seek services illegally or in the private sector.

A quarter of public-sector service provision in the model base year was second-trimester services, offered mainly through misoprostol-only medical induction. Also just 30%

of first-trimester services were provided via medication abortion. This method mix represents current practice and is inefficient from a cost perspective. This analysis demonstrates that technical efficiency gains are possible through shifts to more cost-effective service provision in the public sector, including increasing the proportion of abortions performed in the first trimester, offering more medication abortion, scaling up D&E services, and shifting to a combined regimen of mifepristone and misoprostol for all medical induction services. These changes to the technological method mix in the public sector, assuming no simultaneous expansion of services in the public sector, could result in savings of \$28.1 million over a 10-year period.

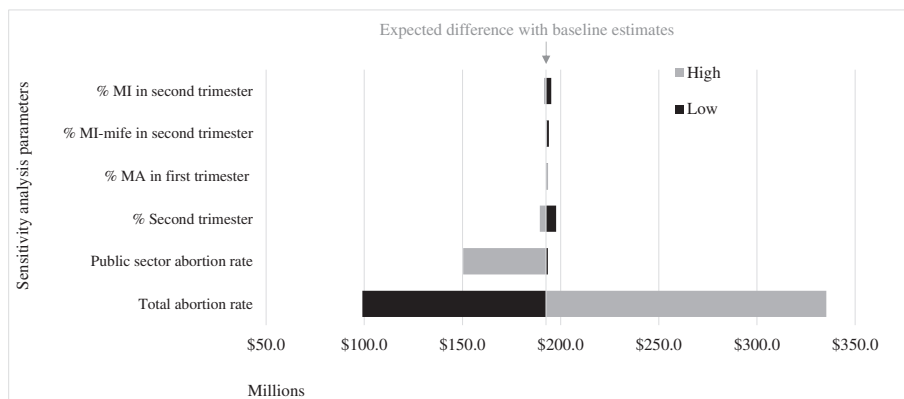


Fig. 3. Tornado diagram: impact of variation of model inputs at baseline (Year 1) on additional 10-year costs required for moving from Scenario 1 (no change) to Scenario 4 (method mix and expansion).

Savings through technical efficiency gains represent an opportunity to improve service quality or expand abortion access or both. Expanding public-sector provision to 80% of all abortions would require an additional \$192.5 million over the next 10 years, or \$19.2 million per year, even with cost savings from shifting the method mix. However, this is a small portion of the overall public health budget, which was roughly \$12 billion (140.9 billion Rands) in 2014/15 alone [31]. Also, an investment in expanding public sector access to abortion services could result in cost savings elsewhere.

Based on modeled data, we estimated that as much as 26% of all abortions currently take place in the illegal sector (by untrained, illegal providers, under unsafe conditions, or both). This is based on a rate reported by Singh et al. in 2006, which approximated hospital admissions from unsafe abortion [20]. The rate was based on South African public hospital admissions data published in 2005 [32], which were subsequently adjusted by Singh et al. to account for postabortion care provided in private hospitals and non-hospital settings. The rate of all unsafe abortion occurring today may be higher or lower than the hospital admissions rate published in 2006. Unfortunately, there is almost no current data on this topic. Given the widespread availability of misoprostol in South Africa today, it is possible that many unsafe abortions do not result in hospital admission. However, other less-safe abortifacients are also used [9]. One study in 2010 in South Africa with school-going youth in grades 8–11 (aged 13–19), showed that 8% had had an abortion, and of those, 48.5% had the abortion outside of a clinic or hospital [33]. However, access for this young group may have been more challenging than for older women. In another study conducted with 18–24-year-old young women in Soweto, South Africa in 2009, nearly 80% knew where to obtain a safe abortion [34].

Regardless of the actual volume of unsafe abortion in the country, it is clear that mortality from unsafe abortion continues to be a problem [13,35]. We estimated that scaling up public-sector service provision could result in 613,000 fewer unsafe abortions over the 10-year modeled period. We were unable to estimate the cost savings to the public sector of eliminating unsafe abortions; however, the costs are likely to be substantial — as has been shown in other settings [36–38].

This study has limitations. The public-sector DHIS data may underrepresent actual service volume; this was addressed through use of an uncertainty interval that allowed for increasing the public sector abortion rate by 25%. Also, many of the model inputs were estimates or based on older, published data. This included the proportion of abortions performed in the first versus second trimester, the estimate of the rate of unsafe abortions in the country, the proportion of abortions performed using medical or surgical means, and the proportions for the three second-trimester methods. For parameters that did not exist in published literature or other reliable sources, we generated estimates using mifepristone sales data (for those services requiring mifepristone) and

expert opinion. We also created uncertainty ranges for each parameter.

It is important to note that our estimates of the volume of abortion services provided in the public sector and the costs to the public sector of expanding service provision are not affected by uncertainty in the illegal sector estimates. Uncertainty in the public sector service volume presented here represents uncertainty in the DHIS data, which captures services provided. Subsequently, the *proportion* of services provided in the public sector and the costs of scaling up are dependent on estimates of the total number of abortions occurring in the country (i.e. the DHIS data) and the estimate of the total abortion rate. Given the sensitivity of the model to the accuracy of the DHIS data, policymakers could benefit from careful checking of this data in the future.

Our estimate of additional funds required over time to expand public sector access are based on assumptions that service provision levels remain the same throughout the 10 years in the “No change” scenario (Scenario 1). Recent service provision data have reflected a decline nationally [17]. If there is no urgent intervention to address that trend, the costs of expanding access could be even greater.

Also, our cost estimates required projecting costs forward in time, and assuming stability in prices and inflation rates. We have provided ranges for all costs based on uncertainty in the model inputs; however, our projections should be viewed as estimates only. Our abortion costs were also derived from studies conducted in hospital settings. For first-trimester services, which can also be provided in clinics, the incremental costs used in our study are unlikely to vary significantly between hospitals and clinics. However, for both second- and first-trimester services, costs would vary if services were provided in other settings — for example in private facilities, potentially through public-private partnerships.

Finally, the costs presented here are incremental and do not include programmatic or overhead costs associated with service provision. Excluding overhead implies that the physical structures, receptionists, security guards, etc. needed for service provision exist already or will be budgeted for separately. This should be considered carefully as prior research has shown that overhead costs can comprise a significant proportion of full abortion service costs [39]. Programmatic costs, which may include outreach campaigns, training or retraining of staff, and other quality and service improvements, may also result in significant costs to the public health service, and should be considered in planning efforts.

There are plans in place in South Africa for introduction of a National Health Insurance (NHI) system, which will create a single payer for all health care (in contrast to the current dual system of publicly and privately funded health care). The deadline for introduction of the NHI is financial year 2025/26 [40], and significant public-private partnership is expected by that date. The introduction of a NHI system in South Africa will bring significant adjustments to health care

financing mechanisms at the national level. Although, the \$192.5 million required for scale up of abortion services may represent a small proportion of the expected national health budget over the next 10 years, in a rapidly changing environment with many competing priorities, abortion service delivery may not be viewed as a priority without further evidence supporting the “hidden” costs of not expanding public sector access. Further research on the expected costs of managing the morbidity and mortality from unsafe abortion in South Africa is urgently needed in order to understand the true costs and benefits of scaling up safe abortion service provision.

To our knowledge, this is the first formal budget impact analysis to explore the costs of changes to abortion services in a country with a progressive abortion law. Other comparable analyses have looked at shifts in service provision in other settings with more restrictive abortion laws [41–43]. These analyses also concluded that shifts to more cost-effective methods, including more medication abortion, could result in cost savings to the health service at the national level. Globally, several countries allow abortion for a broad range of legal reasons and provide services with public funding [44]. Budget impact analyses as performed here may prove beneficial for financial planning in these environments. Governments interested in engaging private sector entities for the establishment of public-private partnerships for service provision, as a means of expanding access, may also benefit from first understanding the costs of offering services in public facilities before engagement.

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