

Monitoring HIV/AIDS Interventions

Assessing the costs of a rural PMTCT pilot site in the Eastern Cape

C Desmond & G Boyce
Funded by the Ford Foundation



Commissioned by the Social Aspects of HIV/AIDS and Health Research Programme and compiled by the Child, Youth and Family Development Research Programme, both of the Human Sciences Research Council

Published by HSRC Publishers
Private Bag X9182, Cape Town, 8000, South Africa
www.hsrcpublishers.ac.za

First published 2004

© 2004 Human Sciences Research Council

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

ISBN 0 7969 2062 1

Cover by FUEL Design
Production by comPress

Distributed in Africa by Blue Weaver Marketing and Distribution,
PO Box 30370, Tokai, Cape Town 7966, South Africa.
Tel: +27 +21-701-4477
Fax: +27 +21-701-7302
email: orders@blueweaver.co.za

Distributed worldwide, except Africa, by Independent Publishers Group,
814 North Franklin Street, Chicago, IL 60610, USA.
www.ipgbook.com
To order, call toll-free: 1-800-888-4741
All other inquiries, Tel: +1 +312-337-0747
Fax: +1 +312-337-5985
email: Frontdesk@ipgbook.com

CONTENTS



LIST OF TABLES AND FIGURES IV

ACKNOWLEDGEMENTS V

INTRODUCTION I

LITERATURE REVIEW 3

METHODOLOGY 9

RESULTS 13

DISCUSSION AND CONCLUSION 21

APPENDIX 23

REFERENCES 25



LIST OF TABLES AND FIGURES

LIST OF TABLES

- Table 1. Average monthly utilisation rates per clinic 13
- Table 2. Total monthly cost 13
- Table 3. Total monthly component costs of clinics 15
- Table 4. Clinic-based monthly financial costs by input type 16
- Table 5. Clinic-based monthly economic costs by input type 17
- Table 6. Clinic-based monthly financial costs by intervention component 17
- Table 7. Clinic-based monthly economic costs by intervention component 18
- Table 8. Clinic-based variable economic costs and utilisation rates 18
- Table 9. Average economic cost until six months of age 19

LIST OF FIGURES

- Figure 1. Total economic cost by input 14
- Figure 2. Total economic cost excluding administration 14

ACKNOWLEDGMENTS



The authors would like to acknowledge the support and advice of Dr Hillary Southall, Efua Dorkenoo and Dr Olive Shisana during the course of this research. The authors would also like to thank Tebogo Gumede, the field workers and the staff at the various health facilities for their support in the data collection. The authors accept full responsibility for the contents of this report.

INTRODUCTION



Pilot sites offering interventions aimed at the prevention of mother-to-child transmission (PMTCT) of HIV now exist in every South African province. Some provinces have expanded on these sites and are offering PMTCT services at numerous facilities.

PMTCT interventions are likely to be one of a number of specialised services offered as part of a response to the HIV/AIDS epidemic. Monitoring the implementation of PMTCT, therefore, is of critical importance, firstly to insure its success and secondly to learn from it in order to inform later similar activities. One aspect of such monitoring is to examine the use of resources associated with the implementation of the intervention. This helps in the budgeting processes and creates a better understanding of which inputs the intervention draws upon most heavily. This improved understanding facilitates better planning.

This report presents the results of research conducted at one of the pilot sites in the Eastern Cape. It is the economic component of a larger research project being conducted at the site by the Human Sciences Research Council (HSRC), funded by the Ford Foundation. A site, in this context, refers to a collection of facilities offering the PMTCT service. This site is co-ordinated by a rural hospital and implementation occurs in the four clinics as well as from certain hospital wards. The aim of this economic component was to build on continuing work being undertaken by the HSRC in the Western Cape in 2003 (Shisana, Hall, Maluleke, Stoker, Schwabe et al.) This existing work seeks to examine and compare the costs of providing nevirapine and Zidovudine (AZT) for PMTCT in two sites located in the Western Cape. By design, the study examines the costs of provision in an urban setting. The area covered in the research presented in *this* paper is rural and provides an interesting comparator. It is hoped that both studies will contribute to the national programme of monitoring and evaluation of the costs and effectiveness of the PMTCT intervention.

This report firstly discusses past work on economic evaluations of PMTCT in an attempt to locate this study within the literature. Thereafter, a description of the method applied is provided, followed by results and finally discussion and conclusions.

LITERATURE REVIEW



The costs of PMTCT have received considerable attention in the literature. Studies have addressed questions concerning the relative affordability of interventions, through to the costs of inaction. Researchers have differed in their approaches, in terms of costs included, outcomes measured and in their analysis of results and comparisons with other interventions. It is useful to understand the nature of these differences so as to assist in locating this study within the range of PMTCT costing studies.

Economic evaluations of interventions have two distinct components – the estimation of the costs of inputs and the value or measurement of outcomes/benefits. What is included in each of these components is not standard across studies and the results, therefore, have different implications.

On the input side of the evaluation, the economic studies of PMTCT reviewed have differed, in a number of respects, in terms of what was included. In theory, the cost of an intervention in economic terms should include the cost incurred by society as a result of the implementation of the intervention. There are, however, a number of practical difficulties in collecting social costs. All the studies reviewed considered the estimates of the input costs of the interventions only from a provider perspective. This means that costs borne by the client and by broader society have not been included in the analyses. If different interventions have very different cost implications for clients and society, outside of those borne by the provider, inappropriate recommendations may have been made.

While all the studies reviewed took a provider perspective, they varied in terms of what they considered as costs to the provider. A number of them included only incremental costs, that is, the additional expenditures associated with the implementation of the intervention, (examples include, Galbraith & Bennish, 2001; Marseille, Kahn, Mmiro, Guay, Musoke, Fowler, Brooks Jackson, 1999; Thaineau, Sirinirund, Tanbanjong, Lallemand, Soucat, Lamboraty, 1998; Wilkinson, Floyd, Gilks 1998). These studies essentially capture only the additional expenditures associated with PMTCT interventions; they are effectively estimates of the budgetary implications of the different approaches to PMTCT. Such an approach ignores the pressure placed on existing resources. Critical among these existing resources are the costs associated with the use of existing staff. The implementation of a new intervention is likely to place pressure on existing staff members; their financial cost to the provider, however, does not increase, and this cost is therefore excluded from an incremental or financial cost analysis. In theory, however, this use of time involves an opportunity cost, that is, the time staff spend on a new intervention is displaced from an existing activity; or if there was excess capacity the new intervention uses it up, removing the opportunity to use that excess capacity for another intervention. This is a point recognised in some of the studies; while the costs of existing staff have not been included in the cost estimate, they have been recorded (see, for example, Galbraith & Bennish, 2001).

Other researchers opted to take a broader view of costs and have estimated the costs associated with the use of resources that were in place prior to the initiation of an intervention, as well as the incremental financial costs (examples include Desmond, Franklin, Steinberg, 2003; Marseille, Morin, Collins, Summers, Kahn, 2002).

The implications of the different approaches depend on the purpose of the analysis and the context in which it is being conducted. If the purpose of the research is to compare

the costs of different approaches to PMTCT and the different methods make similar, or little, use of existing resources, it does not make any difference to the conclusions of the research which approach is used. Similarly, if the analysis is to compare PMTCT interventions with other competing interventions, it does not matter which method is used if both make similar use of existing resources. If, however, different methods of PMTCT or competing interventions have varied implications in regard to the use of existing resources, the inclusion or otherwise of costs associated with existing resources can have implications for the conclusions. Interventions that make greater use of existing resources would, under the incremental costing approach, appear relatively cheaper when compared to interventions that involve a higher proportion of new resources.

Depending on the context of decision-making, the bias towards integrated programmes that occurs when conducting an incremental cost analysis may or may not be appropriate. If the constraint on the provider is financial and is not about existing capacity, the evaluation of programmes in terms of incremental costs may be appropriate. If, however, existing resources are already operating in a strained environment, the exclusion of certain costs may misrepresent the appropriateness of competing interventions.

The cost data itself has been drawn from a number of different sources. Prior to the implementation of PMTCT programmes, researchers relied on information from clinical protocols combined with discussions with medical professionals (for example Marseille et al., 1999; Soderlund, Zwi, Kinghorn & Gray, 1999). As sites were being planned for PMTCT, potentially more accurate estimates of required resources could be obtained from those medical professionals working at these sites (for example Galbraith & Bennish, 2001; Mansergh, Haddix, Steketee, Nieberg, Dale, Simonds & Rogers, 1996; Wilkinson et al., 1998). Finally, as PMTCT implementation has become more widespread, the collection of cost data from functioning sites has become possible (for example Desmond et al., 2003; Skordis & Nattrass, 2000; Thaineau et al., 1998).

The cost data has been used to make estimates of the cost of providing alternative PMTCT interventions for hypothetical cohorts (for example Marseille et al., 1999; Soderlund et al., 1999) as well as providing estimates of costs of alternatives at national level (for example Geffen, Nattrass & Raubenheimer, 2003; Skordis & Nattrass, 2000).

The cost analyses originally found drug costs to be the major factor, but as regimens have become shorter and drugs cheaper, the relative importance of drugs has been reduced. This happened initially with the possibility of short course AZT (Mansergh et al., 1996) and then even more so with nevirapine (Marseille et al., 2002). As the importance of drugs has diminished, the most important cost component has become staff costs, particularly those associated with the provision of voluntary counselling and testing (Marseille et al., 2002).

Cost data alone is of limited use unless combined with some measure of outcome. A number of alternatives exist, but the most commonly used for PMTCT interventions has been cost effectiveness analysis (CEA).

CEA involves the identification of an outcome measure and the presentation of costs per unit of that outcome measure. This method's popularity stems from the practical difficulties with the primary alternative. If an effectiveness measure is not used, the value

LITERATURE REVIEW

of that measure needs to be estimated instead. This type of analysis is referred to as cost benefit analysis (CBA) and involves the monetary valuation of both the costs and the benefits. However, many outcomes, particularly those relating to health, are very difficult to value. CEA is therefore offered as an alternative to attaching a value to outcomes. For example, if an intervention is designed to save lives or prevent infections, such as is the case with PMTCT, a CBA would require a monetary value to be attached to the outcome of the lives saved. Valuations of this nature are theoretically and practically difficult and often controversial. CEA avoids this controversy by dividing the cost of an intervention by its primary outcome. In the above example this would mean dividing the cost by the number of lives saved and reporting a figure for the cost per life saved. This allows for comparison across interventions, highlighting the efficiency of different interventions in achieving certain outcomes.

The CEA approach, while practically simpler, is limited in a number of respects and should be used with caution. The analysis only allows comparisons to be made between different interventions with the same outcome. Efforts have been made to create measures in health that can be used to cover a number of different interventions, these include life years saved, disability adjusted life years (DALY) and quality adjusted life years (QALY). These measures themselves are controversial, but a discussion of that is beyond the scope of this paper. Comparisons of health interventions with other types of interventions, such as employment interventions, are not possible with CEA.

When there are common outcome measures, CEA can be used to identify the relative efficiency of different interventions. It is, however, important to note that efficiency is not the only criterion on which decisions should be made, and the fact that an intervention is more efficient (cost effective) than another intervention, does not mean that it should be undertaken ahead of that intervention. CEA fails to consider the equity considerations and other distributional issues surrounding the decision-making process.

CEAs conducted in relation to PMTCT have used a number of different outcome measures including life years saved (Soderlund et al., 1999), DALYs (Creese, Floyd, Alban & Guinness, 2002), and infections averted and lives saved (Galbraith & Bennish, 2001; Mansergh et al., 1996; Marseille et al., 1999; Skordis & Nattrass, 2000; Soderlund et al., 1999). These and other studies have examined the relative efficiency of different approaches to PMTCT in achieving these outcomes. To measure effectiveness this type of work has relied on the efficacy measured from the original clinical trials (Ades, Ratcliffe, Gibb & Sculpher, 2000). These studies found that PMTCT interventions based on short course treatments, particularly nevirapine, are more cost effective than the original long course AZT treatment. One review (of many) on these studies can be found in Ades et al., (2000) and, for South African work, in Geffen (2001).

Work that compares the efficiency of PMTCT to that of other health interventions, in particular HIV interventions, has also been done. These studies have found that PMTCT interventions fare well, in terms of the efficient realisation of common outcomes, when compared with many other interventions, although some HIV interventions do even better (Creese et al., 2002; Masaki, Green, Greig, Walsh & Potts, undated).

In addition to the more traditional use of CEA in regard to PMTCT, a number of researchers have gone further and examined, in monetary terms, some of the benefits of

interventions (Desmond, 2000). The results of these studies are presented to show that the cost of treating HIV-positive children is so high that spending to avoid infections can save money. Research found that certain PMTCT interventions were cost-saving to the provider (Desmond, 2000; Skordis & Natrass, 2000; Soderlund et al., 1999). These studies are essentially advocacy tools: unless the incremental cost of applying an intervention with greater efficacy is less than the costs saved by achieving that greater efficacy and avoiding treatment, the cost effectiveness ranking of the interventions will not change. And this was not the case. More effective interventions were shown to prevent more infections and thus save by avoiding treatment. But the higher costs of implementation always negated such savings leaving the ranking and associated policy implications unchanged.

The majority of PMTCT costing studies have focused on the important issue of which, if any, PMTCT intervention should be implemented. They have provided evidence that PMTCT interventions are affordable and compare well with other interventions in terms of efficiency. While efficiency should not be the only determinant of policy, it is an important input.

PMTCT interventions are already in place on some scale, or are planned, in a number of countries. The policy decision has been taken in terms of PMTCT provision and the manner of provision. The point in the process where CEA is useful has, therefore, largely passed. What is now important, from an economic analysis point of view, is to examine what costs are involved in the large-scale implementation of the intervention. It is important to understand what the resource implications are of implementing and integrating an intervention into the health system. The implementation of protocol and the approach taken by staff at facilities across a country are likely to differ, having implications for both costs and outcomes. Understanding these implications assists in financial and resource planning for this, and other similar, interventions that may occur in the future, such as the large-scale provision of antiretroviral drugs.

Little work of this descriptive nature has been done in relation to PMTCT. Desmond et al., conducted such a costing in four of the PMTCT pilot sites in South Africa, and to some extent Thaineau did so in Thailand (2003;1998). The work in South Africa showed the importance of prevalence and existing resources in determining the resource uses in relation to PMTCT. The study, however, covered only a subset of facilities at only four sites, none of which were in the Eastern Cape.

This research aims to build on the earlier descriptive costing work of PMTCT by examining in detail the resource uses, and associated costs, in a rural site in the Eastern Cape. The analysis will focus on how the implementation of a PMTCT intervention is drawing on existing and new resources. The analysis draws heavily on the method employed in Desmond et al., effectively adding a fifth, although more comprehensively covered, site (2003). The Desmond et al. study covered hospital-based services and at most one or two external clinics. This analysis covers an entire official PMTCT site of a hospital with a maternity ward, one internal clinic and three external clinics. One clinic that did not offer PMTCT services was excluded as it was not part of the official pilot. It is hoped that this more comprehensive coverage of a site will add to our understanding of resource use associated with PMTCT interventions implementation on a large scale.

LITERATURE REVIEW

As mentioned previously, the HSRC is involved in other descriptive costing work in an urban area in the Western Cape. While developing on the existing work, the design of *this* research differs from that conducted in the Western Cape in a number of ways. The Western Cape study is a prospective study and data are being collected on individual mothers and their children. This study, however, is of a cross-sectional nature and the data collection and analysis have, as a result, focused on the average cost per mother and child pair as opposed to the collection of individual level data. Furthermore, the Western Cape research examined a cohort of HIV negative women and the costs associated with the provision of care to them. The difference in the costs of care provided to HIV negative women, compared to HIV positive women, on the intervention was used to examine the increase in costs associated with the implementation of the intervention. As *this* study is cross-sectional, a similar approach was not possible although a similar outcome was desired. To estimate the increase in costs associated with the implementation of the intervention, data were gathered only on activities directly related to the provision of the interventions. The costs associated with providing care to women that they would have routinely received, were ignored. This approach will (once the other study is complete) effectively allow for meaningful comparisons to be made between the results of the Western Cape study and the results outlined in this report, providing an urban/rural comparison.

METHODOLOGY



The study was designed to capture the economic cost to the provider of implementing PMTCT services at one pilot site. The site consisted of four primary health care clinics and a maternity ward, and is being run from a rural hospital in the Eastern Cape province. As an economic costing, the method was designed to include the costs of both new resources and resources that were already being paid for prior to the introduction of the PMTCT service, but have subsequently been diverted to PMTCT activities. The combined costs of these are referred to in the study as the economic costs. The costs of only the new resources, a subset of the economic costs, are referred to as financial costs. The following section discusses the approach taken to capture and analyse the costs.

The costing considered the resources used during the implementation of the PMTCT service. The sites in the Eastern Cape have based their intervention on the national protocol for the provision of nevirapine to mothers to prevent HIV infections in their children. The intervention involves the screening of pregnant mothers through the provision of voluntary counselling and testing. Testing was originally conducted at a central laboratory, although rapid tests are now being utilised and it is the cost of this practice that has been examined. Once screened, HIV-positive mothers are counselled about the intervention and offered nevirapine, which they take home. They are instructed to administer the nevirapine themselves at the onset of labour. After delivery, the nevirapine suspension is administered to the child at a health facility. Mothers can opt for substitute feed for their child if they wish, which is available free of charge to those on the intervention. Mothers return to clinics for follow up care and for additional supplies of formula. During this period co-trimoxizol is prescribed to mother-child pairs who are part of the PMTCT programme. The intervention is undertaken almost entirely by nursing staff at the professional nurse level. There is very little involvement of doctors or lay persons in the intervention.

Data collection

The data required for the study necessitated both primary and secondary data collection and examination. The primary data collection occurred during a week-long visit to the site in August 2002. It involved interviews and recording of observations. The secondary data collection occurred at the hospital and through contact with the Department of Health.

The site visit began with interviews with staff involved in the management and co-ordination of the PMTCT intervention. As would be the case with all interviews, the study was explained to the interviewees and it was stressed that this was a descriptive costing and not an evaluation. The aim of the initial interviews with management was to obtain a detailed description of the intervention, the staff involved and facilities used. For each clinic involved and at the maternity ward, the management team were asked to identify the individual who co-ordinated PMTCT activities at that clinic/ward. Each of these individuals were later visited at their respective facilities, interviewed in detail about the implementation of PMTCT at their clinic or ward, and asked to identify other staff who were involved, who were then also interviewed. When possible, appointments were made with each staff member to avoid disruptions to their working day. Interviews with staff were conducted in an unstructured manner to avoid placing pressure on staff members. Interviewers were given a list of questions that required answers, but staff were allowed to jump around and talk about unrelated issues. The researchers' previous

experience suggests that structured questionnaires, in this environment, prompt defensive behaviour from staff, who feel that they are not equipped to respond. Discussing the same issues with staff in a less structured and more relaxed manner reveals that they have the necessary knowledge. In essence, each respondent was treated as a key informant

All staff interviewed, including the management and hospital administration, were asked about their involvement in the intervention. Data were collected on the time they spent with each client at the various stages of the intervention and what resources they used, and how this differed from what they would typically have done. In addition to what time they spent with each client, respondents were asked what time they spent on, and what resources were used for, management functions. Detailed descriptions of each time consuming activity were requested to determine the reliability of time estimates.

Co-ordinating staff at each clinic and at the maternity ward were asked to show the interviewers any facilities and equipment used in the implementation of the intervention, such as rooms used for counselling. Dimensions of areas used and descriptions of equipment provided were recorded.

Secondary data were also collected at the clinics and the maternity ward. Utilisation records were copied for each of the facilities for as many months as were available. Order books and relevant financial records were also copied. In addition to secondary data collected at the site, data were collected from the Department of Health. These data included provincial pay scales, and drug, formula and test kit tender prices.

Data were captured in a costing model constructed on an Excel spreadsheet. The model was designed to calculate, from the data, the appropriate summaries of costs.

Analysis

In the first instance, costs were analysed according to input type. Costs were classified into one of the following categories: staff time, facilities, drugs, formula, medical stores and training.

The value of staff time was based on data collected from the site on time spent by activity, contact time with clients and designation of staff involved. Time spent on each activity was combined with data on utilisation levels over the previous three months to generate an estimate of monthly time per activity. This time was valued according to a per unit cost of staff. The unit selected for staff was one hour, the value of which was determined from provincial pay scales and adjusted by dividing the proportion of work time staff of that level are engaged in providing services, which was estimated by taking the total number of working hours less the number of hours of annual leave, sick leave, and ongoing training and dividing the result by the total number of work hours. If staff were newly appointed for the purposes of providing PMTCT, the cost of their time was classified as a financial cost. If they were already employed, their time was classified as an economic cost only, as it carried no new financial implications.

The calculation of economic staff costs was based on the assumption that existing staff members had no excess capacity available, and that there existed alternative activities,

METHODOLOGY

other than PMTCT involvement, to which they could devote their time. Involvement in the PMTCT programme, therefore, was assumed to force them to reallocate their time away from these alternate activities and thus their involvement in the PMTCT programme resulted in an economic cost. In due course, one would expect PMTCT involvement to become incorporated into staff members' daily work routines and eventually no longer attract an economic cost, since their PMTCT duties would be considered when making staff allocations to clinics. In this way the economic cost of staff time would become financial costs as staffing complements increase in time. This transition from economic to financial costs may or may not occur, and should be an area that is monitored.

The total time for which facilities were used was estimated based on interviews with staff and utilisation records. The value of that time was estimated by multiplying the time spent, per hour, using different facilities, such as consulting rooms or waiting rooms, by the cost, per hour, of that facility. The value per hour was estimated by dividing the yearly cost of the facility by the number of hours it is open a year. The yearly cost was estimated based on discussions with staff from the University of Natal's Department of Architecture on building costs and annualising that cost over an estimated useful life of 10 years. Facility costs were classified as economic costs only as no new buildings or equipment were purchased for the purpose of PMTCT.

Drug, formula and medical stores (including test kits) unit costs were obtained from the Department of Health. The quantity of these used was estimated from utilisation records, interviews and order books. Drug, formula and medical stores costs were included as financial costs as they were purchased and consumed as a result of the PMTCT intervention.

The costs of training were obtained from hospital management records. Although these costs occur in a single year, their benefit occurs over a number of years. They were, therefore, treated as start-up costs and annualised over an estimated five years of useful life. This method was used to estimate a monthly cost of training. This cost is not an estimate of monthly expenditure on training, but rather the cost that month of using staff trained in PMTCT. Although training has financial implications it is not classified as a financial cost, because of the way in which it was been transformed into a monthly cost.

The input costs were further analysed by facility and intervention component. The cost of inputs were examined for the three external clinics, the one hospital-based clinic and the maternity ward, and the hospital management. For each of these facilities the costs were further divided according to which component of the intervention they resulted from. The intervention was divided into the following components: group counselling, pre-test counselling, testing, post-test counselling, delivery stage, follow-up care, community mobilisation and overheads.

The purpose of this component division is to facilitate better comparison with similar studies conducted at other sites. It does not have great meaning to compare the monthly costs of providing PMTCT services in a high prevalence area, with those in a low prevalence area. The costs in a high prevalence area will, as a result of the prevalence, be much higher, as a higher proportion of women continue to a later stage of the intervention.

While the meaningfulness of comparing total costs is limited across sites, it is more meaningful to compare the costs of providing different components. The cost of pre-test counselling at different sites, for example, can be compared more meaningfully than total cost. This type of comparison, while an improvement, is however still limited as the total monthly cost, even of a component, will be determined largely by scale. Costs, therefore, are also reported as average unit costs to facilitate later comparisons.

RESULTS



The results of the costing exercise are presented first for the entire site and secondly by clinic. The hospital-based clinic incorporates the costs incurred at the maternity ward. For both sections the input and component costs are reported. In the interests of confidentiality, the clinics are not named, but are rather referred to as Clinics 1 to 4 and administration.

The costs of the intervention should be considered in light of the still low levels of utilisation. Table 1 drawn up from the clinics' monthly records, provides an indication of the varying scales of the intervention at the different clinics.

Table 1: Average monthly utilisation rates per clinic

	Clinic 1	Clinic 2	Clinic 3	Clinic 4
Group counselling	8	12	12	20
Pre-test counselling	30	10	35	38
Testing	20	6	31	38
Post-test counselling	10	6	13	0
Delivery	0	0	2	0
Follow-up care	4	3	18	0
Community mobilisation	2	0	0	0

The total costs of the PMTCT intervention are presented in Table 2. The estimations show that the total monthly financial costs are in the region of R2 500. This will be a slight underestimation, as a large purchase of stationery was recorded in the first year, but was treated as a start-up cost and annualised as an economic cost. Similarly, training costs are considered over five years. The financial costs measured occurred as a result of medical stores (test kits), drugs (nevirapine and follow-up drugs) and formula. No staff were newly appointed across the site, so no financial staff costs were recorded.

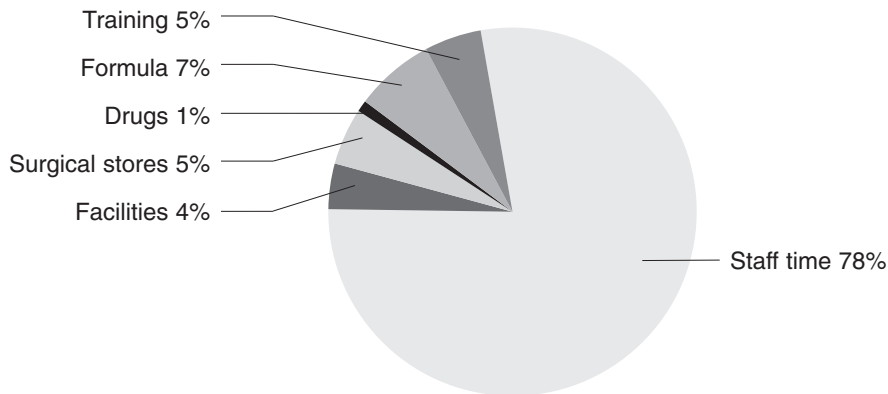
Table 2: Total monthly cost

Input type	Total financial cost	Total economic cost
Staff time	R-	R16 993
Facilities	R-	R836
Stores	R983	R983
Drugs	R304	R304
Formula	R1 441	R1 441
Training	R-	R1 093
Total	R2 728	R21 650

While the intervention is still maturing, the implications of the cost of formula as the driver of financial costs is becoming clear, accounting already for almost two-thirds of financial costs.

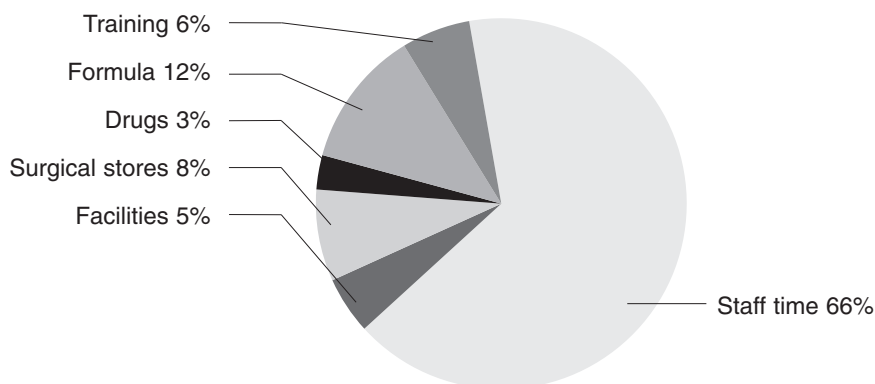
The total economic costs of the intervention are much higher than the financial costs. The economic costs will always be at least the same as the financial costs and never lower, as the financial costs are a subset of the economic. The large economic costs result primarily from the high cost of staff time, with some contribution from training. As noted previously, the training costs represent a monthly cost associated with having trained staff. It does not suggest that the site is spending in the region of R1 000 a month on training, but rather that the cost of training over the period is equivalent to R1 000 a month. Figure 1 shows the breakdown of total economic costs by input type.

Figure 1: Total economic cost by input



The overwhelming importance of staff costs is in part attributable to the high staff costs associated with administration. If these costs are removed, the importance of different inputs in determining running costs becomes more apparent. Figure 2 shows the breakdown of total economic costs, excluding those associated with the central administration of the intervention.

Figure 2: Total economic cost excluding administration



RESULTS

The removal of administrative costs reduces the dominance of staff costs as the primary component. The costs of inputs such as formula, stores and drugs increase. The costs of staff are, however, still by far the most important input. This is in part a function of the age of the intervention. As yet there are still relatively few women on follow-up care. As the intervention matures, this number will increase and the resultant costs of formula will increase along with it.

If the total costs of the intervention, excluding administration, are broken down into components, the still relatively small contribution of follow-up care is even more apparent.

Table 3: Total monthly component costs of clinics

	Financial costs	Economic costs
Group counselling	R–	R1 368
Pre-test counselling	R–	R2 109
Testing	R983	R2 123
Post-test counselling	R138	R1 441
Delivery	R42	R145
Follow-up care	R1 565	R1 767
Community mobilisation	R–	R87
Overheads	R–	R3 071
Total	R2 728	R12 110

While follow-up care is already the largest contributor to financial costs, as a result of the formula, it only contributes 14 per cent towards total economic costs. This relatively small contribution, from the component that is typically expected to be very expensive, is a result of four factors: the HIV prevalence in the surrounding area, the high cost of counselling and testing, the infancy of the intervention and the still relatively high cost of overheads.

HIV prevalence among women attending the clinics who have agreed to testing is low. This means that it is only necessary for a small proportion of women agreeing to voluntary counselling and testing to progress to the follow-up stage. This weights the costs towards the early components of the intervention. If this factor is combined with the high costs of existing senior staff conducting the counselling, the relative importance of the early components is further pronounced, reducing the importance of follow-up care.

The intervention is still fairly new. As the intervention matures the relative importance of follow-up care will increase. Counselling and testing costs reach their peak far sooner than follow-up care costs. The month that the number of women entering the programme reaches its maximum, the costs of counselling and testing will reach a maximum, but the costs of follow-up care will only plateau 20 to 22 months later, as women still have to progress through the stages of follow-up care.

The overhead cost component refers to clinic-based management, as opposed to site co-ordination. This figure is still high, but it is hoped that as the intervention matures and becomes more integrated this cost will not increase as the others do. There are also likely to be economies of scale; ordering twice as much formula should not take twice as long.

It is important to note from Table 3 that the financial costs associated with post-test counselling result from the nevirapine dispensed to mothers prior to delivery.

The total costs of the intervention, as discussed so far, are not evenly spread across the various clinics. The following tables show how the input and component costs are distributed across the clinics involved.

As discussed previously, the financial costs of the intervention are associated with variable inputs such as test kits, drugs and formula. Their distribution, therefore, is associated with the relative utilisation levels across the different clinics. The stores input shows the differing levels of testing activities, while the formula is associated with follow-up numbers. Formula is dispensed according to the Eastern Cape Province's Health Department protocol where each mother on the PMTCT programme who elects to formula feed is given a monthly supply of eight tins of formula at each follow-up visit for a period of six months. The drug costs are higher for Clinic 3 as this is the only facility from which the suspension was available. Suspension dispensing was centralised to reduce wastage because, once opened, suspension has to be discarded after three months. With low utilisation rates at individual facilities, discarding would have been a costly exercise.

Table 4: Clinic-based monthly financial costs by input type

	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Admin
Staff time	R–	R–	R–	R–	R–
Facilities	R–	R–	R–	R–	R–
Stores	R264	R72	R261	R387	R–
Drugs	R32	R23	R181	R67	R–
Formula	R96	R193	R1 152	R–	R–
Training	R–	R–	R–	R–	R–
Total	R392	R288	R1 594	R454	R–

The economic costs distribution is a combination of utilisation levels and differences in approach. Some staff, for example, spend more time than others doing pre-test counselling. This issue is dealt with in more detail later, with an examination of unit costs. Table 5 shows the importance of economic staff costs across all clinics. The large staff costs, mentioned previously, associated with the overall administration of the intervention are clear from the table. In excess of 50 per cent of all staff costs occur as a result of the administration of the intervention.

RESULTS

Table 5: Clinic-based monthly economic costs by input type

	Clinic 1	Clinic 2	Clinic 3	Clinic 4	Admin
Staff time	R1 406	R884	R2 563	R3 272	R8 868
Facilities	R91	R88	R145	R226	R286
Stores	R264	R72	R261	R387	R–
Drugs	R32	R23	R181	R67	R–
Formula	R96	R193	R1 152	R–	R–
Training	R119	R170	R178	R241	R385
Total	R2 008	R1 430	R4 480	R4 192	R9 539

The training costs are distributed across the clinics according to the number of trained personnel, their designation and the length of the training they attended.

The clinic-based distribution of monthly financial costs by component is nearly identical to the division by input, with testing reflecting the number of tests, post-test counselling costs reflecting nevirapine dispensed, and follow-up costs a combination of formula and drug costs.

Table 6: Clinic-based monthly financial costs by intervention component

	Clinic 1	Clinic 2	Clinic 3	Clinic 4
Group counselling	R–	R–	R–	R–
Pre-test counselling	R–	R–	R–	R–
Testing	R264	R72	R261	R387
Post-test counselling	R13	R8	R50	R67
Delivery	R–	R–	R42	R–
Follow-up care	R116	R208	R1 241	R–
Community mobilisation	R–	R–	R–	R–
Overheads	R–	R–	R–	R–
Total	R392	R288	R1 594	R454

The distribution of monthly economic costs by clinic is again a combination of the utilisation of the services at the clinic and the cost per client at each stage. The results show how the different clinics appear to have interventions with differing levels of maturity. Clinic 3 has a substantial portion of its costs associated with follow-up care, while Clinic 4, as yet, has no one receiving follow-up care. The intervention at Clinic 4 has only recently begun in earnest and considerable effort is being invested in pre-test counselling. The differences between Clinics 3 and 4 show how, as the intervention matures, the structure of costs is likely to change.

ASSESSING THE COSTS OF A RURAL PMTCT PILOT SITE IN THE EASTERN CAPE

Table 7: Clinic-based monthly economic costs by intervention component

	Clinic 1	Clinic 2	Clinic 3	Clinic 4
Group counselling	R107	R275	R376	R610
Pre-test counselling	R567	R183	R244	R1 115
Testing	R531	R144	R643	R805
Post-test counselling	R117	R61	R524	R738
Delivery	R–	R–	R145	R–
Follow-up care	R138	R234	R1 395	R–
Community mobilisation	R87	R–	R–	R–
Overheads	R460	R534	R1 152	R924
Total	R2 008	R1 430	R4 480	R4 192

As mentioned previously, the differences in costs between the clinics result not only from different utilisation rates, but also because of different unit costs. Table 8 gives the utilisation of each component at each clinic and the average variable economic cost (AVC) per client.

Table 8: Clinic-based variable economic costs and utilisation rates

	Clinic 1		Clinic 2		Clinic 3		Clinic 4	
	No.	AVC	No.	AVC	No.	AVC	No.	AVC
Group counselling	8	R13	12	R23	12	R31	20	R31
Pre-test counselling	30	R19	10	R18	35	R20	38	R29
Testing	20	R68	6	R68	31	R84	38	R42
Post-test counselling	10	R38	6	R34	13	R100	0	R67
Delivery	0	R11	0	R–	2	R72	0	R–
Follow-up care	4	R121	3	R121	18	R121	0	R121
Community mobilisation	2	R44	0	R–	0	R–	0	R–

The group counselling figure refers to the number of group test counselling sessions conducted, on average, per month; similarly for the other components. Table 8 shows substantial variations across the clinics for almost all of the components. The variations in unit costs occur mainly in the counselling stages of the intervention. The staff at the different clinics spend quite varied lengths of time with each client, leading to different counselling costs. Clinics 3 and 4 have notably higher unit costs associated with counselling than Clinics 1 and 2. Follow-up unit costs are standard across the clinics; this is in part due to the very limited data and the necessity for assumption at this early stage of the implementation.

RESULTS

The differences in unit costs do not necessarily reflect differing levels of efficiency, as the outcomes are not known. It is impossible at this stage to determine what the implications of these different approaches to offering the same service are.

The analysis has, thus far, focused on the costs of components on a monthly basis. Where unit costs are reported, the unit used is that which is appropriate for an individual component. This was done to allow for comparison of components across clinics and between this and other sites. Reporting unit per mother and child pair, while useful, allows for little comparison with other sites. This difficulty in comparison results from the impact on cost of HIV prevalence. Sites with low prevalence will, other things being equal, have higher costs per mother and child pair because of the higher cost of screening. While this method allows for more meaningful comparisons across sites, it does differ from the results typically reported in the press. For this reason, the following section reports the average cost per mother and child pair, up until the child is six months old. Table 9 reports the average cost for VCT, delivery, and six months of follow-up.

Table 9: Average economic cost until six months of age

	Financial	Economic
VCT	R187	R1 173
Delivery	R21	R72
Follow-up for six months	R376	R431
Total	R584	R1 676

The results in the above table differ from those reported previously in a number of ways. The unit costs of VCT are calculated, in this instance, by dividing the total cost of group counselling, pre-test counselling, testing and post-test counselling by the number of HIV-positive women who progress to the delivery stage and to whom nevirapine is administered. This same denominator is used in the calculation of delivery-related costs, while the follow-up costs are estimated based on the costs of the component and the number of follow-up visits. Only the costs directly attributable to each component are included; the overhead costs have not been included. This exclusion effectively ignores the important role of overheads in the determination of costs. The inclusion of these costs would, however, distort the results. Many of the large overhead costs are fixed and will remain unchanged as utilisation levels increase. If, therefore, they were included in the above results they would have inflated the average costs – reflecting not the running costs but the infancy of the intervention.

The table shows that the bulk of the financial costs, per mother and child pair, occur at the follow-up stage of the intervention. This is as expected, as the large new expenditure on formula feed pushes up the financial cost of this component. Follow-up economic costs, while still important, are dwarfed by the high costs of screening. The costs of screening are high, as prevalence is low and highly qualified staff are involved. It is, however, possible to argue that this is an unfair allocation of costs to a PMTCT

intervention. VCT is an intervention in itself and has benefits for HIV-negative women as well as HIV-positive women who continue in the intervention. If VCT was being offered as an intervention it would not be considered only as part of PMTCT and the costs associated with PMTCT would dramatically reduce. This raises the important issue of examining economies of scope. HIV-related interventions evaluated in isolation may appear more expensive than if they were considered as a collection of activities. It is clearly an area which requires further investigation.

DISCUSSION AND CONCLUSION



The most notable aspects of the results were the high economic costs relative to the subset of financial costs and the high costs associated with staff time. These results suggest that very few new resources have been invested in the intervention. While the consumables have been paid for by additional funds, by far the majority of costs have been borne by the site itself.

This result did not stem from a lack of available funds; indeed the site had a budget of R500 000 for the year to spend on PMTCT. The difficulty has, however, emerged in accessing these funds. The inability to access available funds is a consequence of the lack of capacity and the resultant non-coordination of activities with the different tiers of government involved in the PMTCT programme's delivery. Thus, while operating in an already strained environment, this inability to access additional resources has led to increased pressure being placed on the site's own resources. The Desmond et al. study found similar situations in the under-resourced settings, while in the better resourced location, where there was more capacity, additional funding was more easily accessed (2003).

The lack of access to outside funding is partially responsible for the high staff costs. Without the ability to employ new staff, the responsibility for implementation fell to existing personnel. These staff were often of a higher level than was required by the task. For example, it does not require a professional nurse to conduct pre- and post-test counselling. If outside finances had been available, it might have been appropriate to employ lay counsellors, as has been done elsewhere, at a far lower cost. These counsellors, given utilisation levels, could also be involved in other aspects of the intervention such as community mobilisation as well as assisting with other functions of the facilities. Similarly, the introduction of the PMTCT programme would be beneficial to other programmes operating in the hospital (see Thaineau et al., 1998; for example). The training, skills and experience gained whilst administering the PMTCT programme are transferable and can be applied in other aspects of hospital duties or administration. This suggests that, if properly planned and implemented, PMTCT interventions could strengthen rather than pressure existing services.

It is difficult to compare the costs found in this study with those in the literature, as the intervention is still maturing and the cost structure changing. What is clear is the relative unimportance of drugs as a contributor to costs and the growing importance of formula.

The analysis of resource uses associated with PMTCT has important implications for other interventions of a similar description, such as the provision of ARV. The implementation of a new intervention seemingly requires substantial management time. It is not clear at this early stage of PMTCT how this might stabilise, or even reduce, as the intervention becomes more integrated. The implementation of a new intervention, without the accompaniment of additional funds, can place stress on the system and the personnel involved. This site was already suffering with chronic understaffing associated with the inability to fill positions. Placing additional pressure on staff in such circumstances is likely to have negative implications. Staff at the site were generally happy that the intervention was taking place, although they felt strained by additional work without the removal of other responsibilities.

If the capacity of the system is strengthened and resources are made available, the implementation of new interventions can be used to strengthen the system. This study adds weight to the argument that if the capacity of poorer health systems is not improved, the cost of new programmes will be disproportionately felt by the poor, as their service becomes even more pressured.

APPENDIX



Baseline data used for the Eastern Cape PMTCT costing exercise.

HIV status	HIV-/HIV+	HIV-	HIV+	
Feeding status			No formula	Formula
Component				
Group counselling				
Staff time (in minutes)	30			
Facilities' contact time (in minutes)	30			
Pre-test counselling				
Staff time (in minutes)	25			
Facilities' contact time (in minutes)	25			
Testing				
Staff time (in minutes)		15	30	
Facilities' contact time (in minutes)		15	30	
Stores used				
Rapid test		1	1	
EFOORA Test			1	
Post-test counselling				
Staff time (in minutes)		15	30	
Facilities' contact time (in minutes)		15	30	
Stores used				
NVP tablet			1	
Delivery				
Staff time (in minutes)			30	75
Facilities' contact time (in minutes)			30	75
Stores used				
NVP syrup (0.06ml per kg)			1	1



HIV status	HIV-/HIV+	HIV-	HIV+	
Feeding status			No formula	Formula
Follow up (monthly)				
Staff time (in minutes)			5	15
Facilities' contact time (in minutes)			5	15
Stores used				
Bactrim/Co – trimoxizol			1	1
Folic acid			1	1
Multivits			1	1
Pelargon (tins)			8	
Community mobilisation				
Staff time (in minutes per session)	60			
Facilities' contact time (in minutes)	30			
Clinic administration				
Staff time (in hours per week)	3			
Facilities' contact time (in hours)	4			
Hospital administration				
Staff time (in hours per week)	26			
Facilities' contact time (in hours)	26			

REFERENCES



- Ades, A.E., Ratcliffe, J., Gibb, D.M. & Sculpher, M.J. 2000. Economic Issues in the Prevention of Vertical Transmission of HIV. *Pharmacoeconomics*; 18(1): pp 9–22.
- Creese, A., Floyd, K., Alban, A. & Guinness, L. 2002. Cost effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence. *Lancet*; 359: pp 1635–1642.
- Desmond, C. 2000. AIDS Prevention: How Much Does it Cost? *AFRICANA Bulletin*, 42.
- Desmond, C., Franklin, L. & Steinburg, M. 2003. The Prevention of Mother-to-Child HIV Transmission: Costing the Service in Four Sites in South Africa. HST Unpublished paper.
- Galbraith, D. & Bennish, M. 2001. Reducing Mother-to-child transmission in Hlabisa District: Incremental Program Costs, Report, Africa Centre for Health and Population Studies.
- Geffen, N. 2001. Cost and cost effectiveness of mother to child transmission prevention of HIV. Briefing Paper, Treatment Action Campaign.
- Geffen, N., Nattrass, N. & Raubenheimer, C. 2003. The cost of HIV prevention and treatment interventions in South Africa, *Working Paper No. 28*, Centre for Social Science Research (UCT).
- Guay, L., Musoke, P., Fleming, T., Bagenda, D., Allen, M., Nakabiito, C., Sherman, J., Bakaki, P., Ducar, C., Deseyve, M., Emel, L., Mirochnik, M., Fowler, M.G., Mofenson, L., Miotti, P., Dransfield, K., Bray, D., Mmiro, F. & Jackson, J.B. 1999. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial *Lancet*; 354: pp 795–802.
- Mansergh, G., Haddix, A., Steketee, R., Nieburg, P., Dale, J., Simonds, R. & Rogers, M. 1996. Cost effectiveness of Short-Course Zidovudine to prevent perinatal HIV type 1 infection in a Sub-Saharan African developing country setting. *JAMA*; 276: pp 139–145.
- Marseille, E., Kahn, J.G., Mmiro, F., Guay, L., Musoke, P., Fowler, M. & Brooks Jackson, J. 1999. Cost effectiveness of single dose NVP regimen for mothers and babies to decrease vertical HIV-1 transmission in sub-Saharan Africa. *Lancet*; 354: pp 803–809.
- Marseille, E., Morin, S., Collins, C., Summers, T. & Kahn, J. 2002. Cost-effectiveness of HIV prevention in developing countries, HIV InSite Knowledge Base Chapter web page: <http://hivinsite.ucsf.edu/InSite.jsp?doc=kb-08-01-04>
- Masaki, E., Green, R., Greig, F., Walsh, J. & Potts, M. undated. Cost-Effectiveness of HIV Interventions for Resource Scarce countries: setting priorities for HIV/AIDS Management. Unpublished paper.
- Musgrove, P. 1999. Public spending on health care: how are different criteria related? *Health Policy*; 47: pp 207–23.

- Shisana, O., Hall, E., Maluleke, K.R., Stoker, D.J., Schwabe, C., Colvin, M., Chaveau, J., Botha, C., Gumede, T., Fomundam, H., Shaikh, N., Rehle, T., Udjo, E. & Grisselquist, D. 2003. *The Impact of HIV/AIDS on the Health Sector*. Cape Town: HSRC Publishers
<http://www.afroaidsinfo.org.8080/content/sahara/healthstudy4.pdf>
- Skordis, J. & Natrass, N. 2000. Paying to waste lives: the affordability of reducing mother-to-child transmission of HIV in South Africa. *Journal of Health Economics*; 21: pp 405–421.
- Soderlund, N., Zwi, K., Kinghorn, A. & Gray, G. 1999. Prevention of vertical transmission of HIV: An analysis of cost effectiveness options available in South Africa. *BMJ*; 318: pp 1650–1656.
- Thaineau, V., Sirinirund, P., Tanbanjong, A., Lallemand, M., Soucat, A. & Lamboray, J.L. 1998. From Research to Practice: Use of short course Zidovudine to prevent mother-to-child HIV transmission in the context of Routine Health Care in Northern Thailand, *Southeast Asian Journal of Tropical Medicine, Public Health*; 29(3): pp 429–442.
- Wilkinson, D., Floyd, K. & Gilks, C.F. 1999. A national programme to reduce mother-to-child HIV transmission is potentially cost saving: Evidence from South Africa, Medical Research Council.
- Wilkinson, D., Floyd, K. & Gilks, F. 1998. Antiretroviral drugs as a public health intervention for pregnant HIV-infected women in rural South Africa: An issue of cost effectiveness and capacity, *AIDS* (12): pp 1675–1682.
- Young, T. & Coetzee, N. 2000. Technical report: Monitoring methodology used in the Khayelitsha mother-to-child HIV transmission prevention programme, Department of Public Health, Faculty of Health Services (UCT).