

An economic appraisal of a mobile cervical cytology screening service

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Objective. Cervical cytology screening is widely accepted as an important strategy in the control of cervical cancer. With increasing competition for health resources the need for information on the cost-effectiveness of different screening programmes has become critical. This paper describes the cost of screening via a mobile clinic, and compares the cost-effectiveness of screening via a mobile clinic with that of screening at established clinics.

Method. Data were obtained from work studies, review of clinic and health authority records and key informant interviews. In addition to describing the actual cost of the project over the first year, a projection is made of the cost of operating the mobile clinic under non-research conditions. Sensitivity analysis is used to adjust for differences in yield and follow-up in comparing the cost-effectiveness in each setting.

Results. The cost of the project over 1 year was R185 795. The projected cost of running such a project under non-research conditions for 1 year is R291 858. The cost-effectiveness of screening at the mobile clinic was 57% less than that of screening at the established clinics. Sensitivity analysis indicated that for any given yield and follow-up rate, the projected cost-effectiveness of screening at the mobile clinic is 15 - 28% less than for the established clinics.

Conclusion. These findings raise questions about the appropriateness of using mobile clinics in areas where there are established health services.

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Cervical cancer is an important cause of mortality in women throughout the world. This is especially so in less developed countries, where cervical cytology screening services have not been effectively established.¹ There is little doubt about the benefits of organised cervical cytology screening, and debate has shifted to the optimal ages for screening and the intervals between screening.² Much of the debate centres around the costs and benefits of different policies, and it is evident that each increment in improved survival comes at increased cost.^{2,3} Most analysts ascribe a net monetary cost to cervical cancer screening programmes as opposed to no screening and, in general, screening for cervical cancer is regarded as an investment in extending life rather than

saving money.^{2,4} However, a number of studies,⁵⁻⁷ including two done in South Africa,^{8,9} have claimed a net monetary gain from screening for cervical cancer. Many of the studies rest on questionable assumptions and crude costing methods rather than on observed data^{2,10} and the dearth of reported cost-effectiveness studies has been ascribed to the difficulties in conducting rigorous studies of this nature.^{2,10}

There is no simple answer as to whether screening for cervical cancer saves money or not: the relative cost-effectiveness of programmes is related to the degree of organisation and the policy regarding ages and frequency for screening,³ and to the cost, availability and utilisation of various treatment modalities for cervical cancer. Much attention has therefore focused on designing a programme in respect of ages for and frequency of screening and mode of service delivery that optimises the result obtained.^{3,4,11-13} This paper presents an economic appraisal of the costs of screening at a mobile clinic.

In early 1993, the Philani Project of the Cancer Association of South Africa (CANSAs), in collaboration with the Department of Obstetrics and Gynaecology at Groote Schuur Hospital (GSH), initiated a mobile cervical cytology screening project in the greater Cape Town area. The project was introduced to investigate the feasibility of providing diagnostic and therapeutic treatment for patients with premalignant cervical lesions at first visit and first cytological smear-taking. The proposed method was to utilise a fully equipped mobile clinic where smears would be taken and processed. A result would be available and, where necessary, women would undergo colposcopy and appropriate treatment within a matter of hours of having the smear taken.

In the Western Cape, the family planning and STD clinics are run by the local authority, and the dominant local authority in this area is the Western Cape Regional Services Council (WCRSC). Regions III - V of the WCRSC include many of the black and coloured urban and peri-urban settlements of greater Cape Town. The people served by the WCRSC clinics in this region are largely of low socio-economic status. Details of the number of smears, cytological findings and follow-up at the WCRSC clinics (regions III - V), for the period 1991 - 1993, are shown in Table I.

Table I. Average output for mobile clinic for the two periods of operation, and average output for WCRSC for 1991 - 1993

	Output of mobile for 1993 period	Output of mobile for 1994 period	Output for WCRSC clinics
Average No. of smears per month	277	355	125
Mean age of women screened (yrs)	33	30	34
Age range (yrs)	17 - 83	16 - 77	< 20 - 60 +
Percentage of smears showing high-grade lesions (yield)	2.79%	0.85%	1.27%
Follow-up rate for women booked for colposcopy	37.6%	100%	83.8%

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The mobile cytology project was introduced in April 1993, but underwent a major change in mode of operation at the start of 1994. It is therefore convenient to consider the functioning of the project over two separate periods: April 1993 to December 1993, and January 1994 to April 1994. The introduction of the project occurred at a time of marked political unrest in many areas, and prior to January 1994 the project was unable to recruit a cytotechnician who was prepared to travel into the field to work at the mobile clinic site. The mobile clinic therefore served initially simply as a smear collection point, with an associated educational campaign. Smears were examined at private pathology laboratories at a subsidised rate. During this time the mobile clinic was stationed at a specific clinic or day hospital for 2 days a week, over a period varying from a few weeks to a few months, depending on demand. The educational campaign centred around these health facilities, extended to other community centres, and made use of broadcasts on radio Xhosa. The fact that the result was not available on the day of the smear-taking resulted in a policy of referring women to GSH for further management. Information on the number of smears taken, the cytology findings and the follow-up rate for the 1993 period of operation are presented in Table I.

The project was put on hold for two month-long periods in 1994 because key personnel were on leave. For the rest of 1994 the project functioned solely at Nolungile Clinic in Khayelitsha. This site was initially visited 2 days a week, but in April increased to 3 days a week owing to the large number of women attending. In 1994 a cytotechnician and an assistant spent Thursdays examining all smears taken on that day. Smears taken on other days of the week were examined at a private laboratory. On every Thursday afternoon a gynaecology research fellow visited the clinic and undertook colposcopic examination of all women with a cervical abnormality identified during that week. The figures for the 3-month period of operation during February - April 1994 are shown in Table I.

Method

Data were obtained from a wide range of sources including the financial statements of CANSA, the computerised records of the mobile cytology project, the WCRSC head office, the GSH cytology laboratory, the South African Institute for Medical Research (SAIMR), work studies conducted at the WCRSC family planning clinics, observation of the mobile clinic as it functioned in the field, and interviews with personnel directly and indirectly involved in the project.

* Definition of terms:

1. Costs incurred by the service taking smears — these include only those costs paid for by the service taking the smears.
2. Actual costs — these include costs paid for by the service taking the smears plus costs incurred by other services involved in the screening process that would apply in a non-research setting. This includes laboratory and colposcope costs. Costs incurred by women in getting to and from the service, and costs in terms of loss of earnings and psychological stress are not inconsiderable, but have not been included owing to the difficulties of estimating such costs.

The costs incurred by CANSA for the project over the first year, as reflected in their financial statements,* were divided as follows:

1. Costs of facilities and equipment: (i) depreciation on the mobile clinic; (ii) running costs of the mobile clinic; and (iii) office overheads for management.
2. Personnel costs: (i) management; (ii) community-based education; (iii) clerking/administration work; (iv) the taking of Pap smears; and (v) follow-up.
3. Laboratory costs (based on the subsidised rate provided by private pathologists).

No costs were incurred by CANSA for colposcopic examinations of women referred to GSH. The personnel costs of colposcopic examinations at the mobile clinic were covered by the honorarium paid to the research fellow working on the project. The equipment costs of those performed at the mobile clinic were covered by the capital depreciation on the fully equipped mobile clinic.

In projecting the costs of expanding the service on a non-research basis the costs were adjusted to reflect the actual cost of the service including facilities, equipment and services that were not directly paid for by CANSA. The calculation of projected costs was based on the 1994 period of operation because this was closer to the intended mode of operation. These costs include those paid for by CANSA (described in 1 and 2 above), plus: (i) the costs of using clinic facilities — based on the Independent Development Trust budget for building large to medium-sized clinics per square metre of floor space, and using a depreciation rate of 5% per year; (ii) costs of furnishing in clinic rooms — based on a cost of R2 000 per room depreciated at 5% per year; (iii) the costs of laboratory (cytology) processing and reporting — based on the SAIMR rate charged to state services. This rate does not include a profit component; and (iv) the cost of colposcopic examinations performed at the mobile clinic by a visiting senior gynaecology registrar. This cost has been calculated on the basis of one 4-hour session per week to cover travelling and working time, plus mileage costs of 60 km per week at 50 cents per km. The cost of histological evaluation of colposcopy specimens was based on the SAIMR rate charged to state services.

A costing of screening in the WCRSC clinics was conducted to compare the cost-effectiveness of screening at the mobile clinic with screening at fixed clinics. All WCRSC clinics in regions III - V were used for this purpose. Costs are stated in terms of 1993/94 financial year values.

The estimation of the proportion of the total expenditure of the WCRSC clinics on cervical cytology screening was based on the proportion of all clients attending these clinics that had Pap smears over the 3-year period 1991 - 1993. The total costs were obtained from the cost-centred accounting system used by the WCRSC, and include costs incurred at the most senior management level in the health department of the WCRSC through all other levels of personnel — in management, community programmes and based at the clinic. Also included are all supplies (including medication), depreciation on capital costs and servicing of loans. The costs incurred by the WCRSC do not include cytology or colposcopy costs, as the WCRSC is not billed for these costs.

In order to determine the actual costs of the WCRSC screening service the cytology costs have been estimated

on the same basis as for the projected actual costs of the mobile clinic. Actual costs of the WCRSC screening service also include the cost of colposcopic examinations and treatment at GSH. The cost of colposcopy was derived from work studies conducted at GSH.¹⁴

Sensitivity analysis was performed to adjust for variation in yield of high-grade lesions that may have resulted from screening of a different patient mix or reading of the smears by different cytologists during the different periods of operation.

Results

The initial purchase cost of the mobile clinic and equipment was R149 542. In addition to this the costs of running the mobile cytology project over the first year came to R148 409.71. Personnel costs constituted 67% of recurrent costs, laboratory (cytology) costs constituted 19% of recurrent costs, and running expenses constituted 14% of recurrent costs. The overall cost of the project for the period April 1993 to March 1994 is shown in Table II.

Table II. Costs incurred by CANSA for the project (April 1993 - March 1994), projected costs of a mobile screening service under non-research conditions, and estimated actual costs of screening per year at WCRSC clinics

	CANSA-incurred costs for 1st year	Projected actual costs of mobile service	Actual costs of WCRSC screening
Facilities and equipment	58 247.14	59 955.99	33 182.56
Salaries	99 251.92	91 355.80	
Colposcopy costs	N/A	14 526.24	5 080.23
Laboratory costs	28 296.15	126 020.16	44 355.78
Total	185 795.21	291 858.19	82 618.57

The projected actual cost of operating one mobile clinic on a non-research basis according to the system of operation in 1994 is R291 858.19. Personnel costs (including colposcopy) constitute 40% of recurrent costs, laboratory costs (cytology) constitute 51% of recurrent costs, and running expenses constitute 9% of recurrent costs. The projected costs of such a project under non-research conditions are shown in Table II.

The estimated actual cost of screening at the WCRSC clinics in the area specified is R82 618.57 (Table II). Laboratory costs for cytology constitute 54% of the total cost, and colposcopy costs constitute 6% of the total cost.

In the first year of operation of the mobile cytology project 3 328 smears were taken with a 2.79% yield of high-grade lesions. The projected annual output for the project operating on the 1994 system is 4 256. The yield during this period was 0.85%. The average annual output for the WCRSC clinics was 1 498, with a yield of high-grade lesions of 1.27%. The mean age and age range of women screened, and the follow-up rate for women booked for colposcopy under each scenario, are shown in Table I.

The cost per screening, the cost per high-grade lesion detected and the cost per high-grade lesion treated (given the observed yield and follow-up rate under each system)

are shown in Table III. The projected cost per high-grade lesion treated in the mobile cytology project under non-research conditions is 57% greater than the estimated cost per high-grade lesion treated at the WCRSC clinics, given the actual yield and follow-up rates experienced by the two services.

Table III. Mobile clinic cost per unit output for first year, projected cost per unit output for mobile service under 1994 system of operation, and WCRSC average cost per unit output for 1991 - 1993

	CANSA-incurred costs — mobile (year 1)	Actual costs — mobile (1994 system)	Actual costs — WCRSC (1991 - 1993)
Per screening	55.83	68.58	55.17
Per high-grade lesion detected	1 997.80	8 107.17	4 349.66
Per high-grade lesion treated	5 308.43	8 107.17	5 165.22

The cost per high-grade lesion treated, given different yield and different follow-up rates, is shown in Table IV. For any given yield and follow-up rate the projected cost per high-grade lesion treated in the mobile cytology project under non-research conditions is 15 - 28% greater than for the WCRSC clinics (Table IV). It can also be seen from Table IV that in order to match the costs in the WCRSC clinics the mobile cytology project needs to achieve an approximately 20% greater follow-up rate than the WCRSC clinics for any given yield.

Table IV. Sensitivity of cost per high-grade lesion treated to yield and follow-up for mobile service under 1994 system and for WCRSC, 1991 - 1993

Follow-up	Service	Yield 0.85%*	Yield 1.33%*	Yield 2.79%*
60%	Mobile	R13 405.36	R8 589.73	R4 127.21
	WCRSC	R10 468.33	R6 805.44	R3 411.14
80%	Mobile	R10 069.53	R6 457.80	R3 110.92
	WCRSC	R7 931.02	R5 183.85	R2 638.12
100%	Mobile	R8 068.03	R5 178.65	R2 501.14
	WCRSC	R6 408.63	R4 210.89	R2 174.31

* The figures for percentage yield are the lowest (experienced by the mobile service in 1994), the highest (experienced by the mobile service in 1993), and the average yield of all smears taken by both the mobile service and the WCRSC clinics for the study period.

Discussion

The recurrent costs of operating the mobile cytology project for the first year (R148 410) amounted to almost as much as the capital cost of purchasing and equipping the mobile clinic (R149 542). Over two-thirds of the recurrent costs were accounted for by salaries, and one-fifth was accounted for by laboratory costs despite their subsidisation. The difference between the cost of operating the project under the 1994 system under non-research conditions and the costs incurred by CANSA for the first year of operation of the project are accounted for almost entirely by the use of the SAIMR rate for laboratory costs rather than the

subsidised rate of private pathologists, and to an increase in the number of women screened. The SAIMR rate is approximately R10 lower than the Scale of Benefits rate recommended by the Representative Association of Medical Schemes (RAMS),¹⁵ and more than R50 lower than the fee for private pathologists recommended by the MASA.¹⁵ A large proportion of screening costs is attributable to laboratory (cytology) costs.

The difference in laboratory (cytology) costs for the projected cost of the mobile cytology project and the WCRSC clinics shown in Table II is a result of the difference in the number of smears taken by each service. The main reason for the difference in colposcopy costs is that a senior registrar is required to dedicate one full session per week to colposcopic examinations at the mobile clinic. In real terms, the average cost of colposcopy used here is lower than previously quoted costs.⁸ The relatively high cost of performing colposcopic examinations at the mobile clinic where the smear was taken may be justified by the savings made through improved follow-up. However, studies undertaken at the WCRSC clinics indicate that the cost per screening estimate used in this analysis is high,¹⁴ and the greater cost of the mobile cytology project found in this study is probably an underestimate of this difference.

The difference in yield for the different systems of operation of the mobile cytology project and for the WCRSC clinics may be ascribed to three main factors: (i) difference in risk of the population being screened; (ii) difference in technique of the smear-taker, and therefore in adequacy of the sample; and (iii) difference in interpretation/sensitivity of the cytotechnician reading the slides. In comparing the systems of operation of the mobile clinic for the 1993 and the 1994 periods, the smear-taker was the same person using the same technique, and the populations being screened were of similar socio-economic status and similar age. Neither of these factors is therefore likely to be the reason for the different yield. However, the cytotechnician who read the slides did change, and this may explain much of the difference in yield between these two periods.

The age distributions of women screened by the two services are similar. The markedly lower yield from the WCRSC clinics may be due to: (i) different subgroups of women in the community being screened by the two services; and/or (ii) a generally inadequate smear-taking technique among the many nurses who conduct Pap tests in WCRSC clinics; and/or (iii) the different laboratory facilities used. Any difference in the risk of cervical intra-epithelial neoplasia grade III, and therefore in yield, between the populations screened by the different services has been adjusted for in the sensitivity analysis. This allows a comparison of the cost-effectiveness of the services under conditions where populations at the same risk were screened and shows that, in a given population, screening at the WCRSC clinics should be more cost-effective, as long as the follow-up rate is no more than 20% lower than that achieved by the mobile cytology project. The WCRSC clinics in this region have shown that it is possible to achieve a follow-up rate of 84%. It is therefore not possible for the mobile cytology project to be more cost-effective than the WCRSC clinics in this region overall. However, the follow-up rate for WCRSC clinics in Khayelitsha specifically is only 64%,¹⁶ indicating that the mobile clinic may be more cost-

effective in this particular area under present screening conditions at the WCRSC clinics.

The findings of this study raise questions about the cost-effectiveness and appropriateness of using mobile clinics in areas where there are established health services. Issues such as the need to locate the mobile clinic at another health facility (thus eliminating much of the advantage of using a mobile facility), the difficulty in obtaining a cytotechnician prepared to work at the mobile clinic, the effect of a vertical and selective screening service on the functioning of the local health services, the failure to target priority age groups of women to be screened,³ and questionable sustainability suggest that efforts to improve screening should be focused on upgrading the service in the fixed clinics. These findings are supported by a World Health Organisation report which recommends that mobile clinics may have a place only in remote rural areas.³

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