An analysis of the cost of incomplete abortion to the public health sector in South Africa — 1994

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Objective. To analyse the medical costs incurred in treating women for incomplete abortion. This study was performed in conjunction with a nationwide survey of women who presented to public hospitals with incomplete abortion in 1994.

Design. Cost analysis with two modified Delphi panels used to develop models of resource use reflecting three severity categories of symptoms and three hospital treatment settings.

Setting. Public hospitals in South Africa.

Participants. A panel of 15 senior level obstetrician/gynaecologists and a second panel of 11 patient care managers representing district, regional and tertiary level hospitals in 7 provinces.

Main results. A conservative estimate of the total cost of treating women is R18.7 million ± R3.5 million for 1994. An estimated R9.74 million ± R1.3 million of this was spent treating women with 'unsafe' incomplete abortions.

Conclusions. The management of incomplete abortion requires significant public sector expenditure. The long-term indirect costs to women, their families and communities are discussed and treatment costs estimated so that unmet needs for medical care resulting from unsafe abortions can be addressed.

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This article describes a study that assessed the economic costs to the public health sector of treating women in South Africa for the medical consequences of incomplete abortion. The analysis was conducted as one part of a three-pronged national effort to assess various impacts of incomplete abortion. The other two parts examined the epidemiology and hospital management of incomplete abortions[1,2] and women's experience of illegal abortion.[3] This analysis uses

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data derived from an epidemiological study, henceforth referred to as the Incomplete Abortion Study,[1] and has co-ordinated methodology and definitions in respective research designs.

The origin of an incomplete abortion has economic consequences. One is that an induced abortion under unsafe circumstances frequently requires a longer hospital stay and more extensive use of surgery, anaesthesia, blood transfusions and medication than spontaneous incomplete abortions.[4-7] In this analysis we estimate the cost of treatment for all incomplete abortions regardless of origin. We then estimate the fraction of cases that are likely to have been unsafe abortions and estimate the cost of treatment for it.

Although we deal with narrowly defined economic repercussions of treatment, we emphasise that unsafe abortions that are incomplete have broad health and social implications as well.[1,3] Long-term effects, although difficult to quantify in monetary terms, have considerable cost implications for the lives of women, their families and communities and society in general. In the short term, medical treatment frequently represents a major drain on already scarce obstetric and gynaecological hospital resources. Some hospital systems spend 50 - 60% of their obstetric and gynaecology budgets to treat this problem.[6,8] As a result, many hospitals are forced to offer less care to other obstetric and gynaecology patients.

To date, there has been little published information on the economic costs of treating incomplete abortion in South Africa. Although individual clinicians, working in public hospitals and confronted with this issue on an ongoing basis, have reportedly conducted informal assessments of treatment cost (J Moodley — personal communication), there is no record of any attempt to estimate economic costs to the public health sector comprehensively and systematically.

This analysis has used the economic concept of 'inputs' or 'resources' used in providing medical treatment as a foundation for determining costs. We then estimate the value of such resources in monetary terms. The sum total represents the opportunities foregone, or the 'opportunity costs' as a result of using resources to treat a by-and-large preventable health problem. Our specific objectives were: (*i*) to develop a resource use model of patient treatment which reflected differences in the severity of symptoms; (*ii*) to estimate the value of all resources used in treating a patient in each severity category; and (*iii*) to calculate an estimate of the total value of resources used annually by public hospitals to treat patients for incomplete abortion.

Methodology

Conceptual model

The approach to estimating costs in this study was to: (*i*) identify all resources used in treating women with medical complications arising from incomplete abortions; (*ii*) estimate the quantity of each resource used; and (*iii*) determine the monetary value of those resources.[9] The limitations involved in constraining this analysis to an estimation of the direct costs of incomplete abortion are described in the 'Discussion' section of this paper.

We developed a model of hospital resource use that reflected differences in the severity of symptoms and differences in treatment as a function of hospital setting. We defined three levels of severity (high, mid-range, low) and designated three hospital treatment settings: district hospital (< 500 beds), regional hospital (500 - 800 beds) and tertiary care hospital (800+ beds). We then calculated the average cost per patient treatment for each cell a_{ij} in the resulting 3 x 3 matrix of severity level by hospital treatment setting:

	Hospital setting		
	District	*Regional*	*Tertiary*
Severity level	*(< 500 beds)*	*(500 - 800 beds)*	*(800+ beds)*
A = low	a_{11}	a_{12}	a_{13}
B = mid-range	a_{21}	a_{22}	a_{23}
C = high	a_{31}	a_{32}	a_{33}

Using data from the concurrent Incomplete Abortion Study we developed a second 3 x 3 matrix of the incidence of incomplete abortion as a function of severity level and hospital setting. Cells b_{ij} in this matrix are the estimated numbers of women receiving hospital treatment for incomplete abortion during 1994.

The total estimated cost of treatment for 1994 is the sum of the products of corresponding cells in these matrices:

Total cost = $a_{11}b_{11} + a_{12}b_{12} + a_{13}b_{13} + a_{21}b_{21} + \ldots + a_{33}b_{33}$.

Determining severity categories

The study used a panel of 15 physicians working in 14 different hospital settings to assist project staff in developing symptom severity categories. With 1 exception — an obstetrician/gynaecologist presently in an administrative position — all were practising clinicians and represented both urban and rural practice settings located in 7 of the 9 provinces in the country. Five worked in rural district hospitals, 4 worked in regional hospitals and 6 worked in urban, tertiary care settings. All had extensive experience in obstetrics and gynaecology and in the treatment of incomplete abortion. Panellists were identified as a result of their previously expressed interest in the issue under study and/or because they represented a particular practice setting.

A modified Delphi survey approach[10] was used to solicit information from the panellists. Panellists responded to five scenarios, developed by the study staff, which described patients with increasingly severe symptoms requiring different kinds and quantities of resources for treatment. Each panellist was asked to describe, from personal professional practice, the usual treatment protocol for each scenario. Based on the similarity of treatment described in scenarios 1 and 2 and scenarios 4 and 5, descriptions for three categories representing three distinctly different levels of severity were developed. Details of the survey can be found elsewhere.[11] The severity categories are:

Type A (least severe):

Symptoms: No evidence of infection (i.e. no fever); could have vaginal bleeding, some abdominal pain; has retained products of conception.

Treatment: Patient is given an evacuation. She could be treated in the outpatient theatre (if the hospital has one) or treated in the regular operating theatre.

Type B (middle range severity):

Symptoms: Evidence of infection, i.e. low-grade fever; foul smelling discharge/vaginal bleeding; abdominal tenderness and pain.

Treatment: Patient is given an evacuation. She would be admitted as an inpatient and treated in the regular operating theatre.

Type C (most severe):

Symptoms: Evidence of infection; definitely elevated temperature; severe abdominal pain and offensive smelling discharge. Patient complains of weakness, rapid/irregular heartbeat.

Treatment: Patient is admitted and surgery is performed in the regular operating theatre. Patient may require resuscitation. Any surgery beyond evacuation would place the patient in this category, i.e. laparotomy, colpotomy, colpopuncture, hysterectomy. Postoperative care could take place in the ICU if one is available.

Estimating resource use

Information on the kind and quantity of hospital resources used in treating women for incomplete abortion was solicited from individuals with a current practising knowledge of their treatment and care. Ostensibly, these were nurses in charge of acute gynaecology wards. A list of 20 hospitals representing the three hospital settings, located in KwaZulu-Natal, Western Cape, Eastern Cape, Gauteng, Free State, North-West, Mpumalanga and the Northern Province was developed. These hospitals also represented part of the sample for the concurrent Incomplete Abortion Study.

Information was collected via use of a written questionnaire describing a patient's passage through the hospital. The questionnaire was developed for each of the three severity categories described above. Patient time spent at the hospital was divided into 'pre-procedure', 'procedure' and 'post-procedure' intervals. Various stations were identified within each interval along with personnel categories. A check-off and short-answer format was used. The respondent was asked to identify personnel attending the patient at various points and to estimate the length of time they were in contact with the patient. Space for listing usual drugs/medication, laboratory tests, disposable supplies was provided. This process was repeated for each patient prototype: A, B, and C. Questionnaire forms were pilot tested at a study hospital and modified where appropriate.

Personnel from 11 hospitals completed and returned the questionnaires. Respondents represented 4 hospitals at the district level, 3 hospitals at the regional level and 4 hospitals at the tertiary care level.

Summaries of personnel contact time, drugs/medication lists and quantities, laboratory tests and disposable supplies were compiled by the hospital from these questionnaires. Subtotals of types and quantities of personnel and materials for the pre-procedure, procedure and post-procedure periods were calculated for each hospital. Salary schedules for public sector hospital personnel and unit cost schedules for drugs/fluids, disposable supplies and laboratory tests for public hospitals were provided by the Department of Planning at Groote Schuur Hospital, Cape Town.

Hospitalisation costs were estimated from a sample of annual expenditure reports from 3 district hospitals (500 beds), 2 regional hospitals (500 - 800 beds), and 2 tertiary care hospitals (800+ beds). Hospitalisation was defined to include all 'hotel' functions of care, administrative overheads, rent, maintenance and depreciation costs. Mean expenditures for each hospital category were determined and included selected items under 'administrative', 'stores', 'equipment', 'professional and special services' and 'miscellaneous' subheadings. Care was taken not to include items already tallied under 'personnel', 'drugs/medication', 'supplies', 'laboratory' as identified in the resource use survey. Average-cost-per-patient-day figures published for hospitals were not used in order to avoid double-counting the resources enumerated above.

Unit costs were multiplied by the corresponding quantities of resources to obtain a subtotal of estimated costs per treatment per hospital. Because the listing of disposable supplies appeared incomplete for a significant number of the survey respondents, we estimated their value at 5% of the sum of personnel, drugs, laboratory tests and hospitalisation costs. The total of personnel, drugs, laboratory, supplies and mean hospitalisation expenditures by hospital type was determined for each of the 11 hospitals.

The mean cost per patient treatment per severity category was calculated for each hospital type. These represent cells a_{ij} in the 3 x 3 cost matrix. We have dealt with uncertainties in these estimates in the 'Sensitivity analysis' section.

Results

Estimated average cost per treatment

Table I shows the matrix of estimated average patient treatment costs by hospital setting and severity level, referred to earlier as a_{ij}. As might be expected, costs increase with the level of complexity of the hospital setting and with the degree of severity of the patient's symptoms. For the smallest- and largest-capacity hospitals at least, confidence intervals are narrowest for the least severe category and increase as the severity level increases. There is no apparent trend in the range of estimates about the mean for the mid-size (500 - 800 beds) hospitals.

Table I. Average cost per patient treated for incomplete abortion complications (rands)

	Hospital setting		
Severity level	District* (< 500 beds)	Regional† (500 - 800 beds)	Tertiary‡ (800+ beds)
A = low	212 ± 26§	275 ± 158	422 ± 119
B = mid-range	441 ± 57	443 ± 97	576 ± 157
C = high	834 ± 388	896 ± 133	1 497 ± 394

* Average of 4 hospitals.
† Average of 3 hospitals.
‡ Average of 4 hospitals.
§ 95% confidence interval.

The variation of treatment costs within a hospital setting is what would be expected as more severe cases require more

extensive use of resources for stabilisation and treatment. Variation across hospital settings can be explained in part by differences in hospitalisation costs (tertiary care settings are considerably higher), differences in the numbers and type of personnel used to perform various tasks (smaller hospitals would use a medical officer to administer anaesthetic; larger hospitals would use an anaesthesiologist), differences in medical/surgical practice resulting from training and experience and differences in the availability of resources.

Differences in medical protocols within a given severity level have cost implications as well. Respondents reported differences in the use of a general anaesthetic, a systemic analgesic or a local anaesthetic/analgesic for the lowest severity level patients. These differences have implications for the use of surgery facilities and the length of hospital stay. Preferences for specific medications, particularly anaesthetics and analgesics, resulted in significant cost differences (e.g. recommended dosages of fentanyl, 150 µg dose ampoule @R78.57, compared with pethidine, 150 µg dose ampoule @R0.79, both narcotic analgesics).

As might be expected for the more severe cases, there was a considerable difference of opinion on how long to hospitalise a patient. Intensive care units, frequently necessary for level C patients, were unavailable in small rural hospitals. The issue for personnel practising in these settings was when to transfer the patient.

Total cost estimates for the public hospital sector

The estimated number of incomplete abortion patients treated in public hospitals in 1994, as determined in the Incomplete Abortion Study,[1] was 44 686. This number was disaggregated by severity level of patients and by hospital setting in which treatment was received and appears in Table II. Entries in this matrix are b_{ij} referred to in the 'Methodology' section.

The estimated total cost of treating patients for incomplete abortion is R18.7 million. This figure is also disaggregated by severity level and hospital setting. Data appear in Table III. Entries in this matrix represent the products of $a_{ij}b_{ij}$. Their sum represents the estimated total cost.

Sensitivity analysis

How sensitive are the estimates of average cost per patient treatment to uncertainties in the estimates of personnel, drug and laboratory costs? Because the use of these resources were the educated guesses of respondents to the patient management survey, we examined the impact of differences in their estimates on the cost per patient treatment.

Table II. Estimated numbers of incomplete abortions treated in public hospitals in 1994 adapted from Rees *et al.*[1]

Severity level	Hospital setting: District (< 500 beds)	Regional (500 - 800 beds)	Tertiary (800+ beds)	Total
A = low	17 886	4 890	9 083	31 859
B = mid-range	2 918	1 262	2 780	6 960
C = high	2 552	1 326	1 989	5 867
Total	23 356	7 478	13 852	44 686

Table III. Estimated total cost of treating incomplete abortion in public hospitals in 1994 (rands)

Severity level	Hospital setting: District (< 500 beds)	Regional (500 - 800 beds)	Tertiary (800+ beds)	Total
A = low	3 791 832	1 344 750	3 833 026	8 969 608
B = mid-range	1 286 838	559 066	1 601 280	3 447 184
C = high	2 128 368	1 188 096	2 977 533	6 293 997
Total	7 207 038	3 091 912	8 411 839	18 710 789

Table IV gives the maximum percentage deviation on the average total cost per patients given the 95% CI of mean personnel, drug and laboratory costs. These percentages are given for each severity level. For simplicity, we have not disaggregated data by hospital setting. Therefore, for severity level A, we can expect a maximum deviation from the true average total cost per patient of 8%, contributed by personnel costs. If the mean average total cost per patient for severity level A is R303, we can expect this figure to be too high or too low by R24 at the most (i.e. 8% of R303). Drug cost estimates contribute a maximum of 22% deviation in average total costs and laboratory cost estimates contribute 7%. In general, drug cost estimates contributed most to uncertainties in the total average cost estimate. This may be because there are medical decisions about the use of a particular category of drug, decisions about a particular drug within the category and decisions about the quantities to prescribe in the course of the patient's stay. All have significant cost consequences. In contrast, there are fewer comparable decisions about

Table IV. Maximum percentage deviation in average total costs per patient due to uncertainties in estimates for personnel, drug and laboratory costs (rands)

	Severity level: A	B	C
Estimated average total cost per patient*	303	487	1 076
Personnel costs (mean, 95% CI)	68 (43 - 92)	109 (84 - 133)	269 (143 - 395)
Max. % deviation† in average total cost per patient	8%	5%	11.5%
Drug costs (mean, 95% CI)	106 (40 - 172)	126 (51 - 201)	262 (162 - 362)
Max. % deviation in average total cost per patient	22%	15.5%	9.5%
Laboratory costs (mean, 95% CI)	21.5 (0 - 43)	55.5 (14 - 97)	89 (56 - 122)
Max. % deviation in average total cost per patient	7%	8.5%	3%

* The sum of personnel, drug, laboratory, supplies, hospitalisation averaged over 11 hospitals.
† (high end estimated personal costs — low estimated personal costs) (0.5)(100) / (average total cost) and comparable calculations for the effect of drug and laboratory costs on average total costs per patient.

laboratory tests. Choices of personnel type to carry out a particular task (i.e. a professional nurse v. an enrolled nurse, a medical officer v. an obstetrician/gynaecologist) are more likely to be related to the size of hospital and its staff (data not shown) as well as the severity level of the patient. When total costs are re-calculated using the lowest and highest values of the average cost per patient treated at each severity level and summed over all severity levels, the range is R15.8 million to R22.8 million.

Discussion

Direct and indirect costs — limitations of the conceptual model

This analysis presents a very conservative estimate of the costs arising from incomplete abortion. We have restricted the analysis to public sector hospitals and we have excluded, by research design, women who had medical complications but did not or could not seek treatment in a hospital setting. Our approach has dealt only with the medical costs of treatment, usually referred to as 'direct costs', for women who have access to the health care system. The 'indirect costs' of incomplete abortion, particularly those arising from unsafe, induced abortions, often far outweigh the short-term direct costs of medical treatment. Indirect costs include long-term effects such as sterility, impaired fertility and related morbidity and the cost of medical care to treat these conditions as well as the social and psychological consequences of abortion and infertility. They include the 'cost' of mortality for which we can only begin to estimate tangible aspects such as earnings foregone as a result of death let alone the intangible costs of the loss of a mother, wife and family member. Data from the national survey indicate that 425 women died in public hospitals in 1994 as a result of septic abortion.[1] In short, estimating direct costs to public hospitals is an attempt to begin to assess the monetary impact of incomplete abortion, and unsafe abortion in particular, on society and the use of public resources.

Sources of uncertainty in study estimates

The study's first objective was to develop a model of resource use in the treatment of incomplete abortion. Although the medical protocols for terminating a pregnancy are well established and are among the most simple and straightforward of surgical procedures, there is a complex array of alternatives for treating the repercussions of an incomplete abortion, in particular an unsafe, induced abortion. This analysis model has attempted to address this complexity by defining specific levels of severity of presenting symptoms and by sampling hospitals in urban and rural settings with a range of bed capacities and levels of complexity. Data from hospitals were the 'best judgement' estimates of practising clinicians. The 11 respondents representing these hospitals indicated that there were differences in the types of surgical procedures performed, in the numbers and types of medical and ancillary staff used, in the amounts and types of medication provided and in laboratory tests performed. There were also differences in the length of hospitalisation of patients with equally severe symptoms. Treatment protocols discussed with members of the Delphi panel suggest that our sample of 11 hospitals has mapped most of the range in treatment approaches.[11]

In addition we are not able to determine whether the distribution of different treatment protocols represented by our sample of respondents is an accurate reflection of what is occurring in all public hospitals in the country. We have noted (Table I) that symptom severity and treatment setting can result in variations in treatment that have potentially significant impacts on the estimation of total cost. We are able to model the least severe (and most prevalent) cases more completely than we can the most severe. This latter category can include a large range of surgical treatments, a wide variety of medications and dosages and a significant range in the length of time the patient spends in the hospital. Each aspect has significant cost implications. By placing all 'severe' cases into a single category and developing a common, conservative, treatment approach, we have underestimated the resource use, and thus the economic impact of treatment.

There were fewer uncertainties in determining the value of resources used in treatment, the study's second objective. This was primarily because of the existence of standard salary and wages schedules and unit prices charged to all hospitals in the public sector for drugs and laboratory tests.

Estimating the cost of treating unsafe abortions

Results from the Incomplete Abortion Study indicated that 8% of 44 686 incomplete abortions were definitely illegally induced.[1] Twenty-nine per cent of all patients were infected and 39% of the total were aborted after the third month of pregnancy. In conjunction with the epidemiological study[1] and for purposes of this analysis we assumed that all cases in severity levels B and C represented unsafe abortions. From data in Tables III and IV we estimate that the total cost of treating unsafe abortions is R9.74 million ± R1.3 million.

It has been suggested that 10 - 50% of women who have had unsafe induced abortions actually receive medical attention.[12] If we assume that these women represent severity levels similar to those described in this study, then the cost of treating women in actual need of medical care could conceivably be much higher.

Given that morbidity and mortality resulting from unsafe abortion are preventable, even under very basic medical conditions, these estimates represent considerable opportunity costs to the public hospital system. Furthermore, data from this analysis have suggested that there may be more efficient and equally effective ways of treating women with uncomplicated incomplete abortions. Preventing the need for unsafe abortion as well as reducing the need for induced abortion are goals that are achievable with existing medical technology.[13] The costs reported in this analysis represent expenditures of public funds that could be redirected to well-tested programmes that focus on prevention and education, eliminating unsafe abortion and reducing the need for induced abortion as part of a comprehensive, pro-active strategy on reproductive health.

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