COST-EFFECTIVENESS OF PROGRAMME SANIYA IN BOBO-DIOULASSO, BURKINA FASO

REPORT

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REFERENCES

CHAPTER I

INTRODUCTION

STUDY OBJECTIVE

A hygiene promotion programme aims to improve the health of a target population by changing behaviour relating to specified risk practices, with a proven impact on health. The objective of this study is to test the hypothesis that a hygiene promotion programme represents a cost-effective approach towards the fight against diarrhoeal diseases among young children. We aimed to do this by carrying out an economic evaluation of a hygiene promotion programme implemented over the years 1993-1998 in Bobo-Dioualsso, Burkina Faso: the Saniya programme.

BACKGROUND TO THE SANIYA PROGRAMME

TIME FRAME OF THE PROGRAMME

The Saniya programme comprised three stages of implementation. First there was a period of research covering a four year period (1989-1993). This was carried out to determine the key risk factors associated with diarrhoeal diseases in Bobo-Dioulasso, through a case-control study, focus group discussions and structured observation of hygiene practices (LSHTM, 1993). The aim was also to understand the population's perceptions and beliefs relating to hygiene.

Subsequently a pilot study was carried out for a period of one year (1993-1994). During the pilot year, volunteer mothers took part in behaviour trials to design target practices that were both acceptable and feasible. The main programme activities were then tested on a small scale, in just one of the sectors of the town.

Finally, programme implementation began on August 12th 1995 and continued through to August 12th 1998. An extension in programme funding has allowed activities to continue until the end of 1999. During this time the project was monitored closely to ascertain the outputs of the various activities.

The evaluation period was defined as that from the start of the research phase to the end of the implementation phase in August 1998. The costs for the entire 3 phases were included. However, the benefits were evaluated over the three year implementation period as the project was not seen to produce results

until the start of implementation. Although the project is likely to produce benefits in the future these were not considered.

OBJECTIVES OF THE PROGRAMME

Prior to the research period, a number of behaviour change objectives were defined for the project. The main objective of the project was the reduction of diarrhoeal diseases in young children by:

- Increasing the percentage of children aged from 0-36 months defecating in a pot;
- Increasing the proportion of cases in which child stools are evacuated in a latrine;
- Increasing the proportion of cases in which hands are washed with soap after cleaning up a child's stools;
- Increasing the proportion of times that mothers use soap to wash their hands on coming out of a latrine.

A series of observational studies of the associated practices of interest were then carried out in the research period and the impact of the programme on behaviour was evaluated at intervals during project implementation.

The programme promoted two messages relating to hygiene promotion addressing local risk factors, employing local concepts of disease and hygiene motivation and using existing channels of communication to reach the population:

- hand washing with soap after contact with child stools
- safely disposing of stools in a latrine

These messages were primarily targeted at mothers of children under 36 months, maids and primary school children, all agents who had most regular contact with young children.

Since Saniya was an experimental programme, using new approaches to promote behaviour change, it had a further objective to document and record all activities for future use, as well as to scientifically evaluate the results and the associated costs.

PROJECT ACTIVITIES

There were two main categories of programme activities:

- the core activities of the programme, which have a direct impact on the target population, and which define the direct intervention process: the promotion of the two main Saniya messages: washing hands with soap after contact with stools, and safely disposing of stools in a latrine.
- the 'support' activities which are essential to the smooth running of the programme, yet do not bear a direct impact on behaviour or health per se.

Core Activities

There were five components to the intervention process:

- Monthly household visits were carried out by trained volunteers, the 'Responsables Saniya', who were selected by local election after a Djandjoba (a neighbourhood event with music and dancing). Five full time field workers, the 'animatrices', accompany the volunteers during this process, referred to as the 'Commissions Saniya'.
- Health centre staff were trained in participatory discussion techniques and added a Saniya discussion to their normal programme of health talks in the health centre. Community volunteers and 'animatrices' also organised meetings in their neighbourhoods which were attended by health staff.
- A curriculum of six hygiene lessons for primary schools was created in a workshop by school inspectors, teachers, health agents and project staff. Primary school teachers were then trained and furnished with the lesson guides. Participating schools also received a starter box of soap and two buckets, and in 5 schools a set of six latrines were constructed.
- A youth theatre group created a comic play based around a scenario concerning the social value of cleanliness and stool avoidance which was shown around the town.
- Comic radio 'spots' were created by mixed teams of project staff and local people. Eventually a set of 12 spots with an evolving comic story in Dioula, Moré and French were created and were broadcast at peak listening times for women.

Support Activities

The support activities have been classified into three groups:

- Administration, which covers the overhead costs, office materials, and personnel responsible for setting up and planning activities, rather than their implementation.
- Research, which covers the input of local consultants at the Centre Muraz as well as the input from international consultants at the London School of Hygiene and Tropical Medicine (LSHTM). This category also includes the follow-up and monitoring essential to the programme's evaluation as well as to the general motivation of the project workers.

- Publicity: covers the posters and stickers publicising Saniya, as well as exhibits at the national culture week.

ORGANISATION AND FUNDING OF THE PROJECT

The Saniya project was funded by UNICEF. The project was implemented in the Bobo-Dioulasso region of Burkina Faso from the project headquarters at the Centre Muraz (OCGE), Bobo-Dioulasso town. It was implemented in collaboration with the Ministries of Health and Education. The project was supervised by the Regional Health Director of the Ministry of Health, who provided technical advice. The Ministry of Health also provided some project staff including the Programme Manager. They also funded some equipment and half the vehicle costs. The Ministry of Education supported the in-school activities by providing lesson time in which to implement the project and teacher's time. Technical assistance was provided by the WELL Resource Centre at the LSHTM. The project reports to UNICEF and the Ministry of Health.

COST-EFFECTIVENESS ANALYSIS

This report presents a cost-effectiveness analysis of the Saniya programme. Below is a brief definition of this method of economic evaluation, an outline of the specific approach adopted for the purpose of this study and a list of the main study objectives.

Definitions

Economic evaluation has been defined as 'the quantitative analysis of the relative desirability to the whole community of investing in alternative projects or programmes' (Mills A & Gilson L, 1996), where desirability is assessed in terms of both costs and consequences. More specifically a cost-effectiveness analysis investigates the best way of achieving a single objective (here, reducing the impact of childhood diarrhoea) by comparing effects and costs.

The calculation of a cost-effectiveness ratio can be summarised by Equation 1 below:

Equation 1 Calculation of a Cost-Effectiveness Ratio

$$CE\ Ratio = \frac{Cp - Ca}{Ep - Ea}$$

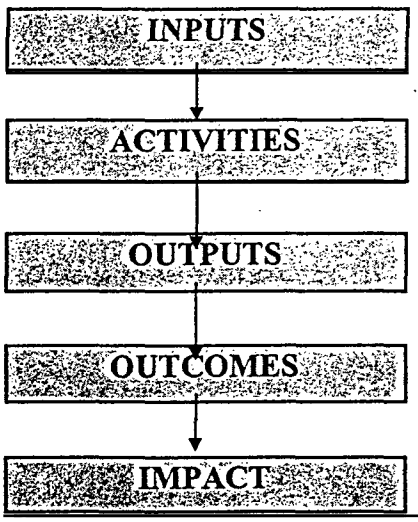
where Cp is the programme cost

Ca is the cost of the alternative
Ep is the effectiveness of the programme measured in units of effect
Ea is the effectiveness of the alternative measured in the same units

Approach

Outlined below is the approach which was used for this cost-effectiveness study (see Figure 1). Having established the hypothesis to be tested, the study perspective was identified, in order to select which costs and consequences would be relevant to the economic evaluation. The costs of resources (or inputs) involved in organising and operating the programme were then evaluated. These inputs contributed to a framework of programme activities, or processes which generated the programme outputs, such as promotional visits to households and radio spots. The outcomes were also considered and defined as the effects of the programme in terms of coverage and behaviour change (change in hygiene practices), in line with the programme objectives. Finally, the (health) impact of the programme reflects the changes in quality of life of the target population in terms of morbidity and mortality as a consequence of reduced incidence of diarrhoea.

Figure 1 Overall Structure of the Analysis



Study Perspective

The choice of costs to be included in the analysis depends on the study perspective. We chose here to adopt two alternative perspectives: the perspective of the programme provider (either a donor or a Ministry of Health) and of society as a whole. The chosen perspectives can be defined, and their selection justified, in the following way:

- A provider perspective includes all direct costs to the provider associated with the implementation of the programme, including costs which are purely research based, as well as deferred medical costs associated with diarrhoeal disease. This is useful for replication purposes when a policy-maker is considering the direct funds required for alternative projects.
- A broader societal perspective, takes into account costs borne by other members of society, in particular households, in order to implement the programme, in addition to the direct costs to the provider. The principle of 'opportunity cost' is used to value the resources provided in kind (e.g. volunteer time) The opportunity cost of the use of a resource is the alternative use which is sacrificed by using this resource in the project, and the value of this alternative use. Non medical (indirect) costs including lost caregiver workdays and the lost productivity of a dying child, deferred by the programme are also considered.

The Choice of Alternative

In addition to defining the study perspective, we also had to identify a comparator, or alternative intervention against which the project was valued. Cost-effectiveness is a relative measure of the worth of an intervention, and consequently the description of the chosen alternative is essential to a clear interpretation of the cost-effectiveness ratio. In this instance an alternative would need to be a diarrhoeal disease intervention within the same or similar population, evaluated using the same cost framework. As no such alternative exists, we have chosen to compare the programme to a 'do nothing' alternative. So we are considering the costs and consequences of Saniya, in relation to the costs and consequences of a case scenario with no programme. However, later we attempt to make comparisons with other cost-effectiveness analyses of diarrhoeal disease control interventions.

Outline of Objectives

In order to test the stated hypothesis this study aims to:

- Identify the programme outputs;
- Identify the total and average costs of the Programme Saniya;
- Identify the costs of the 'do nothing' alternative, i.e. the savings generated by the programme;
- Calculate the net cost of the programme;
- Estimate the impact of the programme;
- Calculate the cost-effectiveness of the programme at the three levels of effectiveness (coverage, behaviour change and health impact);
- Conduct sensitivity analyses to test the robustness of results to variations in the key assumptions underpinning the analysis;

- Address the issue of the programme's affordability;
- Consider the implications for the cost-effectiveness analysis of:
  - ⇒ replicating the programme in another region of Burkina Faso, with a target population of similar size;
  - ⇒ extending the programme to a national level;
  - ⇒ replicating the programme in other countries;
- Compare the cost-effectiveness of Saniya with other diarrhoeal disease interventions.

CHAPTER II

COST-EFFECTIVENESS ANALYSIS OF THE SANIYA PROGRAMME

METHODOLOGY

COST ANALYSIS

Valuation of Costs

Inputs were quantified and valued from expenditure data, completed by a standard ingredients approach, discussions with project workers and a household survey. The programme's unit costs were classified according to the nature of resources, either recurrent or capital, and were valued at current prices (FCFA). Costs were converted into dollar values using the average exchange rates for each year, obtained from the central bank. A more detailed description of these inputs is provided in Appendix A1. Opportunity costs were included, such as the costs of volunteer time.

The costs of all inputs providing a service over more than one year have been converted to annual equivalents. The annual equivalent reflects the purchase price of the capital item, its length of life, and the opportunity cost in terms of foregone interest of tying up funds in the capital item, which could otherwise be invested (this aspect is incorporated by using a discount rate). Details of the calculation are provided in the Appendix A3.

Approach to Cost Calculation

An estimate of the total net programme cost was derived using the calculation process outlined in equations 1 and 2:

Equation 1. Net Cost to the Provider

NET COST = (COSTS TO THE PROVIDER) -(SAVINGS TO THE PROVIDER)

Equation2. Net Cost to Society

NET COST =(COSTS TO THE PROVIDER) + (COSTS TO THE COMMUNITY) - (SAVINGS TO THE PROVIDER) - (SAVINGS TO THE COMMUNITY)

Costs to the Provider

The project was evaluated at three levels: the period of formative research, the pilot study and the implementation phase. Cost data enabling the evaluation was obtained from various sources (detailed below), and accordingly a number of assumptions were made. We have considered each level of the programme in turn. Finally, we have summarised the main outputs of the programme per activity.

Formative Research
Saniya was based on four years of prior research into hygiene and diarrhoea in Bobo-Dioulasso. Such a detailed programme is not feasible or practical for future interventions. Hence the team distilled the essential elements into a short programme of formative research which could be carried out in three-four months prior to an intervention. The approach is explained in four illustrated booklets produced with UNICEF and was tested successfully in India.

Data based on this experience were available. Therefore, we obtained information regarding resource use for the period of formative research relating to this project. We then applied Burkina Faso prices to these resources.

Our cost analysis is therefore based on the three month time frame of the Indian project, and not the four year period of the Burkina work, since a much shorter time frame for the research period is sufficient to replicate such a hygiene promotion programme.

Pilot Study and Implementation Phase
For calculation of total and unit costs of the pilot study and implementation phase, costs were classified according to input (see appendix A1). Costs for both support and core activities are included in the analysis Cost data for these activities were taken from expenditure records at the project and the LSHTM. Any missing data were accounted for by means of a standard ingredients approach to costing[1].

The main areas of missing data were personnel and transportation costs. This was due to delays in flows of funds reaching the programme. Consequently, for years 2 and 3 certain payments were not registered in the expenditure files. Although the resources themselves (essentially personnel) were actually in use during this period. Furthermore, a breakdown of some resources used on the project were not available. These costs were also estimated using the satndard

[1] In a standard ingredients approach, inputs to the programme are quantified and costed using market prices.

ingredients approach. A detailed breakdown of unit costs and quantities of all resources used in the programme is shown in Appendix A2.

Costs were also calculated for each of the programme activities, classified as follows:

Costs related to the programme activities, classified as follows:

Core Activities:
- house to house visits;
- focus group discussions;
- radio spots;
- theatre representations;
- in-school hygiene lessons.

Support Activities:
- Research (local and international inputs in the form of technical assistance; follow-up and evaluation activities)[2]
- Administration;
- Publicity.

All assumptions relating to the classification of costs for each activity are presented in Appendix A4.

The outputs of the programme for each activity are presented in Table 1.

Insert Table 1.

Costs to the Community

A survey of (n=8) households was conducted in order to identify the cost per household of implementing the programme. We accompanied 2 of the project field workers during their house-to-house visits in sectors 2 and 9. To carry out the survey, a questionnaire (shown in Appendix A5) was translated into Dioula during the interviews with the mothers.

The first message of interest was washing hands with soap after contact with child stools. The inputs that needed to be quantified were:

-the quantity of soap used per family per year;

[2] At this stage we included the costs of all research activities relating to the project. Some of these activities were subsequently excluded, to explore the cost implications of replicating such a hygiene promotion programme elsewhere - see ChIII.

-the average price paid for a bar of soap;
-the quantity of water required for hand washing with soap;
-the number of times hands were washed with soap per day.

Assumptions were made regarding the percentage of soap used for Saniya (rather than laundry, washing up and general washing), and the purchase of a water jug (necessary for water pouring, during hand washing). The aim was to provide a maximum estimate of cost for the household, assuming a maximum usage of soap, and taking into account additional soap usage for all members of the family (not just mothers) as a result of the Saniya programme. In practice, however, the overall cost associated with hand washing from the household perspective is probably less than has been estimated for this analysis. The findings from the survey and the assumptions made for the final calculation of cost are listed in Appendix A6.

Regarding the second message of the programme: safe disposal of stools in a latrine, we estimated the cost involved to be simply that associated with the construction of the latrine, in those households without. The presence of a latrine was noted in 90% of households before the start of the programme (Soton A, 1994). Therefore we assumed that the remaining 10% of households would construct a latrine as a response to the programme (most probably an overestimate, but this gives an idea of the maximum cost to the household of applying the message within the home). The cost was annualised, to account for the lasting effects of the construction (also see Appendix A6).

Opportunity costs to the community were also estimated. These costs were split into three categories listed below. All assumptions regarding the calculation of the opportunity costs are outlined in Appendix A7. The opportunity costs include:

The Value of Teaching Time
The time allocated by the teachers trained to participate in the programme, for the provision of a lesson in hygiene was evaluated. This time represents an opportunity cost for the community, as it could be used to focus on another part of the educational curriculum. This cost was estimated as a proportion of the teacher's average monthly income.

The Value of Health Agents' Time
The time allocated by the health agents to focus group discussions relating to Saniya was evaluated. This time represents an opportunity cost for the community as it could have been used to provide additional consultations or services. It was valued as a proportion of a health agent's average monthly salary.

The Value of Volunteers' Time

The time allocated by volunteers to the house-to-house visits and the focus group meetings represents an opportunity cost to the volunteers themselves in terms of a foregone revenue. Indeed, one of the problems encountered during the programme was the motivation of volunteers. At the onset motivation levels were high, but as the project continued this was difficult to sustain. However, the volunteers contribution was an essential component to the programme, and various strategies were adopted to try and improve motivation (an issue which is developed in ChIV). The volunteers input into the programme also represents an opportunity cost to the community at large, as time allocated to the programme was time spent away from the home and the family. To place a value on this input, we used a proportion of the market minimum wage, representative of the time actually spent on the project, which was felt be the most accurate estimate of the foregone revenue.

Costs to Society

The total cost of the programme to society is the sum of the cost to the provider and the cost to the community.

ANALYSIS OF SAVINGS

Approach to the Calculation of Savings

The reduction in the incidence of diarrhoea resulting from Saniya brings about direct savings to the household and to the state. For the household, the direct savings relate to deferred consultations, examinations, medication and potentially hospitalisation fees, as well as funeral charges in the case of death. The non medical (indirect) savings relate to the revenue associated with lost caregiver workdays. For the state, the direct savings relate to the deferred medical costs associated with the management of diarrhoeal diseases. The indirect savings to the state are associated with the value of the productivity lost due to a child's diarrhoea-related death.

To evaluate these savings we first estimated the number of episodes of diarrhoea averted as a result of the programme. Based on this estimate, and the probability of death for a child with diarrhoea (obtained from the literature), we derived the number of deaths averted by the programme (see Appendix B1).

Next, we estimated the cost of managing an episode of diarrhoea, from the household and the state perspective, in Burkina Faso. Based on the household survey, described above, and the literature, we defined the standard treatment

path for a child with diarrhoea. For the purpose of our model we chose to consider four types of healthcare seeking behaviour, considered to be the most likely options, as outlined in Table 2.

Insert Table 2.

The household perspective

In the first case of *self treatment* there are no direct costs associated with the management of diarrhoea. The costs incurred by the household are indirect costs to a parent/guardian from lost revenue, due to time spent with the sick child. From the household survey we estimated that mothers spend an average of 2 working days with their sick child. The estimates of lost revenue were derived from the average monthly income of the mothers interviewed. This was substantially lower than the market minimum wage of 15,000FCFA/month, and therefore represents a minimum estimate of the cost incurred. Lost income to the father or to additional family members was not considered.

For a household consulting a *traditional practitioner* the same indirect costs would be incurred. In addition, there are direct costs relating to the treatment session, and/or the actual treatment provided. Payments were usually made in kind, and during the household survey mothers provided an estimate of the actual cost (in FCFA).

For a household choosing to refer their child to a *health centre*, in addition to the indirect costs from lost revenue, they will face fees relating to the consultation with a health agent, an examination of stools and the purchase of the prescribed medication. A sample of health agents (n=8) was interviewed and helped us to identify the most commonly prescribed medication for a child with diarrhoea. With their help we were also able to define different types of diarrhoea (e.g. with or without dehydration; with or without infection) and the typical medication prescribed for each. Details are provided in Appendix B3, along with unit costs of medicines obtained from a local pharmacy.

If a child is *hospitalised*, the household will face hospital charges for each night spent in hospital and fees relating to the purchase of prescribed medication. Health agents provided an estimate of the average number of nights spent in hospital for a child with diarrhoea.

An outline of the calculation of the hospitalisation charges is provided in the Appendix B4. Unit costs relating to consultations with a traditional practitioner or a health agent are based on the household and health centre

surveys, as described above. From the above, we were able to provide an estimate of the cost associated with each treatment strategy. The total cost to the household associated with the management of diarrhoeal morbidity was then derived using the probability estimates associated with each treatment path.

In order to evaluate the cost of diarrhoea mortality, we estimated the average funeral cost (for a child) in Bobo-Dioulasso, associated with the risk of death from diarrhoea.

We were able to then calculate the total savings for the whole community and the savings for each household following the messages of the programme. The calculation of the savings to the community is based on the medical and non medical costs associated with treating all those cases of diarrhoea averted by the programme. The savings for a household implementing the programme were calculated based on the medical and non medical costs associated with treating all those cases of diarrhoea occurring within the household which are averted by the programme.

The Provider Perspective

The provider perspective explores the costs of the project from the point of view of the agency or agencies responsible for programme set-up and implementation. Although in this case UNICEF is the key donor involved, with some support from the Ministry of Health, we have considered the provider's perspective as if the Ministry of Health were the sole funding and implementing agent. This allows us to show the costs and cost savings to the public sector, of implementing such a programme. For example, by preventing disease, the programme would reduce the burden on hospitals and thus lead to cost savings for the Ministry of Health.

In this section, therefore, we consider only the direct costs of implementing the programme plus the savings to the Ministry corresponding to the cost of treating diarrhoea cases prevented. These savings relate to avoided consultations with health agents, stool examinations and hospitalisations. They were calculated using the unit costs to the Ministry of Health, associated with each treatment path and the probabilities of their occurrence, outlined in Appendices B1&2. The costs take into account the building and equipment costs, the salary of health agents, and generally all aspects of the service provided; minus the fees paid by the households.

The Societal Perspective

The societal perspective incorporates the direct and indirect savings to the state and to the household (as shown in Equation 2 above).

The calculation process relating to direct and indirect household savings and direct savings to the provider has been outlined above. However, we must also consider indirect savings to the state relating to diarrhoea mortality. The indirect saving associated with death is the cumulated lost productivity over the remaining years of working life, discounted back to the present.

In order to estimate the value of the average productivity lost over a lifetime for a childhood death caused by diarrhoea, we assumed a life expectancy of 47 years, and an average working life of 29 years. We also assumed an average monthly income equivalent to the market minimum wage, and a working year of 11 months. In line with World Bank guidelines, a discount rate of 3% was used to provide a present value estimate of lost productivity. The detail of the calculation figures in Appendix B5.

Together with the estimate of the number of programme related averted deaths, the value of lost productivity associated with each case, provided an estimate of the total indirect cost to the state relating to diarrhoea mortality.

NET COST OF THE PROGRAMME

The net cost to the household was first considered. This represents the costs of following the programme messages minus the savings generated by the programme for each household. The net cost to the provider is the total cost to the provider minus the direct savings to the provider. The net cost to society is the total cost to society minus the direct and indirect savings to society.

COST-EFFECTIVENESS

Cost-effectiveness ratios were calculated to account for the three levels of effectiveness:

- Coverage
- Behaviour Change
- Health Impact

For effectiveness levels one and two, the total programme cost was used as the estimate of programme cost 'Cp' of Equation 1 (the numerator). Whereas for the third level, we used the net programme cost to the provider and to society. Consequently, the programme's cost-effectiveness at the level of coverage and behaviour change is presented independently of the savings from reduced incidence of diarrhoea. The programme's net cost already places a value on

effectiveness at the level of health impact, in terms of the savings associated with a lower incidence of diarrhoea.

Coverage
We calculated the cost per capita of the total population covered by the programme (including men, women, adults and children). The programme targeted the populations within the central sectors of the town: 1,2,3,4,6,7,8,9,10,16,17 within the first year of operation. However, in the following years the peripheral sectors were also targeted: populations of sectors 11,12,13,14,15,18,19,21,22,23,24. The radio diffusions covered the whole town throughout the three years of activity. Therefore, we have assumed that the whole population of Bobo-Dioulasso (men and women and children of all ages) is covered by the programme to some extent, whether directly through the radio spots or theatre representations, or indirectly through word of mouth. The population of Bobo-Dioulasso is 341,523 (Municipal estimates, 1998).

Behaviour Change
The key targets for the programme were:

- Mothers of children under 36 months
- Maids
- Primary school children

However, in the evaluation phase of the programme, behaviour change was only monitored for mothers. Consequently, the effectiveness data collected by the project in terms of behaviour change is only available for mothers. Therefore, we have chosen to focus uniquely on mothers as the target group for behaviour change. It should be borne in mind, however, that rates of behaviour change may be underestimated as a result (the effect of behaviour change in brothers and sisters of primary school age, maids and even husbands, on child health is not considered).

We did not have figures relating to the number of mothers targeted by the programme. Target mothers are those mothers with children under 36 moths. Therefore, we first considered the number of children aged under 36 months in Bobo-Dioulasso. Based on the population pyramid, we estimated that children under 36 months represent 11.7% of Bobo's population (see Appendix D1). From previous studies we estimated that a mother in Bobo has on average 1.07 children under 36 months[3]. From these estimates we were able to derive the number of target mothers, amounting to 37,319.

[3] This average is based on 93% of mothers having 1 child under 36 months and 7% 2 children under 36 months.

A series of observational studies of the practices of interest were carried out in the years prior to the intervention, just before the intervention started and after three years of intervention. For this analysis, we considered the evolution of behaviour just before the programme (in 1995), and three years later (1998) i.e. the proportion of mothers who changed their behaviour during this period (see Appendix C). We assumed that all behaviour change during this period was due to Saniya. Knowing the number of mothers targeted, and the proportion who changed their behaviour in response to the programme, we were able to evaluate the number of mothers who changed their behaviour: our measure of effectiveness.

From this we calculated the cost per indicator of behaviour change:

- the cost per mother who washes hands after contact with child stools.

The cost per mother who disposes of the child's stools in a latrine was not considered, despite the fact that children with mothers who disposed of their stools in a latrine have been found to have between 40-50% less risk of diarrhoea than those without (Troaré E et al., 1994). In this study the increase in mothers disposing of stools in a latrine as a result of the programme was not statistically significant ($p=0.24$), which is why we have chosen to focus on hand washing with soap which resulted in a highly significant impact on behaviour ($p<0.001$) (Curtis V et al., 1999). However, in practice a proportion of those mothers who begin washing their hands with soap as a result of the programme, will also dispose of stools in a latrine, which suggests that the programme's true impact on diarrhoea incidence may be greater than what has been assumed here.

The following equation summarises the calculation process:

Cost/hands washed = total programme cost / total number of mothers who wash hands due to programme

Morbidity and Mortality

The target population in terms of health impact were children under 36 months. Indeed, the aim of the programme was to reduce the incidence of childhood diarrhoea. Prior to the intervention the incidence of diarrhoea in young children was estimated at 2.78 episodes per child per year (Soton A, 1994).

In order to identify the number of cases of diarrhoea avoided we related the indicators of behaviour change to their impact on health. Within the literature, findings show that hand washing with soap can reduce the incidence of

diarrhoea from 14 to 89%[4]. As an average we assumed that the reduction in diarrhoea resulting from hand washing with soap is 50% (an average of the findings from the literature), and this value was varied in the sensitivity analysis.

Consequently, we assumed that during the three years of the programme, the incidence of diarrhoea would fall to 1.39 for those children with mothers who changed their behaviour during this period. Based on our estimate of the number of mothers who wash their hands with soap as a result of the programme, and the number of children per mother, we derived the total number of children affected by the mother's hand-washing, amounting to 7,398.

We calculated the cost per case of diarrhoea averted in children under 36 months. By extension we calculated the cost per case of deferred consultation, avoided hospitalisation and per child death prevented. The following equations summarise the calculation process:

Cost/averted case of childhood diarrhoea = net programme cost / total number of cases of averted diarrhoea;

Cost/averted consultation = net programme cost / number of avoided consultations;

Cost/averted hospitalisation = net programme cost / number of avoided hospitalisations;

Cost/averted child death = net programme cost / total number of averted deaths.

SENSITIVITY ANALYSES.

The cost-effectiveness analysis was based on a number of assumptions, many of which were associated with a degree of uncertainty. Sensitivity analyses assess the impact of varying the value of the assumptions on the results, enabling us to test the robustness of our results to these assumptions.

The calculation of the number of cases of diarrhoea averted by the programme was based on two key assumptions:

[4] Estimates of the impact of hand washing on the percentage reduction in diarrhoea incidence are varied from 14% (Feachem RG, 1987) to 27% (Peterson EA et al., 1998) to 37% (Khan MU, 1982) to 62% (Shahid NS et al., 1996) and 89% (Wilson JM et al., 1991).

- the initial level of diarrhoeal incidence in children before the start of the programme;
- the percentage reduction in the initial diarrhoea incidence level, due to mothers washing their hands with soap after contact with child stools.

We tested the impact of varying the estimated values on the study results.

The initial incidence of diarrhoea was varied from the baseline 2.78 episodes per child per year down to 1.6 episodes and up to 9.9 episodes. These values were taken from the literature, and provide a measure of the extremes experienced by various developing countries (Bern C et al., 1992).

Additionally, the literature provides wide ranging estimates of the effect of hand washing with soap on the incidence of diarrhoea. We used an average of 50% reduction in our study, however estimates varied from 14% up to 89%.

It is possible that the baseline value used be an underestimate of the programme's true impact on health status. Indeed, we did not consider the impact of stool disposal. However, it is possible that the combined effect of stool disposal in a latrine with hand washing with soap, would have a greater impact on health than hand-washing alone.

Our analysis also assumed that only mothers changed their behaviour in response to the programme, as behaviour change was only monitored in this target group. However, husbands, maids, and brothers/sisters of primary school age may also implement the messages with the effect of decreasing the cost per behaviour change which could result in a greater impact on health.

Consequently, we adopted the range from the literature to see the effect on results of an increase, or a decrease (in the case of an overestimation) of the baseline value. The effect of the variation was considered on the cost per case of diarrhoea averted.

The calculation of programme costs was based on a number of assumptions.

Costs to the provider were obtained from expenditure data and are assumed to provide a fairly accurate reflection of reality. However, the estimate of costs to the household of hand washing with soap relies on the assumption that this will involve using 10% of the soap purchased by the family. This estimate was varied between a 'reasonable' range of values: from 5% up to 50% (it is difficult to imagine that households consume more soap through the process of hand washing than laundry, washing up and general washing combined). The

effect of varying this parameter was considered on cost-effective ratios at the three levels of effectiveness.

To calculate the opportunity costs of the programme, we placed a value on volunteer time based on the market minimum wage. In practice, after the first 18 months of the programme it proved difficult to sustain the volunteers' motivation. A project was set up to train the volunteers to make soap, and provide them with the necessary material (moulds, and soap ingredients) in an attempt to provide a source of income serving as an incentive to their contribution to the programme. The costs associated with this activity were included in the direct provider costs. However, this activity ran at a loss as it was not viable in terms of providing adequate remuneration to the volunteers. We discussed the issue of the remuneration of volunteers with the field workers who suggested they would require a direct remuneration in order to guarantee their motivation.

Therefore, we considered the effect of increasing the value of the volunteers time on the overall results. We increased the value of the foregone revenue from a percentage of the market minimum wage (15000 FCFA per month) to 90,000 FCFA per month to see the effect on the programme's cost-effectiveness.

The calculation of the savings from the programme, and by extension the programme's net cost rely on four key assumptions: the probability of consulting a health agent, a traditional practitioner, of referral to hospital and of death.

The probability of a consultation with a health agent was set at 10% (based on the literature) and was varied down to 2.5% and up to 25%.

The probability of treatment from a traditional practitioner was set at 10% and was varied down to 2.5% and up to 50%.

The probability of hospitalisation was set at 3.7% which was derived from a report based on the prior case-control study in Bobo-Dioulasso (Soton A, 1994). However, in the literature the estimates of the probability of hospitalisation due to diarrhoea are as low as 1% (Bern C. et al., 1992). Therefore, this estimate was reduced to 1% to test the impact on the cost per case of diarrhoea averted. We also considered the impact on results of increasing the probability of hospitalisation up to 5%.

The probability of death for a child with diarrhoea was set at a base-line value of 1.21%, which was obtained from the literature as an average for developing

countries. However, this value can be as low as 0.1% in some countries (Bern C et al., 1992). Therefore our estimate was reduced to this level, to test the impact on the cost per case of diarrhoea averted. We also considered the effect on the results of a risk of death of up to 4%.

Finally, the estimate of the number of mothers who change behaviour, and consequently, the number of cases of diarrhoea averted, is based on the proportion of children of 36 months of age and under. This estimate affects the programme's cost to the community (the number of households who implement the programme) and the net cost of the programme.

The baseline value was derived from the population pyramid, 1985, so this should be a reliable estimate for Bobo. However, due to the wide ranging implications of this assumption, we have chosen to vary our baseline value of 11.7% down to 4.2% and up to 16.2%, to provide information for replication purposes. The effects were considered on the cost-effectiveness ratios for the three levels of programme effectiveness.

RESULTS

PRESENTATION OF PROGRAMME COSTS

Provider Costs

The previous section outlined the methods used to derive the costs of the Saniya programme. Table 3, presents the estimates of recurrent and capital costs associated with the start-up of Saniya (costs related to the estimated formative research period and the pilot study) and the programme running costs (actual) (95-98).

Insert Table 3.

The results show that the majority of costs are recurrent: 130,420,607 FCFA (USD 248,091). The personnel costs amount to 72,720,617 FCFA (USD 140,200) which accounts for more than half of total recurrent costs, and just under half of total costs for each year (160,601,551 FCFA; USD 303,502). According to Table 4[5], this represents 39% of total provider costs, suggesting that a hygiene promotion programme is human capital intensive. This also reflects the problem of flows of funds experienced by the programme, slowing field activities dramatically.

[5] Table 4 expresses inputs as a proportion of the total programme cost. Percentages are rounded up to the nearest unit, which accounts for the apparent discrepancy between the sum of yearly percentages and the total

Transport, equipment and communication are next in terms of resource costs, representing respectively 10% and 6.7% of total provider costs.

Most input costs can be seen to increase each year, which reflects the expansion of the programme into additional sectors of the town, necessitating additional staff members and training. This increase also reflects, to a more limited extent, the evolution of costs in response to inflation. One of the most striking increases is for the follow-up and monitoring where the costs more than doubled in the third year of the programme, compared with the first and second years (3,009,850 FCFA; USD 5,166 compared to 1,333,175 FCFA; USD 2,380). This is due to a greater number of paid supervisors working on the project in the third year (see Appendix A2).

Of note also is the distribution of total costs between each stage of the programme: combined start-up costs being minimal compared to the yearly running costs.

Insert Table 4.

The above tables illustrate the costs borne by the provider, and the key inputs necessary for setting up and implementing the programme.

Costs to Society as a Whole

The following table (Table 5) reflects the costs borne by the community.

Insert Table 5.

25 à 30.000 p/m

The table illustrates that costs to the community amount to just over half of the costs to the provider. The main cost driver is the practice of hand washing with soap. This represents the total expenditure summed across all households who change their behaviour. The implementation cost per households amounts to 4,528 FCFA per year (USD 8), or 13,584 FCFA (USD 24) for 3 years.

The opportunity costs are relatively low compared to the programme implementation costs. The costs associated with the use of teachers time is highest due to the large number of teachers involved in the programme (see Table 1). If we analyse programme costs from a societal perspective, the provider is bearing 63% of total costs compared to 37% by the community (Table 6).

Insert Table 6.

We also considered the total costs to society in terms of the economic agents supporting the programme on a yearly basis, as shown in Table 7. This shows that for Saniya the direct programme costs were mainly supported by the donor, and during the running phase the household also contributed a substantial amount, at the micro level, by implementing the programme messages.

Insert Table 7.

In summary, the total costs from the provider and societal perspectives are presented in Tables 8 and 9.

Insert Table 8.

Insert Table 9.

Resource use was also analysed in terms of the programme activities, during the operational period (August 95-August 98). Table 10 illustrates that the core programme activities (Commission Saniya; Focus Groups; School; Theatre and Radio) together represent only 28% of total provider costs, while the support activities account for 72% of these costs. Furthermore, the main cost drivers within the support activities (namely research and administration) are personnel, transport/vehicle costs. The costs of the programme activities are of roughly the same order, with the house-to-house visits and the in-school hygiene lessons accounting for a slightly higher percentage of total cost, and radio the lowest percentage (7% versus 3%).

Insert Table 10.

SAVINGS FROM THE PROGRAMME

In order to derive the net programme cost we have considered the savings from the programme in terms of the reduced costs of managing diarrhoea, for the provider and for society as a whole. The savings correspond to the avoided costs associated with managing diarrhoea at the state and the household level for those cases of diarrhoea prevented by Saniya. There are direct savings resulting from a reduction in the use of health care services, medical treatment and general medical costs associated with diarrheoal diseases, and indirect savings in the form of deferred non medical costs including lost caregiver workdays and the lost lifetime productivity of a child dying.

The State Perspective

Table 11 presents a summary of the costs associated with the management of diarrhoea (morbidity and mortality) from the perspective of the state.

Insert Table 11.

The table illustrates that the indirect savings are the most substantial. This amount alone is greater than the total programme cost. However, this saving is only included in the analysis from the societal perspective. Indirect savings relating to transportation to health services were not included as within our survey this cost was seen to be minimal. However, within rural areas where health centres are fewer and more widely dispersed this cost could be substantial.

The provider perspective only considers the direct savings to the Ministry of Health. The savings from deferred hospitalisations are prominent here, representing roughly twice the savings from deferred consultations. So, although the probability of hospitalisation is much lower than that of a consultation, the associated savings from each averted referral are sufficiently great that the associated total savings are more significant than for consultations. The total savings to the provider amount to 7,016,541 FCFA (USD 12,764)[6].

The Societal Perspective

To analyse the savings from a broader societal perspective, savings to the community must be included, as well as the indirect savings to both the community and the state. Table 12 illustrates the direct and indirect costs associated with managing a case for the community, based on the treatment strategies outlined in the Methodology, and the unit costs and probabilities presented in the Appendices B1-4.

Insert Table 12.

For the community the distribution of direct saving is slightly different. The savings associated with deferred consultations are greatest. There are also savings relating to averted funerals and savings associated with traditional therapy. The direct savings amounting to the household represent roughly 70% of those amounting to the Ministry of Health. This suggests, that the community contributes an important part of treatment costs in Burkina Faso.

[6] The average $ exchange rate during the operational period of the project (95-98) was used for conversions relating to savings estimates (see Appendix D2).

The indirect savings, associated with lost caregiver days, are greater than the direct savings, associated with medical costs, but still greatly inferior to those amounting to the state.

We can also consider the savings to the household which amount to 1841 FCFA per year.

Table 13 summarises the savings to society.

Insert Table 13.

NET COST OF THE PROGRAMME

From the household perspective the net cost of the programme is the cost of implementing the programme minus the direct and indirect savings from reduced diarrhoea incidence. We saw that the annual cost of implementing the programme for the household was: 4528 FCFA (USD 8), and the annual savings: 1841 FCFA (USD 3). Therefore the net cost to the household per year is: 2687 FCFA (USD 5).

The net cost of the programme from the provider perspective is the total programme cost to the provider minus the savings to the provider. The net cost to the provider amounts then to 153,585,011 FCFA (USD 290,738).

Although the programme costs society 256,775,787 FCFA, the programme results in the prevention of an estimated 10,284 cases of diarrhoea, 1,028 consultations with health agents, 1,028 consultations with traditional practitioners, 385 hospital referrals and 124 deaths, leading to a total savings of 270,953,107 FCFA which exceeds the cost by 14,177,320 FCFA. Consequently, the programme generates **a net saving to society** of 14,177,320 FCFA (USD 14,030).

COST-EFFECTIVENESS

Using the estimates of total and net programme costs we were able to calculate cost-effectiveness ratios (CE ratios) for each of the three levels of effectiveness. Table 14 summarises the findings.

Insert Table 14.

Coverage

The cost per person exposed to the programme messages, assuming the programme covers the whole population of Bobo-Dioulasso, is 470 FCFA

(USD 7.6) from a provider perspective and 752 FCFA (USD 12) from a societal perspective.

Behaviour Change
The total cost per mother who washes hands after contact with child stools is 23,223 FCFA (USD 43.9) from a provider perspective and 37,129 FCFA (USD 69.2) from the perspective of society as a whole.

Health Impact
The net cost per case of averted diarrhoea amounts to 14,935 FCFA (USD 28.3), from a provider perspective but generates a net savings of 1379 FCFA (USD 1.4) per case from a societal perspective.

The net cost per avoided consultation amounts to 149,420 FCFA (USD 283) per case, from a provider perspective but generates a net savings of 13,791 FCFA (USD 14) from a societal perspective.

The net cost per case of avoided hospitalisation amounts to 398,922 FCFA (USD 754) per case, from a provider perspective but generates a net savings of 36,824 FCFA (USD 36) per case from a societal perspective.

The net cost per avoided death amounts to 1,238,589 FCFA (USD 2336) per case, from a provider perspective but offers a net savings of 114,333 FCFA (USD 113) per case from a societal perspective.

SENSITIVITY ANALYSES

All figures are presented in Appendix E.

The sensitivity of results to the initial incidence of diarrhoea
Figure E1 outlines the impact of varying this estimate on the cost per case of diarrhoea averted. If the average number of episodes per child per year increases, the effect is a reduction of the cost to the provider per case of averted diarrhoea, and an increase in the savings per case to society. The cost-effectiveness curve, from the provider perspective, lies consistently above the curve for the societal perspective, and presents an inferior slope (less sensitive to changes in our parameter).

As the incidence of diarrhoea is reduced below the baseline value, the impact on the programme's cost-effectiveness is more pronounced (marked by the greater slope of the curves). Indeed, if the number of episodes of diarrhoea per child per year falls to 1.78, the cost per case would increase to 23,728FCFA for the provider and to 12,649 FCFA for society.

However, if the incidence of diarrhoea is greater than the baseline value, the cost per case of averted diarrhoea from the provider perspective reduces but, overall, is not very sensitive to the change. There is a greater variation from the societal perspective with savings per case of averted diarrhoea increasing to 19,250 FCFA if the number of episodes rises to 9.78 per child per year.

The Sensitivity of Results to the efficacy of hand washing with soap in terms of reducing the incidence of diarrhoeal disease

The findings are presented in Figure E2. If the impact of hand washing on diarrhoea incidence is greater than that assumed at the baseline, the impact on the cost-effectiveness is relatively insignificant. However if the impact on diarrhoea incidence is lower (less effective) there is a more significant impact on cost-effectiveness.

Indeed, if hand washing results in a reduction in the incidence of diarrhoea by 90%, then the cost per case of averted diarrhoea for the provider would fall by half (7994 FCFA) and from the societal perspective savings per case would increase 12 fold (12 476 FCFA). However, if hand washing with soap only leads to a 60% reduction in the incidence of diarrhoea in children, the effect on the cost per case for the provider is only marginal (13515 FCFA) and for society (-3648 FCFA).

If the impact of hand washing leads to a *reduction* in the incidence of diarrhoeal disease which is less than the baseline value, the impact on the project cost-effectiveness is much greater. A reduction below 20% results in the cost per case to society becoming greater than to the provider. The slope of the curves are much steeper along the range of values below 30% (25,346 FCFA per case to the provider; 15,267 FCFA to society), jumping to 51,374 FCFA to the provider and 56,882 FCFA to society per case of averted diarrhoea, if the percentage reduction falls to 15%.

Further research is necessary to quantify the extent of the impact of hand washing on the incidence of diarrhoeal disease. Research is necessary to determine whether the relationship is country specific, and if so, to estimate the variation across various regions of the globe.

Sensitivity of Results to the Probability of Consulting a Health Agent

The findings are presented in Figure E3. The variation bares hardly any impact on the cost per case of diarrhoea averted, indicating that the results are robust to changes in this parameter.

Sensitivity of Results to the Probability of Consulting a Traditional Practitioner

The results were robust to changes in this parameter. The cost of a consultation with a traditional practitioner was sufficiently low to not bare any impact on the overall results. Indeed, the value of the cost-effectiveness ratio remained constant during the variation in this parameter between a range of plausible values..

The Sensitivity of Results to the Probability of Hospitalisation
The findings are presented in Figure E4. If the probability of hospitalisation falls to 0.7% this would lead to an increase in the cost per case to the provider up to 15,301 FCFA and to society a reduction in savings down to 882 FCFA. If the probability of hospitalisation rises to 5.2% then the cost to the provider would fall to 14,760 FCFA and the savings to society increase to 1616 FCFA per case of diarrhoea averted. We can conclude that the results are robust to variations in this parameter.

The Sensitivity of Results to the Probability of Death
The findings are presented in Figure E5. If the risk of death for a child with diarrhoea falls to 0.3%, in line with the experience of certain developing countries, the cost per case averted to society would increase to 16,850 FCFA. However, the cost per case to the provider would remain constant, as indirect savings are not considered.

A reduction in the risk of death to an extreme of 0.01%, more in line with developed countries increases the cost to society to 22,926 FCFA. The degree of variation is not excessive, so we can concluded that within the realms of the developing world experience, and more specifically to that of Africa the results are robust to reductions in this parameter. However, if the risk of death increases above 1.3% the cost per case to society becomes very sensitive to this parameter, the savings increasing to 34,797 FCFA with a risk of death of 2.8% and 65,178 FCFA with a risk of death of 4.3%.

The Sensitivity of Results to the Percentage of Soap Used by the Household to Follow Saniya's Messages
The findings are presented in Figure E6. There is no impact on the cost-effectiveness ratio from the provider perspective. However, from societal perspective there is an impact at each level of effectiveness. The effect is greatest on the cost per case of averted diarrhoea, which falls to -3634 per case at 5% of utilisation and increases to 16,667 FCFA at 50% utilisation. However, the baseline value was a maximum estimate, so it is most likely that the percentage soap use will be lower.

In terms of the cost per hands washed the cost falls to 33,775 FCFA and increases to 63,963 FCFA. Finally, in terms of cost per person covered the cost falls to 684 FCFA and increases to 1295 FCFA. From a household

perspective the cost of implementing the programme falls to 3410 FCFA per year.

The Sensitivity of Results to the Opportunity Cost of Volunteers
The findings are presented in Figure E7. There is no impact on the cost-effectiveness ratio from the provider perspective and there was no significant effect on results from a societal perspective of varying the value of the volunteers' time into the programme. If we increased the average monthly wage to 90,000 FCFA (the value of their time being a percentage of this wage, based on the number of hours worked) the cost per person covered by the programme increases very slightly by 9 FCFA, to 691 FCFA, the cost per mother changing behaviour increases to 37,562 FCFA (just over 400 FCFA) and the savings per case of averted diarrhoea falls, by less than 300 FCFA, to 1,088 FCFA. Consequently, the results are robust to changes in this variable.

The sensitivity of Results to the Population of Children under 36 Months in Bobo-Dioulasso
The findings are presented in Figure E8. We considered the impact on the three levels of effectiveness from both the provider and the societal perspectives. Except for the cost per coverage (where the provider and societal perspectives are virtually confounded), the cost-effectiveness ratio curve of the societal perspective runs parallel to and above that of the provider perspective , with a gap of roughly 15,000-20,000 FCFA.

If the proportion of children under 36 months is greater than that assumed at the baseline, there is little impact on the cost-effectiveness ratios. The results are robust to increases in this parameter.

If the proportion of children under 36 months within the general population, falls below 10% then the cost-per behaviour change and per case of diarrhoea averted increase substantially. The effect on the cost per behaviour change is the greatest (with the ratio doubling if the proportion falls to 4.2%).

Within Africa, it is unlikely that children under 36 months represent a much smaller proportion of the total population, than that estimated as the baseline of our analysis as this was derived from the population pyramid of Bobo. However, it is useful to bear these results in mind if the programme is to be replicated in a region where the proportion is substantially lower.

SUMMARY CHAPTER I.

We saw that the Saniya programme cost the provider 160,601,551 FCFA (USD 303,502) covering the start-up period of formative research, the pilot study and three operational years. The project was human-capital intensive

with personnel representing 38.6% of the cost. Forty two percent of resources were used for administrative purposes, and over 15% funded an international research input into the programme. The costs of the core programme activities amounted to only 29% of the total, 44% when monitoring and evaluation costs are included.

The total project cost, including the costs to the community was 256,775,787 FCFA (USD 466,878). Thirty eight percent of the cost is borne bye the household, compared to 62.5% by the provider.

The programme resulted in direct savings to the state and the household in terms of deferred treatment costs for those cases of diarrhoea averted by the project. Indirect savings to the state, however, in terms of productivity gains from averted death, were the most substantial.

Consequently, although the programme cost the provider 14,935 FCFA (USD 28.3) per case of averted diarrhoea, from the perspective of society each case averted resulted in a net saving of 1,379 FCFA (USD 1.4). An estimated 10,284 cases of diarrhoea, 1,028 consultations with a health agent, 1,028 consultations with a traditional practitioner, 385 hospitalisations and 124 deaths were averted by the programme.

The results were robust to changes in the majority of the core assumptions of the analysis. However, the results were sensitive to the degree of impact of hand washing with soap after contact with child stools on diarrhoeal disease incidence. Results were particularly sensitive if hand washing with soap leads to a greater reduction in the incidence of diarrhoeal disease than that assumed at the baseline. The results were sensitive to the incidence of diarrhoea in children prior to the project, which was based on a cohort study carried out prior to the start of the programme (Soton A, 1994). The results were also sensitive to the reduction in the proportion of children under 36 months below 10%.

Having completed the economic analysis of the programme, we will consider next the implications of replicating the model elsewhere.

CHAPTER III

PROGRAMME REPLICATION

The cost-effectiveness analysis enabled us to establish the costs involved in setting up and running a hygiene promotion programme with a research input, based on the experience of Saniya in Bobo-Dioulasso. However, the analysis was also intended to indicate the general costs and consequences which are associated with the implementation of a hygiene promotion programme. The aim of this section is to extract from this experience the costs of a model programme which can serve as a reference for replication purposes.

METHODOLOGY

In replicating the Saniya experience in another region of Burkina Faso, it is likely that the costs would be reduced. If the region is similar in the sense of hygiene practices, geographical access to households, education and income level, the costs associated with programme 'start-up' will be less. The aim here is to extract the lessons from the Saniya experience and see where there could be scope for increased efficiency (greater cost-effectiveness) if the model was to be applied elsewhere.

Three cases of replication were considered:

- Replication in another region of Burkina Faso
- Programme expansion nation-wide
- Replication in another country

Replication in Another Region of Burkina Faso

We made a number of assumptions enabling the meaningful comparison with Saniya, and then identified potential areas of cost saving, if the programme were to be replicated within Burkina Faso. In order for the costs and consequences of Saniya to be applicable, a number of assumptions regarding the characteristics of the region were made:

A) supports a population of a similar size to Bobo
B) risk factors for diarrhoea facing the population are the same as in Bobo
C) population has the same access to programme activities as in Bobo (i.e. they will have the same coverage) - i.e. the population is urban-based rather than rural.

From these assumptions we were able to identify the areas of cost saving when the programme is replicated in another region of the country.

Assuming the above hold, the programme will be able to save on the start-up costs associated with Saniya. If assumption A) and B) hold, the programme running costs will be of a similar order to Saniya, and the coverage will also be of the same order. If assumption C) holds, the formative research period is no longer necessary, as the risk factors and intervention strategy have already been identified. The optimal routes for communicating the programme messages were already identified for Saniya, so it is not necessary to re-run a pilot study.

Furthermore, the research costs may be reduced. Table 6 indicated that costs relating to research in Saniya accounted for a large proportion of total running costs (30%). Research costs can be broken down into:

- follow-up, monitoring and evaluation costs (13%);
- local research costs (15%);
- a significant input from international researchers (72%) (Appendix A1).

Follow-up and evaluation provide an essential report on the programme's effectiveness, in terms of the programme impact on the target population. This component of research also helps to sustain the motivation and enthusiasm of the project workers. However, costs relating to the international research input can be cut out. Although an important part of the Saniya experience and the set-up of this initial model, these costs should not be essential to replication.

Programme expansion nation-wide

Additionally, policy makers may be interested in having an estimate of the cost implications of expanding the programme nation-wide or, more generally, increasing coverage. In order to draw on the Saniya experience, using programme costs and resources, scaled up to cater for the increased coverage, we must assume that people would have a similar access to the programme across the country as they do to the Saniya project in Bobo.

International Replication

Here, we were unable to make direct cost comparisons, but provide indications of an approach to predicting costs and discuss the difficulties of cross-country comparisons.

We have chosen to present the costs associated with the programme's replication in 1999 constant prices, to give an indication of the cost of such a programme today (see average inflation rate).

RESULTS

Replication in Another Region of Burkina Faso

The total provider cost, taking into account of reduced start-up and research costs amounts to 155,292,989 FCFA (constant 99 prices) (USD 267,747[7]) compared to 160,601,551 FCFA (USD 303,502) for Saniya. The impact on the programme's cost per person covered is outlined in the table below:

Insert Table 15.

However, we cannot provide a meaningful comparison of the impact of a replicated programme in relation to Saniya. The programme's effectiveness may be greater or inferior to that of Saniya, depending on the population characteristics (demographic, geographic, income level). Therefore, more or less mothers may change behaviour in response to the programme, resulting in more or less cases of diarrhoea being averted. It will be essential to track the programme's impact to enable such comparisons to be made.

Furthermore, if the assumptions outlined in the Methodology do not hold then it is difficult to extrapolate from Saniya in terms of replication costs. For example, if the programme is replicated in a rural area, the access to programme activities will be inferior. This may generate additional costs to the provider in order to improve access for dispersed populations living far from health care and educational facilities. Activities may have to be modified and, for example, additional emphasis may be placed on the house-to-house visits, which, in the context of dispersed dwellings would be more time intensive.

Programme Expansion Nation-wide

The cost per person covered by Saniya was estimated at 470 FCFA. The population of Burkina Faso was estimated at 11,266,393 (July 1998). Therefore, total cost for the nation as a whole would amount to 5,295,204,710 FCFA (USD 9,627,645). In practice there may be economies of scale relating, for example, to the radio broadcasts which can be operated at a national level, with costs not necessarily increasing proportionally with the size of the population.

[7] Using 1998 exchange rate estimate.

However, the assumption regarding the accessibility of the programme may not be very realistic. A country such as Burkina Faso comprises varying geographic regions: rural and urban areas (83% rural) with populations with very different levels of access to programme activities. Therefore, in practice it is likely that any reductions in programme cost from economies of scale will be insignificant compared to the increased costs associated with setting up activities in rural areas where communications are more difficult and facilities more widely dispersed. In turn this may affect the effectiveness of the programme in terms of behaviour change.

International Replication

The lessons from Saniya in terms of replicating the programme in another country are less easily determined. A period of formative research is necessary to determine the risk factors and people's perception of hygiene and diarrhoeal disease. We can consider the example of India, where a shorter time period was sufficient to conduct the formative research prior to the programme's implementation. However, this was taken into consideration in our analysis of costs, so there would not be a foreseeable reduction in formative research costs. In this case the pilot study should also be replicated to test the selected messages, guaranteeing a maximum impact on health.

However, it is difficult to make meaningful comparisons of costs between countries. Assuming the activities are the same, the unit costs will not necessarily be uniform. For example, personnel costs vary widely between countries and radio broadcasts can be more or less costly as a means of communication. In this programme radio spots were the cheapest means of promoting the hygiene messages (3% of total provider cost)., the Saniya Commissions and the in-school hygiene lessons were the most costly (7%), followed by theatre representations (6%) and finally the focus group discussions (5%).

However, the quantification of resources based on the Saniya experience can be used as a reference, and costed within a local setting, to give an estimate of costs which is country specific, assuming a target population of similar size. For a larger population the costs should be scaled up accordingly. Once the population's existing practices have been identified (the percentage of mothers washing hands prior to the intervention) impact targets can be defined and behaviour monitored accordingly.

CHAPTER IV

AFFORDABILITY

METHODOLOGY

If the programme is a viable model for replication, it is important to consider the affordability for the government and for the household. The government perspective is important to determine whether an investment into a hygiene promotion programme is economically viable in terms of the national health budget, enabling the government to act as provider in the case of replication. The household perspective shows whether the investment in the programme (following the messages) is economically viable, in relation to the average household budget.

We defined affordability for the government in two ways:

- in terms of the national health budget per capita
- in terms of GNP per capita

We first estimated the cost per person covered by the programme as a percentage of the per capita health budget for Burkina Faso. Then we estimated the cost per person covered by the programme as a percentage of GNP per capita.

We defined affordability for the household in terms of the average annual income. In order to derive an estimate of average annual income we considered the average income of a mother and a father, assuming there are no other income providers within the household.

The estimate of the average yearly income of mothers was based on the household survey. Although, this will probably be an underestimate as people are often reluctant to admit their true earnings, particularly to a stranger, it enables us to measure the maximum burden the programme might place on the poorer households in the country. Also, our estimate is based on a very small, and possibly unrepresentative, sample. The estimate of a father's average income is based on the national minimum wage.

RESULTS

The total health budget between years 1995 and 1998 was estimated at: 93 billion FCFA (years: 96;97;98) (Appendix D2). Assuming a population of 11,266,393 (July, 1998), health expenditure per capita is equivalent to 8255 FCFA. In parallel, the cost per person covered by the Saniya programme was estimated at 470 FCFA for the provider. This represents 5.7% of the per capita health budget. However, we have seen that there are savings to the state from the programme. So the net cost would account for an ever lower proportion of the budget.

Per capita GNP in Burkina Faso was estimated at USD 250 (IBRD, 1999). The cost per person covered by the programme was estimated at USD 7.6. This represents 3% of per capita GNP.

The average yearly income of mothers was estimated at 53,704 FCFA (USD 98). The estimate of a father's average income is: 25,000 FCFA a month for 11 months per year: totalling 275,000 FCFA (USD 500) The estimate of the average yearly income for the household as a whole is 328,704 FCFA (USD 598).

The direct cost of implementing the programme at the household level was estimated at 4528 FCFA per year. This cost represents 1.4% of the estimated average yearly income. On average, a saving of 1841 FCFA per year will be made from reduced incidence of diarrhoea. So the net cost 2687 FCFA per year represents merely 0.8% of average yearly income.

CHAPTER V

COMPARISON AGAINST OTHER INTERVENTIONS FOR THE CONTROL OF CHILDHOOD DIARRHOEA

METHODOLOGY

A review of the literature was conducted to identify articles relating to the cost-effectiveness of alternative interventions to reduce the burden of diarrhoeal disease elsewhere. We only considered preventative interventions and did not consider curative interventions such as ORT. The aim was to compare the costs and consequences of these interventions with the costs and consequences associated with Saniya to give an idea of relative cost-effectiveness. A systematic search of medline, popline and healthstar databases was carried out. We searched under the MESH headings:

- Cost & effectiveness & rotavirus;
- Cost & effectiveness & water & sanitation;
- Cost & effectiveness & hygiene promotion.;
- Cost & effectiveness & health promotion.

The search was confined to English language publications after 1987.

We only identified 20 articles which were relevant to our analysis. However, of those articles only 6 presented costs and consequences of programmes in a way which enabled a meaningful comparison with Saniya. This requires a description of programme inputs, and associated costs. Where possible costs were converted to reflect the purchasing power of Burkina Faso to be comparable with Saniya.

The studies found relate to a rotavirus immunisation programme (n=2), to a cholera vaccination programme (n=2), to a breast feeding programme (n=2). There were no descriptions of water and sanitation programmes which gave costs, during the period considered. Therefore, we referred back to the review by Esrey, 1985, in order to derive some indicators of cost, using effectiveness measures presented here and in other articles (Young B et al., 1987).

All costs obtained were based on estimates found in the literature. They are presented in dollars, and were inflated to 1998 prices using the inflation rates covering the period (Apoendix D2). Programme costs and effects were analysed for a period of three years to be comparable with the Saniya

programme. We assumed that children under 36 months were the target of the programmes and that this target group was the same size as for Saniya (39,924). Using the efficacy level presented in the literature, and the baseline diarrhoea incidence from Soton (2.78/child/year) the morbidity effects were estimated: the number of cases of diarrhoea averted by the programme and the number of averted deaths. The total programme cost was derived from the cost data presented in the literature, and the savings from the programme from a provider and a societal perspective were based on the Saniya estimates of the costs to the household and the state of managing a case of diarrhoea, funeral costs and the value of lost productivity from death. This enabled the calculation of the net cost of the programme. The cost-effectiveness ratio considered is the cost per case of averted diarrhoea.

Rotavirus Immunisation Programmes

Rotavirus diarrhoea is the major cause of severe dehydrating diarrhoea in young children in developed and developing countries. It accounts for roughly 30% of diarrhoea cases among children in the developing world (WHO,1989). We were unable to identify cost-effectiveness studies relating to immunisation programmes in the developing world. The two studies considered refer to setting up an immunisation programme in the US (Tucker AW et al, 1998; Smith JC et al., 1995)

Personnel costs were scaled down by 10% to account for the cheaper manpower in Burkina Faso. The inputs into the programme are minimal compared to Saniya, and their cost reflects 3 doses of vaccine at two weekly intervals. This is a one off intervention, reducing the risk of rotavirus diarrhoea by 50%, and simple diarrhoea by 0.15% in young children, for the first 5 years of life.

An rotavirus immunisation programme was assumed to have a preventative effect in all children receiving the immunisation vaccine (assumed here to be all children aged under 36 months in Bobo-Dioulasso). For the Saniya programme, only those children with a mother who changed her behaviour in response to the programme face a lower risk of diarrhoeal disease.

Cholera Immunisation Programmes

We also considered the cost-effectiveness of a cholera immunisation programme. The context for such a programme is quite different to that of the rotavirus programme. Indeed, WHO has strongly discouraged the use of previous cholera vaccines as they are largely ineffective and when they confer protection, do so for a limited time. However, during outbreaks of cholera

epidemics with high incidence and mortality, the case for cholera vaccines has been put forward (Murray Jet al, 1998; Nafciy A et al, 1998).

Similarly to a rotavirus immunisation programme, a cholera immunisation programme is assumed to have a preventative effect in all children receiving the immunisation vaccine (here, all children aged under 36 months in Bobo-Dioulasso).

Water and Sanitation Programmes

As Varley RCG et al points out (1998) the 'hardware' water and sanitation programmes are not usually health sector interventions, although the health sector should influence the design of the infrastructure, how it is operated and maintained, to encourage health impact. Hygiene promotion, on the other hand is much more the responsibility of public health agencies.

However, for purposes of comparison it is interesting to compare the relative cost-effectiveness against a hygiene promotion programme.

The cost estimations used in this analysis refer to water supply and sewerage for urban and rural households[8] and are per capita costs. However, the benefits of the programme are shared by the household. With an average of seven people per household in Burkina Faso, the total cost to the household was considered to be seven times the per capita cost. This is incorporated into the total cost estimate.

We assumed that all children under 36 months were covered by the programme, which results in much greater effectiveness in terms of cases of diarrhoea averted. This assumes that all families implement the programme (100% coverage). For Saniya, only those children with mothers who changed their behaviour faced a lower risk of diarrhoeal disease.

Furthermore, we have not considered the full benefits in terms of averted cases of diarrhoea over the 20 years covered by water and sanitation infrastructure. The time frame under consideration is 3 years, to be comparable with the Saniya evaluation. If the additional future benefits were considered then the cost-effectiveness ratio for the water and sanitation programme would undoubtedly be much lower.

[8] Costs refer to the annual total cost per capita (assuming that construction costs are 70% of total, the rest relating to operation and maintenance) and are based on the median values of costs from 87 developing countries reports to WHO. A lifetime of 20 years is assumed for urban and rural water supply, 50 years for urban sewage, and 10 years for rural sewerage. The cost per urban household includes water supply (50% house connection and 50% public tap) and sewerage. The cost per rural households includes water supply and sewage (Esrey SA,).

Breast Feeding Programmes

Finally, we considered the costs and effects of breast-feeding promotion programmes. The beneficial effects of breast feeding in reducing diarrhoea morbidity and mortality are substantial (Huffman SL & Combest C, 1990). Breast feeding is recommended up to the age of 4-6 months, and exclusive breast feeding is associated with the lowest risk of diarrhoea, although any breast feeding is reported to be better than non at all.

No cost data could be obtained relating to programmes promoting the practice of breast feeding, but standard resource use for such a programme was described in the literature. According to Phillips MA et al., 1987, a package of breast feeding promotional activities, would include:

a) changes in hospital routine
b) face-to-face education
c) promotion through the mass media (radio spots, theatre)
d) legislation to control the marketing of breast milk substitutes

RESULTS

The results presented in this section rely on many assumptions. The shortcomings of the analysis and the general difficulties of comparing cost-effectiveness studies of alternative are developed in ChVI.

Rotavirus Immunisation Programmes

The results figure in Table 16. The total programme cost is nearly 5 times greater than Saniya. The cost per child covered by the programme amounts to USD 69.7, which is more than Saniya (nearly double), if we consider that those covered by Saniya are children under 36 months with mothers who change their behaviour (USD 39.5).

However, in parallel the effectiveness in terms of cases of averted diarrhoea and death is also nearly five times greater than Saniya, and so are savings. Despite the savings, the net programme cost is still greater than for Saniya. This difference outweighs the benefits in terms of averted diarrhoea as the cost-effectiveness ratio is higher for the immunisation programme: from the provider perspective the cost per case of diarrhoea averted is twice that of Saniya; form a societal perspective the cost falls to USD 6 per case compared to a net savings for Saniya of USD 2.5 per case.

The cost per case of diarrhoea averted, remains very low very in absolute terms, but is less cost-effective in comparison with the Saniya programme.

In summary, our calculations indicate that Saniya has a good cost profile compared with a rotavirus vaccination programme, but the effects are less significant in terms of averted diarrhoea cases.

Insert Table 16.

Cholera Immunisation Programmes

Table 17, presents our estimates of costs and effects associated with cholera vaccination programmes, based on the findings in the literature.

The cost per vaccine is much lower than the rotavirus, with a cost per dose of vaccine of USD 2. Efficacy is 50%, resulting in a 50% reduction in cases of cholera for those ho are vaccinated. However, cholera was estimated to represent only 0.3% of all diarrhoea cases. Based on these estimates, the total cost for the population covered is very low, less than half the cost of Saniya. The effects are less widespread, however, due to the small percentage of diarrhoea cases resulting in cholera. The number of cases of averted death is relatively high though (103 versus 124 for Saniya), as an estimated 20% of cholera cases result in death (Murray J et al.,1998).

The savings to the provider are much less than Saniya (12 times), but the savings to the society are in the same order (due to the large number of averted deaths). Consequently, if we take a provider perspective the cost-effectiveness ratio is high, with a cost per case averted of USD 118. If the benefits to society are also considered, however, the cost-effectiveness ratio falls dramatically, resulting in a net savings to society of USD 619 per case averted.

In summary, our calculations indicate that a cholera vaccination programme has a very favourable cost profile compared to Saniya. However, the effects in terms of the number of averted cases of diarrhoea are less significant, due to the low incidence of cholera, although there are a substantial number of prevented deaths, due to the high risk of death for cholera patients.

Insert Table 17.

Water and Sanitation Programmes

Table 17. summarises the findings from the literature.

Total costs of implementing the programme are very high compared to the other interventions considered. Efficacy was estimated at between 35-50% (Young B et al., 1987). We used the average of these values, 42.5. In accordance with these effectiveness figures, total savings to the provider and to society are much greater than for Saniya. However, from the provider perspective Saniya still offers a lower cost-effectiveness ratio (USD 24 per case of averted diarrhoea compared to USD 173). From the societal perspective, on the other hand, the net savings from the water and sanitation programme is very substantial resulting in a saving of USD 4,957 per case averted (compared to USD 2.5 per case for Saniya).

In summary, our calculations indicate that Saniya has a good cost profile compared to a water and sanitation programme, but the effects are less significant in terms of averted cases of diarrhoea and death. The greater effectiveness is due to our assumption that all children under 36 months are covered by the programme (in terms of reduced risk), whereas for Saniya, only the percentage of children with mothers who change their behaviour are covered in this sense.

Insert Table 18.

Breast Feeding Programmes.

The main difference between a hygiene and a breast feeding promotion programme is the target population for behaviour change. For Saniya, we saw that mothers of children under 36 months, maids and children of primary school age were directly targeted by the programme activities. However, a breast feeding promotion programme targets a smaller group: mothers with children between 4 and 6 months.

The activities involved in the promotion of breast feeding are of a similar nature to those used in the Saniya programme. The main difference is the absence of in-school hygiene lessons, and the addition of legislation control relating to the marketing of breast milk substitutes.

The risk of diarrhoea has been estimated to fall by 36% in children between 0-5 months who have been breast fed compared to those who haven't (De Zoysa, 1991). However, the impact of breast feeding, in terms of reduced incidence of diarrhoea and death, only covers the first 6 months of life of the child. For Saniya, on the other hand, the effects are evaluated over the full three operational years of the programme (and although not considered in our analysis, continue even after the programme's termination).

Reported cost-effectiveness ratios for breast feeding promotion programmes in the literature are varied. However, it seems likely that the unit costs of running a promotional programme will be similar to Saniya. Inevitably, there will be administration and research costs and costs associated with the specific programme activities. Assuming a similar set of activities (house-to-house visits etc...) and a similarity in terms of cost between the in-school hygiene lessons and the legislation control, it is likely that total programme costs will be of the same order of Saniya.

The impact on behaviour change will depend on the percentage of mothers who already practice breast feeding. The benefits of the programme will cover the first 5 months of child life, so the number of cases of avoided diarrhoea and death will be less than Saniya.

Taken as a whole, these factors seem to indicate that breast feeding promotion may be a less cost-effective intervention compared to the Saniya project.

CHAPTER VI

DISCUSSION & CONCLUSIONS

The aim of the economic analysis was to evaluate the cost-effectiveness of the programme Saniya, a hygiene promotion programme in Bobo-Dioulasso. We also considered the programme's affordability from the perspective of the government and the household, and the implications for replicating the programme, based on the Saniya experience. Finally, the cost-effectiveness of the Saniya project was compared to alternative interventions to reduce diarrhoeal diseases in children.

This chapter summarises and discusses the main findings, and provides a number of recommendations for future research.

COST-EFFECTIVENESS OF THE SANIYA PROGRAMME

The programme cost the provider 160,601,551 FCFA (USD 303,502), and cost society as a whole 256,775,787 FCFA (USD 466,878). The programme resulted in substantial direct and indirect savings to the household and to the state in terms of deferred treatment costs for those cases of diarrhoea averted by the programme, and productivity gains associated with mother's time spent looking after a sick child and associated with a child's averted death.

The cost to the provider per case of diarrhoea averted is 14,935 FCFA (USD 28.3), and from the societal perspective the programme resulted in a net saving per case averted of 1379 FCFA (USD 1.4).

SENSITIVITY OF RESULTS

The results were robust to changes in many of the core assumptions of the analysis. However, the results were very sensitive to the estimated impact on diarrhoeal disease incidence of hand washing with soap after contact with child stools. Results were particularly sensitive to a reduction in this parameter below the baseline value of 50%. If the reduction in diarrhoeal disease is lower than we estimated, for example 25%, this would entail a cost per case of 38,360 FCFA (USD 70) per case and 36,075 FCFA (USD 65) from a societal perspective.

However, in the case of Saniya, we have reason to believe that the strength of the relationship between targeted hygiene practices, and health impact

(reduction in the incidence of diarrhoeal diseases) is more likely to have been underestimated than overestimated. The reasons for this belief are two-fold.

- Firstly, the aim was to promote two hygiene practices: both hand washing with soap after contact with child stools, and the safe disposal of stools in a latrine. We did not consider the impact of stool disposal on diarrhoeal incidence as the number of mothers who changed their behaviour during the operational period of the programme was not significant. However, the combined effect of hand washing and stool disposal may have a greater impact on diarrhoea incidence, than the baseline value considered.

- Furthermore, the programmes' effectiveness in terms of behaviour change in other family members: husbands, maids, primary school children (brother and sisters) was not evaluated. However, these family members were all covered by the programme activities (directly or indirectly). It seems reasonable to assume that a child from a household where the father and older brothers and sisters of primary school age have changed their behaviour, as well as the child's mother, would have an even lower incidence of diarrhoea. Indeed, unless the mother has the support of her husband it will be difficult to fully apply the programme messages (where for example the construction of a latrine is necessary).

Finally, in order to improve our understanding of the nature of the relationship between specific hygiene behaviour and health (in terms of incidence of diarrhoea), further research should be carried out. It is important to investigate whether the relationship is country specific, and if so to define the variation between regions.

Additionally, more information is required concerning the impact of more than one type of behaviour (i.e. hand washing and disposal of stools in a latrine) on health impact, to enable the compilation of indices of health impact.

The results were also sensitive to the initial incidence of diarrhoea in children, (number of episodes per child per year) which was based on a cohort study carried out prior to the start of the programme. The baseline value was similar to the average incidence level in Africa (2.6 per child per year), which suggests that it is unlikely that the estimated value used in our analysis, be unrepresentative of Burkina Faso (particularly of Bobo-Dioulasso). However, findings vary from study to study and this should be considered in the event of replication. The sensitivity of our results to this parameter indicates that, other things equal, the programme will be more cost-effective in countries/regions where the incidence of diarrhoea in children is greater. Indeed there is more scope for health impact, potentially more cases of diarrhoea will be averted by

the programme. In more developed countries where the incidence is lower, there is less scope for health improvement and consequently the programme would probably be less cost-effective.

STUDY TIME FRAME

This study considered benefits from the project occurring within the operational period (95-98). We were only interested in the costs and benefits relating to the programme during the specified time frame. However, the programme will undoubtedly lead to benefits in terms of reduced diarrhoea mortality and morbidity which will continue well into the future. Those mothers who change their behaviour in response to the project are more than likely to adopt this new behaviour in the long run. Consequently, this will have a preventative effect on children born of these women, even after the programme has finished, resulting in further averted cases of diarrhoea, averted deaths and further reducing the burden of diarrhoeal diseases on the state and households in Burkina Faso. In turn it is likely to impact on the behaviour of girls of primary school age, who were covered by the programme, when they have their own children in future years.

AFFORDABILITY

In terms of affordability, the cost to the provider per person covered by the programme represented only 3% of per capita GNP and 5.7% of the national health budget per capita, indicating that a hygiene promotion programme based on the Saniya model represents an affordable means of reducing the incidence of childhood diarrhoea for Burkina Faso.

The role of the household, in terms of applying the programme's messages is essential if the programme is to have the desired impact on health. Therefore the affordability for the household is an important consideration. Based on a minimal estimate of a household's average monthly salary in Bobo, and a maximal estimate of the implementation cost to the household, the cost to the household of following the programme messages was estimated at only 1.4% of their average yearly income, the net cost representing only 0.8% of annual revenue. The programme appears to be affordable from the perspectives of both the provider and the household.

REPLICATION

We considered the implications of replicating a model of hygiene promotion based on Saniya elsewhere. Based on a number of assumptions, relating to the characteristics of the target population, we suggested that replication within another region of Burkina Faso would enable savings to be made in terms of

programme start-up costs and international research, hence lowering the cost-effectiveness ratio. The expansion of the programme nation-wide could result in the scaling up of costs in accordance with the size of the new target population, taking into account potential economies of scale, such as the diffusion of radio spots.

However, it is difficult to predict the exact effects in terms of cost-effectiveness without knowing the characteristics of the population in question (mainly incidence of diarrhoea, access to programme activities, size of population). Although costs can be estimated from the Saniya model, assuming the same accessibility to programme activities, prediction of a programme's effectiveness is difficult. This will depend on the responsiveness of the population to the programme messages, the existing hygiene behaviour of the population (the scope for improvement), the incidence of diarrhoea in children etc. Indeed, for the replication of the programme in rural areas poorer accessibility to health care and educational facilities could have the effect of reducing the efficacy of these activities, at least in terms of population coverage. The costs associated with house-to-house visits may increase due to the geographic dispersion of households in rural areas.

For the programme's replication in a another country the population characteristics should be considered during a period of formative research (as for Saniya), and if alternative routes of communication are found to be preferable, a pilot study should be carried out to test their impact.

OTHER INTERVENTIONS

Finally, we tried to compare the cost-effectiveness of Saniya to other preventative interventions for the reduction in diarrhoeal diseases in children.

The results indicated that from the provider perspective Saniya compared favourably to the alternative interventions considered. The cost to the provider per case of averted diarrhoea was lower by more than half compared to the other interventions considered (USD 24 per case compared to USD 54 for rotavirus immunisation, USD 117 for cholera immunisation and USD 173 for water and sanitation). However, from the societal perspective the alternative interventions rank more favourably, resulting in a saving per case of averted diarrhoea of USD 4,957 for the water and sanitation programme, USD 619 for the cholera immunisation and a cost per case of USD 6 for rotavirus immunisation.

However, these results should be treated with great caution. The results are based on a number of assumptions and provide rough estimates which should

be confirmed or disproved in future studies. A number of issues are raised by this analysis and should be considered by policy makers faced with the choice of investing in alternative health promotion programmes.

Concerning rotavirus immunisation, we should bare in mind that benefits span over the first five years of life, so assuming the vaccination takes place during the first months of life, the benefits should continue over the following 5 years (not just the three years considered for comparison against Saniya). This would increase the number of averted cases of diarrhoea, and increase the cost-effectiveness of this option. In relation to Saniya it will be interesting to see to what extent mothers will continue to maintain the new hygiene practices over the next two years, and even further into the future.

Sustainy →

Additionally, our evaluation of the rotavirus immunisation programme is very much dependent on the vaccine price, which is based on US experience. It is possible that the vaccine is available at lower cost in the developing world, although the review of the literature did not offer information relating to this issue. However, the substantially lower cost of the cholera vaccine (USD 2) suggests that the cost of the rotavirus vaccine within a developing country context may be cheaper.

Finally, a rotavirus vaccination programme presents certain advantages and disadvantages compared with a hygiene promotion programme. The inputs into the programme are limited compared to Saniya in the sense that there is a single route of communication: the injection itself. The intervention is neither capital nor human capital intensive. However, this type programme is only targeting rotavirus diarrhoea (30%) and does not impact on other strains of simple diarrhoea. Furthermore, only vaccinated children are affected, whereas a hygiene promotion programme, by changing people's behaviour, can affect the health of a much greater section of society. The household as a whole can benefit from better hygiene (although the benefits to other family members were not evaluated in Saniya).

Concerning a cholera immunisation programme, it is important to note that the context for use of the cholera vaccine is not as widespread as hygiene promotion. The selected authors were arguing the case within the context of a population at risk of endemic cholera within refugee populations. Indeed, the incidence of cholera in the population at large is very low. So, unless a target population presents specific risks of a cholera outbreak due, for example, to inappropriate living conditions (as found in refugee camps) the implementation a cholera immunisation programme would usually not be considered. The programme is context specific. The application of hygiene promotion is more widespread, and even has its place within the developed world where there is always scope for improvement.

Finally, the benefits offered from the water and sanitation programme were very substantial compared to the other interventions. In addition, the effects from a water and sanitation programme, like hygiene promotion will impact on the health of the population as a whole. We considered here the impact on children under 36 months, to give a idea of effectiveness on the same scale as the Saniya programme (the same target population). This will have undermined the true impact of the programme. However, the cost-effectiveness of the 'hardware' interventions can improve substantially with the addition of hygiene education (Varley RCG et al., 1998) Indeed, the presence of existing water and sanitation hardware provides the opportunity for substantial health impact from a relatively small investment in hygiene promotion.

Generally, the literature review revealed a paucity of cost-effectiveness studies of interventions for the control of diarrhoeal disease in children. The majority of the literature referred to the impact of specific interventions on health (through case-control studies), without reference to costs. Where costs were discussed, resources were not detailed. Often costs are underestimated as essential programme inputs such as administration and research are not considered. However, as the Saniya experience demonstrated, in practice these inputs represent an important part of total programme costs. There is much need for future studies to explore this issue further, and for future programmes elsewhere to ensure a close documentation of costs as well as health impact.

TABLES

Table 1 Retrospective of the Saniya Activities

Activity	Pilot year	95-96	96-97	97-98	Total (without pilot)
Setting up of Commissions Saniya	Sector 10	9,10,1,2,3,4	8,7	6,7,16	11 sectors
Training of volunteers	25	80	13	15	108[9]
Number of health centres involved[10]	Accartville (3)	Accartville (3) Hamadallaye (4) Tounouma (3)	Koko (3) Sikasocira (3)	Lafiabougou (4) Sarfalao (4) Bolmakoté (2)	8
Number of health agents trained	3	10	6	18	34
Number of theatrical representations	3	22	22	38	82
Contract with -radio Bobo -radio HFM -radio energie	 -3 months - -	 -6 months -6 months -	 -6 months -6 months -	 -9 months -9 months -3 months	 21 months 21 months 3 months
Number of radio spots	128	512	512	896	1920
Primary schools involved	1	17	17	30	64
Trained teachers	8	159	151	126	436

Table 2 Treatment Options for Diarrhoea Management and Associated Costs

Options	Costs to Household	Costs to State
Self Treatment	The value of the parent/guardian's time looking after the sick child	No Cost
Consult a Traditional Practitioner	The fee paid for treatment	No Cost
Consult a health agent	The consultation fee, the price paid for medication and the subsidised fee for an examination of stools	The cost of a consultation minus the fee and the cost of an examination of stools minus the fee

[9] A total of 108 RS were trained for the programme (excluding the pilot year) and 50 were retained and recycled a second time during the third year.
[10] In brackets: the number of health agents per health centre.

Referral to hospital	The price paid for medication and the charge for 3 nights in hospital	The cost of 3 nights hospitalisation minus the fee

Table 3 Total Cost of Saniya to the Provider (current FCFA prices)

	Formative Research (estimate)	Pilot Study (actual)	95-96	96-97	97-98	Total
RECURRENT COSTS						
Personnel	4,439,787	5,736,218	13,043,925	25,673,513	23,827,174	72,720,617
Training	-	435,150	1,698,028	1,939,744	1,610,637	5,683,558
Supplies	281,250	111,700	2,846,358	1,841,175	3,980,439	9,060,922
Radio spots	-	300,000	1,282,475	1,225,000	2,100,000	4,907,475
Construction (water electricity)	28,333	1,020,000	1,035,000	1,020,000	1,020,000	4,123,333
Communication	-	983,603	2,108,887	4,320,374	3,348,999	10,761,864
Transport	1,107,096	3,216,725	3,022,036	3,883,925	4,897,484	16,127,266
Follow-up-evaluation	-	355,800	1,254,850	1,333,175	3,009,850	5,953,675
Other	-	20,000	410,985	336,252	314,660	1,081,897
SUB TOTAL	5,856,466	12,179,196	26,702,543	41,573,158	44,109,244	130,420,607
CAPITAL COSTS						
Construction	50,000	1,800,000	2,372,494	2,372,494	2,372,494	8,967,482
Vehicle	-	-	3,048,780	3,048,780	3,048,780	9,146,341
Equipment	-	-	4,022,374	4,022,374	4,022,374	12,067,121
SUB TOTAL	50,000	1,800,000	9,443,648	9,443,648	9,443,648	30,180,944
TOTAL PROVIDER	5,906,466	13,979,196	36,146,191	51,016,806	53,552,892	160,601,551

Table 4 Inputs by Year as a Proportion of Total (expressed as percentages of total)

	Start-up	95-96	96-97	97-98	TOTAL
RECURRENT COSTS					
Personnel	6.3%	8.1%	16.0%	14.8%	45.2%
Training	0.3%	1.1%	1.2%	1.0%	3.5%
Supplies	0.2%	1.8%	1.1%	2.5%	5.6%
Radio spots	0.2%	0.8%	0.8%	1.3%	3.1%
Construction (water electricity)	0.7%	0.6%	0.6%	0.6%	2.6%
Communication	0.6%	1.3%	2.7%	2.1%	6.7%
Transport	2.7%	1.9%	2.4%	3.0%	10.0%
Follow-up-evaluation	0.2%	0.8%	0.8%	1.9%	3.7%
Other	0.0%	0.3%	0.2%	0.2%	0.7%
SUB TOTAL	11.2%	16.6%	25.9%	27.5%	81.2%

CAPITAL COSTS					
Construction	1.2%	1.5%	1.5%	1.5%	5.6%
Vehicle	0.0%	1.9%	1.9%	1.9%	5.7%
Equipment	0.0%	2.5%	2.5%	2.5%	7.5%
SUB TOTAL	1.2%	5.9%	5.9%	5.9%	18.8%
TOTAL PROVIDER	12.4%	22.5%	31.8%	33.3%	100.0%

Table 5 Costs Borne by the Community (FCFA)

	Formative Research	Pilot Study	95-96	96-97	97-98	Total
Washing hands with soap			29,356,404	29,356,404	29,356,404	88,069,213
Throwing stools in latrine			776,039	776,039	776,039	2,328,117
TOTAL BEHAVIOUR CHANGE			30,132,443	30,132,443	30,132,443	90,397,329
TOTAL PER HOUSEHOLD			4,528	4,528	4,528	13,584
Opportunity cost of volunteers' time		18,750	165,000	191,813	222,750	598,313
Opportunity cost of teachers' time		43,750	869,531	1,695,313	2,384,375	4,992,969
Opportunity cost of health agents' time		20,625	68,750	41,250	55,000	185,625
TOTAL OPPORTUNITY COST		83,125	1,103,281	1,928,375	2,662,125	5,776,906
TOTAL COMMUNITY COST	-	83,125	31,235,724	32,060,818	32,794,568	96,174,236

Table 6 Provider and Community Costs as a Proportion of the Total (expressed as percentages of the total)

	Formative Research	Pilot Study	95-96	96-97	97-98	TOTAL
PROVIDER COSTS						
Total Recurrent	2.3	4.7	10.4	16.2	17.2	50.8
Total Capital	0.0	0.7	3.7	3.7	3.7	11.8
TOTAL PROVIDER	2.3	5.4	14.1	19.9	20.9	62.5
COSTS TO COMMUNITY						
Behaviour change	0.0	0.0	11.7	11.7	11.7	35.2
Opportunity costs	0.0	0.0	0.4	0.8	1.0	2.2
TOTAL COMMUNITY	0.0	0.0	12.2	12.5	12.8	37.5
TOTAL SOCIETY	2.3	5.5	26.2	32.4	33.6	100.0

Table 7 Calculation of Costs by Supporting Economic Agent, as a Proportion of the Total for each Year (expressed as % of total)

	Formative Research	Pilot Study	95-96	96-97	97-98	Total
HOUSEHOLDS	0.0	0.6	46.4	38.6	38.0	37.5
GOVERNMENT	0.0	0.0	7.1	5.7	5.6	5.6
DONOR	100.0	99.4	46.6	55.7	56.4	57.0

Table 8 Total Costs from the Provider and Societal Perspectives (FCFA)

	Start-up	95-96	96-97	97-98	TOTAL
TOTAL COST TO THE PROVIDER	19,885,662	36,146,191	51,016,806	53,552,892	160,601,551
TOTAL COST TO SOCIETY	19,968,787	67,381,916	83,077,624	86,347,460	256,775,787

Table 9 Total Costs from the Provider and Societal Perspectives (USD)

	Start-up	95-96	96-97	97-98	TOTAL
TOTAL COST TO THE PROVIDER	49,121	71,389	91,082	91,911	292,003
TOTAL COST TO SOCIETY	49,282	133,079	148,321	148,195	466,865

Table 10 Activities as a Proportion of Total Provider Cost (expressed as percentages of total provider cost)

	Commission Saniya	Focus Groups	School	Theatre	Radio	Administration	Research	Publicity
RECURRENT COSTS								
Personnel	4	2	2	3	0	16	17	0
Training	1	1	2	0		0	0	0
Supplies	0	1	1	0	0	2	1	1
Radio Spots	0	0		0	3	0	0	0
Construction (water electricity)	0	0	0	0	0	2	0	0
Communication	0	0	0	0	0	3	3	0
Transport	1	1	1	1	0	2	2	0
Follow-up Evaluation	0	0	0	0	0	0	4	0
Other	0	0	0	0	0	0	0	0
SUB TOTAL	7	5	6	4	3	25	28	1
CAPITAL COSTS								
Construction	0	0	1	0	0	4	0	0
Vehicle	0	0	0	1	0	4	1	0
Equipment	0	0	0	0	0	9	0	0
SUB TOTAL	0	0	1	1	0	16	1	0
TOTAL PROVIDER	7	5	7	6	3	42	30	1

Table 11 Savings to the State from Reduced Rates of Diarrhoeal Mortality and Morbidity

SAVINGS	Total savings from project (FCFA)
Direct ...(Cost of consultation minus fee) + (cost of examination minus fee)	2,380,334
...Cost of stay in hospital minus fee	4,636,207
...Total direct savings	7,016,541
Indirect	250,782,258

...Value of lost productivity associated with death of child	
TOTAL SAVINGS	257,798,799

Table 12 Savings to the Community from Reduced Diarrhoea Related Mortality and Morbidity

SAVINGS	Total savings from project (FCFA)
Direct ...Cost of consultation (fee + examination + medication)	2,626,015
...Cost of visit to traditional healer	462,775
...Cost of stay in hospital	1,648,682
...Cost of death/funeral costs	1,244,350
...Total direct savings	5,981,823
Indirect ...Value of parent's/guardian's time spent with child	7,172,486
TOTAL SAVINGS	12,998,363

Table 13 Total Savings to Society (FCFA and USD)

Savings	FCFA	USD
Direct community	5,981,823	10,882
Indirect community	7,172,486	13,048
Direct state	7,016,541	12,764
Indirect state	250,782,258	456,214
TOTAL	270,953,107	492,908

Table 14 Estimation of Cost-Effectiveness Ratios (FCFA (USD))

	Cost provider	Cost society	Effect	CE ratio provider	CE ratio society
Cost/coverage	160,601,551	256,775,787	341,523	470 (8)	752 (12)
Cost/Behaviour Change	160,601,551	256,775,787	6916	23,223 (44)	37,129 (69)
Cost/case of diarrhoea averted	153,585,011	-14,177,320	7398	14,935 (28.3)	- 1379 (- 1.4)
Cost/case of deferred consultation	153,585,011	-14,177,320	1028	149,420 (283)	- 13,791 (-14)
Cost/case of avoided hospitalisation	153,585,011	-14,177,320	385	398,922 (754)	- 36,824 (-36)
Cost/ averted death	153,585,011	-14,177,320	124	1,238,589 (2336)	- 114,333 (-113)

Table 15 Cost-Effectiveness of Replicating the Programme in Another Region of Burkina Faso (FCFA (USD))

	Cost provider	Effect	CE ratio
Cost/coverage	155,212,989 (267,747)	341,523	454 (0.78)

Table 16 Cost-Effectiveness of Rotavirus Immunisation Programmes (Costs in 1998 (USD))

Outcomes	Cost and Effects	
Cost per vaccinated child ...vaccine/dose ...delivery kit ...personnel cost	 67.7[11] 1.0 1.0	
Total	69.7	
Efficacy rate (%)	50	
Rotavirus as % of diarrhoea cases	30	
Total cost ($)	2,781,201	
No of cases of averted diarrhoea	49,945	
No of cases of averted death	604	
	Provider Perspective	Societal Perspective
Saving from programme	64,747	2,490,520
Net cost	2,716,455	290,681
CE ratio	54	6

Table 17 Cost-Effectiveness of a Cholera Immunisation Programme (in USD (1998))

	Costs and Effects	
Cost of vaccine ...2 doses ...delivery kit ...personnel	 1.25 0.37 0.37	
Total/vaccine	2[12]	
Efficacy	50	
Cholera as % of diarrhoea	0.3	
Total cost	79,734	
Number of cases of averted diarrhoea	666	
Number of cases of averted death	103	
	Provider	Societal

[11] The estimated cost of vaccine is based on a weighted average of public and private sector purchase and administration of comparable childhood vaccines (R.H Synder, MA, National Immunisation Program, Centres for Disease Control, written communication December 1993).

[12] The cost estimate was provided by Médécins Sans Frontières and Epicentre, Paris, France.

	Perspective	Perspective
Savings	863	491,716
Net cost	78,871	-411,983
CE ratio	118	-619

Table 18 Cost-Effectiveness of a Water and Sanitation Programme

	Costs and Effects	
Cost per capita urban/year[13]	70	
Cost per capita rural/year	24	
Average Cost per capita 3 years	94	
Efficacy (%)	42.5	
Total Cost	24,681,192	
No. of cases of averted diarrhoea	141,511	
No of cases of averted death	17,123	
	Provider Perspective	Societal Perspective
Savings	52,990	726,129,179
Net Cost	24,493,369	-701,447,987
CE ratio	173	-4,957

[13] In Burkina Faso 17% of the population live in urban areas, 83% in rural areas (World Development Report, 1999).

APPENDIX A1

CLASSIFICATION OF COSTS

i) Recurrent Inputs

The recurrent inputs are those which must be replaced on a regular basis. They have been classified in the following way:

- Personnel: the actors involved in running and setting up the programme
- Training is considered as a recurrent cost as the effects of training are estimated to be of limited duration, necessitating regular updates. This category is assumed to incorporate all inputs relating to the training process including personnel, transport, supplies, rental and subsistence
- Supplies cover all materials relating to the programme: office, photocopies, stationary etc..
- Transport: covers taxi rides, rental of scooters, air fares and missions with UNICEF vehicle
- Communication: includes postal costs, telephone and fax bills
- Radio development: covers all costs relating to the development and broadcast of radio spots
- Building: covers water and electricity bills
- Follow-up and monitoring of the programme covers all personnel, supplies, and transport involved in this process.

ii Capital inputs.

The capital inputs represent an initial investment for the programme with effects which are ongoing for the duration of the project. Consequently, the cost is annualised, providing a yearly estimate of cost based on the life expectancy of the input and the chosen discount rate (here 7%). The inputs have been classified according to the following categories:

- Vehicle: representing the annualised cost of purchasing a vehicle for the programme
- Equipment: representing the annualised cost of purchasing 3 computers, 1 photocopier and a fax machine.
- Building: representing the cost of purchasing an office space in order to run the programme. The rental price was used as an estimate of the corresponding annualised value. Also included is the construction cost of latrines in schools. A set of 6 latrines in 5 schools were constructed as part of the programme. The cost was annualised over the 3 years of the programme.

APPENDIX A2

UNIT COSTS AND QUANTITIES OF RESOURCES USED IN THE SANIYA PROGRAMME, CLASSIFIED BY INPUT CATEGORY

SALARIES/month	Number of units					Unit Cost				
	FR[14]	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Field Workers	3	5	5	5	5	38,397	38,397	42,885	92,385	114,902
Computer Support	1	1	1	1	1	97,750	97,750	165,550	184,930	205,921
Programme Co-ordinator	1	1	1	1	1	153,963	153,963	296,200	335,560	373,427
Driver	0	1	1	1	1	-	-	25,000	25,000	25,000
Programme manager	1	1	1	1	1	50,000	30,850	50,000	50,000	50,000
Theatre representations	0	22	22	38	0	-	20,000	20,000	20,000	20,000
Regional health director	0	1	1	1	1	-	70,000	75,000	75,000	75,000

PER DIEMS	Number of units					Number of days					Unit Cost				
	FR	PY[15]	95-96	96-97	97-98	FR	PY	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Field Workers	0	0	5	0	0	0	0	2	0	0	-	-	6,200	-	-
Computer support	0	0	1	0	1	0	0	6.5	0	15	-	-	20,000	-	20,000
Co-ordinator	0	0	1	0	1	0	0	12.5	0	12	-	-	25,000	-	25,000
Teacher	0	8	159	151	126	0	2	2	2.5	2.5	-	1,500	1,500	2,000	2,000
Trainers of teachers	10	1	2	2	2	3	2	2	2	2	20,000	20,000	20,000	20,000	20,000
Trainers of volunteers	0	2	2	2	2	0	2	2	2	2	-	20,000	20,000	20,000	20,000
Trainers of field workers	0	2	0	2	0	0	3.5	0	3.5	0	-	20,000	-	20,000	-
Volunteers	0	25	80	93	108	0	2	2	2	2	-	2,300	1,500	1,500	1,500
Local researchers	0	5	9	2	2	0	12	11.3	2	2	-	20,000	20,000	193,500	20,000
International researchers	1	1	0	1	1	20	0	0	0	0	146,400	2,148,800	-	12,202,948	8,167,236
Journalist	0	0	1	0	0	0	0	1	0	0	-	-	32,500	-	-
Animator	0	1	1	0	7	0	1	1	0	1	-	5,000	5,000	-	5,000
Griotte	0	5	5	5	5	0	2	2	10	1	-	2,000	2,000	2,000	2,000
Health agent	0	3	10	6	18	0	2	2	2	2	-	5,000	5,000	5,000	5,000
Trainers of health agents	0	1	2	1	1	0	2	4	2	2	-	15,000	20,000	15,000	15,000
Medical inspector	0	0	3	0	0	0	0	1	0	0	-	-	7,000	-	-
Training of encadreur	0	0	2	2	0	0	0	2	2.5	0	-	-	4,000	7,000	-
Radio trainer	0	0	0	0	1	0	0	0	0	1	-	-	-	-	20,000
Administration training	0	0	0	1	0	0	0	0	15	0	-	-	-	9,000	-
Administrator	0	0	1	0	0	0	0	1	0	0	-	-	50,000	-	-
Supervision	0	3	0	0	10	0	2	0	0	4	-	49,300	-	-	60,000
Per diems supervisors	0	2	2	2	0	0	10	10	10	0	-	2,500	5,000	5,000	-
Training supervisors	0	0	2	2	0	0	0	12	12	0	-	-	20,000	20,000	-
Distributor de questionnaire	0	1	2	2	2	0	10	75	19.5	12	-	2,500	2,500	5,000	2,500
Orchestra	0	0	1	0	0	0	0	1	0	0	-	-	35,000	-	-
Parent student organisation	0	0	2	4	2	0	0	2	7.5	11	-	-	2,000	2,500	2,500
Pagnes	0	0	0	0	50	0	0	0	0	1	-	-	-	-	250
Discussion of scenario	0	0	4	0	4	0	0	2	0	2	-	-	5,000	-	5,000

[14] FR: formative research
[15] PY: pilot year

Train volunteers make soap	0	0	80	13	0	0	0	2	2	0	-	-	1,211	3,761	-
Perdiem artistic director	0	1	1	0	1	0	2	10	0	10	-	9,000	10,000	-	10,000

SUPPLIES	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Posters	0	0	54	0	0	-	-	4,500	-	-
Stickers	0	0	6000	0	0	-	-	70	-	-
Calculator	0	0	2	0	0	-	-	13,750	-	-
Calendar	0	0	2	0	0	-	-	3,900	-	-
Map	0	0	8	0	0	-	-	6,000	-	-
Cassette	0	0	1	1	1	-	-	13,655	800	1,500
Material for focus group	0	1	0	0	1	-	28,500	-	-	79,200
Fold outs	0	0	2500	0	0	-	-	50	-	-
Soap ingredients	0	0	1	1	1	-	-	90,430	104,800	50,500
Files	0	0	1	1	1	-	-	207,100	553,725	576,250
Pictures	6	2	179	25	125	3,000	3,000	3,000	3,000	3,000
Invitations	0	0	1	1	0	-	-	11,600	21,100	-
Games	0	0	0	0	1	-	-	-	-	267,700
LSHTM	0	0	0	0	1	-	-	-	-	1,976,439
Manual	0	0	130	130	180	-	-	500	500	500
Office material administration	1	1	1	1	1	31,250	-	524,038	1,066,225	247,250
Office Material schools	0	0	1	1	1	-	-	7,675	14,450	6,000
Pagnes	0	0	0	0	1	-	-	-	-	16,000
Photocopies/Admin.	1000	200	4558	2550	628	50	50	50	50	50
Photocopies/School	0	0	300	0	0	-	-	50	-	-
Photocopies/Questionnaire	0	200	8725	3989	0	-	50	50	50	-
Photocopies/report	4000	0	0	919	0	50	-	-	50	-
Photocopies/volunteers	0	0	0	610	408	-	-	-	50	50
Piles/radio	0	0	1	1	0	-	-	6,600	2,000	-
Piles/theatre	0	0	0	1	1	-	-	-	4,800	4,000
Soap for mothers	0	0	0	0	1000	-	-	-	-	300
Soap/school	0	38	890	640	640	-	300	300	300	300
Buckets	0	62	109	109	275	-	900	900	900	900
Stand	0	0	1	0	0	-	-	138,960	-	-

TRANSPORT	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Parent-student association	0	0	1	0	0	-	-	4,000	-	-
Health agents	0	0	103	103	103	-	-	500	500	500
Vehicle Service	0	0	1	1	1	-	-	542,826	737,550	1,429,794
Petrol admin.	0	1	1	1	1	-	166,500	486,740	615,743	93,000
Petrol school	0	1	1	1	0	-	11,000	5,000	176,938	-
Petrol theatre	0	1	1	1	0	-	6,000	10,000	3,000	-
Petrol radio	0	0	1	0	0	-	-	8,500	-	-
Petrol griotte	0	0	0	1	0	-	-	-	14,000	-
Petrol research	0	1	0	0	0	-	630,429	-	-	-
Car rental - publicity	0	0	1	0	0	-	-	8,000	-	-
Car rental admin.	270	1	3	0	0	500	8,000	8,000	-	-
Car rental radio	0	0	2	0	0	-	-	8,000	-	-
Mission to Ouaga admin.	0	2	14	12	4	-	20,000	20,000	20,000	20,000
Mission to Ouaga research	0	8	7	0	0	-	20,000	20,000	-	-
Pagne	0	0	0	0	1	-	-	-	-	48,000
Buckets and soap	0	1	1	1	0	-	1,150	11,750	11,750	-
Stand	0	0	1	0	0	-	-	2,850	-	-
Follow-up and evaluation	0	0	0	0	1	-	-	-	-	33,600
Petrol admin.	0	4	12	12	12	-	60,000	60,000	60,000	60,000
Scooter rental	0	5	12	12	12	-	78,000	78,000	78,000	78,000
LSHTM	2	1	0	1	1	486,048	1,531,646	-	672,464	2,111,108

OTHERS	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Bench rental for schools	0	0	14	0	0	-	-	200	-	-
Bench rental for volunteers	0	50	205	252	0	-	200	200	200	-
Chair rental for volunteers	0	0	22	15	0	-	-	200	200	-
Bench rental for theatre	0	50	181	265	295	-	200	200	200	200
Chair rental for theatre	0	0	27	0	0	-	-	200	-	-
Stand rental	0	0	1	0	0	-	-	25,000	-	-
ORS sachet/focus groups	0	0	0	0	375	-	-	-	-	160
Subsistence volunteers	0	0	1	1	1	-	-	30,000	116,852	30,000
Subsistence pagnes	0	0	0	0	1	-	-	-	-	30,660
Subsistence theatre	0	0	0	0	1	-	-	-	-	30,000
Subsistence admin.	0	1	0	1	0	-	91,435	-	21,000	-
Subsistence school	0	0	1	0	0	-	-	18,650	-	-
Subsistence house-to-house visit	0	0	1	0	0	-	-	38,095	-	-
Subsistence work shop	0	1	1	0	0	-	15,150	9,935	-	-
Subsistence focus groups	0	0	1	0	0	-	-	16,505	-	-
Subsistence publicity	0	0	1	0	0	-	-	3,000	-	-
Moulds for making soap	0	0	1	1	1	-	-	208,000	92,000	105,000

COMMUNICATION	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Tel admin.	0	1	1	1	1	-	980,498	1,584,307	1,770,532	1,033,053
Fax admin.	0	0	1	1	1	-	-	408,320	21,000	39,500
Postage admin.	0	1	1	1	1	-	3,105	1,400	7,200	1,000
Postage research	0	0	1	0	0	-	-	41,550	-	-
LSHTM	0	0	1	1	1	-	-	73,310	2,521,642	2,275,446

TRAINING	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Coverage document	0	0	1	0	0	-	-	7,500	-	-
Document for volunteers	0	0	3	0	0	-	-	7,500	-	-
Supplies for soap training	0	0	1	1	1	-	-	140,870	140,870	11,387
Bench rental for volunteers soap making	0	0	22	22	22	-	-	200	200	200
Room rental for volunteers training	0	0	1	1	0	-	-	20,000	20,000	-
Training material health agents	0	0	1	1	1	-	-	42,900	42,900	42,900
Training material radio	0	0	1	0	0	-	-	5,000	-	-
Training material schools	0	1	1	1	1	-	1,500	18,315	50,025	82,500
Training materials all activities	0	0	1	0	0	-	-	35,045	-	-
Supplies volunteer training	0	0	1	1	1	-	-	15,875	19,825	194,900
Photocopies health agents	0	20	128	128	128	-	50	50	50	50
Photocopies training/school	0	8	329	20	0	-	50	50	50	-
Photocopies volunteers	0	25	9	9	432	-	50	50	50	50
Photocopies/all activities	0	0	183	0	0	-	-	50	-	-
Subsistence volunteers	0	0	1	0	0	-	-	15,550	-	-
Transport volunteers	0	0	1	0	0	-	-	3,500	-	-
Transport benches schools	0	0	1	0	0	-	-	2,800	-	-

RADIO	Number of Units					Unit Cost				
	FR	Pilot Year	95-96	96-97	97-98	FR	Pilot Year	95-96	96-97	97-98
Broadcast radio Bobo	0	3	6	6	9	-	100,000	100,000	100,000	100,000
Broadcast radio HFM	0	0	6	6	9	-	-	100,000	100,000	100,000
Broadcast radio energie	0	0	0	0	3	-	-	-	-	100,000
Coffee break	0	0	1	0	0	-	-	6,475	-	-
Room rental	0	0	1	0	0	-	-	15,000	-	
Recording programme	0	0	1	0	0	-	-	1,000	-	-
Work shop	0	0	1	0	0	-	-	60,000	-	-
Communication	0	0	0	1	0	-	-	-	25,000	-

APPENDIX A3

ANNUALISATION OF CAPITAL INPUTS.

	Number of units u	Unit Cost (FCFA)	Total Cost (FCFA)	Lifetime	Discount rate	Annualisation factor	Annualised total cost
Construction of: Latrines (x6)	5	1,213,000	6,065,000	20	0.07	10.594	572,494
Equipment:							
...Computer	3	1,500,000	4,500,000	3	0.07	2.54	1,771,654
...Printer	1	500,000	500,000	3	0.07	2.54	196,850
...Photocopier	1	5,000,000	5,000,000	3	0.07	2.54	1,968,504
...Fax machine	1	350,000	350,000	5	0.07	4.1	85,366
Vehicle	1	12,500,000[16]	12,500,000	5	0.07	4.1	3,048,780

[16] The vehicle is shared between the DRS and the Saniya Programme. Therefore we have assumed that only half the cost is borne by Saniya (so 12,500,000 FCFA is 50% of the cost of a car).

APPENDIX A4

ASSUMPTIONS REGARDING THE DISTRIBUTION OF COSTS BETWEEN PROGRAMME ACTIVITIES

Table A1 Allocation of Personnel per Activity.

	Activities of intervention
Programme Co-ordinator	100% Administration
Computer engineer	100% Administration
Driver	60% Administration; 20% Theatre; 20% Research
Field Workers	40% House to house visits; 20% Focus Groups; 20% School; 20% Theatre
Volunteers	50% House to house visits; 50% Focus Groups
Regional Health Directot	Administration
Programme manager	Administration
Griotte	50% House to house visits; 50% Theatre
Local consultants	Research
International consultants	Research
Journalist	Radio
Radio animator	Radio
Medical inspector	School
Encadreur	School
Trainers	33.33% House to house visits; 33.33% Focus Groups; 33.33% School
Artist	Theatre
Supervisors	Research
Orchestra	50% House to house visits; 50% Focus Groups

House to house.

Table A2 Allocation of resources across activities (percentages).

	ADM	CS	Focus Groups	School	Theatre	Radio	Research	Publicity
Vehicle	60				20		20	
Training		33	33	33				
Images		25	25	50				
Posters			50	50				
Stickers								100
Depliants								100
Maps		50					50	
Follow-up							100	

APPENDIX A5

QUESTIONNAIRE USED IN HOUSEHOLD SURVEY

For a mother of a young child having experienced diarrhoea in the past four weeks

Identification of Direct Costs associated with managing a child with diarrhoea.

- Who was consulted ?
- How much was the consultation fee?

What treatment was the child given?	How much?	Who provided it?	How much did it cost?
ORS			
Antibiotics (specify)			
Antiparasitics (specify)			
Antidiarrhoeals (specify)			
Other			

Identification of Indirect Costs associated with the management of Diarrhoea.

- What was the means of transport or travel expenses?
- Do you carry out an activity (formal/informal) which generates a revenue?
- What is the nature of this activity?
- On average how much revenue do you generate per week?
- How long did the episode of diarrhoea last?
- Did your child's illness cause you to stop work? If so, for how many days?

Identification of Costs Associated with Hand Washing.

- How much water is necessary to wash hands with soap? (ask the mother to perform action and measure the quantity of water used, by means of a graduated jug).
- How many times do you wash your hands with soap per day?
- How much does a ball of soap cost you?
- How many times a month must you replace the soap?

APPENDIX A6.

CALCULATION OF COSTS TO THE HOUSEHOLD OF IMPLEMENTING THE PROGRAMME. ESTIMATES FROM THE HOUSEHOLD SURVEY.

Cost of hand washing with soap.

Average number of persons in household: 7
Average cost of a ball of soap: 288 FCFA
Number of balls of soap consumed per year (based on an estimate of the average duration of a ball of soap): 73
Average quantity of water used for hand washing: 0.333 litres
Average number of times hands washed per day (for family as a whole): 11
Average cost of one litre of water: 1.25 FCFA
Average cost of a jug to pour water: 400 FCFA.

We assumed that only 10% of the soap used by a household is used for the purpose of Saniya, the main use being washing up, laundry and general washing. This value was tested in the sensitivity analyses.

Cost of disposing of stools in a latrine.

Estimated average cost to construct a latrine in the household: 30,000 FCFA.
Duration: 20 years.
Discount rate: 7%
Annualisation factor: 10.594
Annualised cost: 2,832 FCFA.

APPENDIX A7.

CALCULATION OF OPPORTUNITY COSTS.

1) Evaluation of teachers' time.
According to the field workers, on average teachers spend 15 minutes of their regular curricula per week on hygiene.
We made the following assumptions:

- an average monthly salary of 70,000 FCFA
- 6 days of teaching per week
- 8 hours of teaching per day
- Hourly salary: 364.6 FCFA
- Number of hours per year allocated to Saniya: 15
- Total cost to the community per year per teacher: 5,469 FCFA

2) Evaluation of Health Agents' time.
According to the field workers, on average health agents spend 2 hours a month on focus group discussions relating to Saniya.
We made the following assumptions:

- an average monthly salary of 50,000 FCFA
- 5 days per week
- eight hours of consultancy per day
- Monthly salary: 625 FCFA
- 11 working months per year
- Total cost to the community per health agent: 6,875 FCFA

3) Evaluation of Volunteers' time.
According to field workers the volunteers spent an average of 2 hours a month working on the programme. They were valued at the market minimum wage: 15000 FCFA per month.

- average monthly salary 15,000 FCFA
- 5 days per week
- eight hours per day
- Hourly wage: 93.6 FCFA
- Total cost to the community per volunteer: 2,063 FCFA

APPENDIX B1

PROBABILITY AND BURDEN OF ILLNESS ESTIMATES OF DIARRHOEA MORBIDITY AND MORTALITY

Table B1 Probability estimates associated with diarrhoea morbidity and mortality.

	Estimate	Source	Range
Average number of nights in hospital with diarrhoea	3	Interviews with health agents	
No of episodes of diarrhoea/child/year pre Saniya	2.78	Soton, 1994	1-5
Probabilities			
Consult a health agent	0.1	Survey	0.05-0.25
Consult traditional practitioner	0.1	Survey	0.05-0.5
Hospitalisation	0.037	Soton, 1994	0.01-0.05
Stool examination	0.53	Interviews with health agents	
Death	0.0121	Bern et al., 1992	0.003-0.04

Table B2 Estimates of the programme impact on diarrhoea morbidity and mortality.

Impact	No. of cases of diarrhoea from 95-98	No. of consultations	No. of stays in hospital	No. of deaths
With Saniya	10284[17]	1028	385	124
Without Saniya	20568	2056	770	248
Averted	10284	1028	385	124

From a household perspective the number of cases of diarrhoea averted per year for a household following the programme messages was estimated as follows:

No. of cases averted = Initial incidence of diarrhoea x Percentage reduction due to hand washing x No. of children under 36 months per household

No. of cases averted/year = 2.78 x 0.5 x 1.07 = 1.5

[17] Using the interval estimation approach: 2 time 5142 FCFA per year.

APPENDIX B2

UNIT COST ESTIMATES FOR THE MANAGEMENT OF DIARRHOEA BY MINISTRY OF HEALTH

Table B3. Unit costs associated with the management of diarrhoea for the Ministry

Costs FCFA	Cost	Fee	Cost borne by MH
Consultation	2199	150	2049
Examination of stools	1000	500	500
Total savings per consultation	2199 + (0.53 x 1000)=2729	150 + (0.53 x 500) = 415	2314
Hospitalisation per night	4636	625	4011

Sources of costs.

- The costs of a night in hospital were based on an average of costs presented in a study of unit costs of health services in Burkina Faso conducted by the University of Ouagadougou in collaboration with the Ministry of Health (Welta C et al., 1999). The costs obtained relate to a Kongossi (an average cost of 6,229 FCFA per night of hospitalisation) and Tougan (3,042 FCFA per night).
- The cost of a consultation was obtained from the same source. The cost of providing a consultation in Kongoussi was estimated at 1,455 FCFA and 2,943 FCFA in Tougan.
- The cost of an examination of stools was assumed to be equal to the fee charged in the private sector: 1000 FCFA (obtained from the interviews with health agents).

APPENDIX B3

UNIT COST ESTIMATES OF MANAGEMENT OF DIARRHOEA FOR THE HOUSEHOLD

- The cost of treatment from a traditional healer was derived from the household survey and estimated at 450 FCFA.
- The standard prescription for a child with diarrhoea was identified from interviews with 8 doctors/nurses from health clinics around the town. From the interviews 4 types of diarrhoea were described, with the typical prescription for each as well as the probability of occurrence of each case:

1) Diarrhoea without dehydration including:
   A Viral diarrhoea
   B Bacterial diarrhoea
   C Parasitic diarrhoea

2) Diarrhoea with dehydration including:
   A Mild dehydration manage d in the clinic

The standard prescriptions associated with each case were defined and costed accordingly. This gave an estimate of the cost of a prescription to the household.

Table B4 Treatment of patient with diarrhoea and associated probabilities

Type of diarrhoea suspected	Probability	Drug 1	No of units	Drug 2	No of units
Viral	0.13	ORS	4	Antidiarrhoeal	1
Bacterial	0.36	ORS	3	Cotrimoxazole	1
Parasitic	0.45	ORS	3	Mebendazole/ Metronidazole	1
With dehydration	0.06	ORS	8	None	None

All patients are prescribed oral rehydration salts (ORS).

However for patients suspected of having viral diarrhoea an antidiarrhoeal will be prescribed in 33% of cases.

All patients suspected of having bacterial diarrhoea will be prescribed cotrimoxazole.

For patients suspected of having parasitic diarrhoea, the probability of receiving mebendazole or metronidazole is 50%.

Table B5 below indicates the most commonly prescribed drugs and their associated costs. Unit costs were obtained from Pharmacie de l'Houet in Bobo-Dioulasso.

Table B5 Typical prescription for diarrhoea and associated costs

Drug type	Most commonly prescribed	Cost/Unit	Unit
Anti-diarrhoeal	Actapulgite	3663	Box
Mebendazole	Vermox	1407	Box
Metronidazole	Flagyl Syrop	2210	Bottle
Cotrimoxazole	Cotrimoxazole	917	Bottle
ORS	ORS	100	Sachet

Hence, the average prescription cost to the household, including the consultation cost (150 FCFA) and the cost of an examination of stools in 53% of cases (500 FCFA) is 2138 FCFA.

APPENDIX B4

ESTIMATION OF HOSPITALISATION CHARGES FOR THE HOUSEHOLD

Hospital costs (FCFA). Charges per night (estimates from Dr. Meda):

Category 1	4500/par jour
2	2000/par jour
3	1000/par jour
4	500/par jour
5	100/par jour

Patients select which category they want. On average:
50% choose category 5
30% choose category 4
10% choose category 3
5% choose category 2
5% choose category 1

On average the charge for each night spent in hospital is: 625 FCFA. We assumed a length of stay of 3 nights, totalling: 1875 FCFA

Patients must additionally cover the costs of medication and examination of stools. We assumed an average prescription cost of 2138 FCFA (see Appendix B3) and the cost of an examination of stools (500 FCFA with a probability 0.53): 266 FCFA.

Hence, the total charge for hospitalisation: 4279 FCFA.

APPENDIX B5

ESTIMATION OF THE VALUE OF LOST PRODUCTIVITY DUE TO A DIARRHOEA-REALTED CHILD DEATH

For the purpose of this calculation, we assumed that the child was born in 1995. We also assumed that the child would start work at 18 and continue through to 47 years of age (a working life of 29 years). We used a discount rate of 3% in line with World Bank recommendations (IBRD, 1993). Presented at the bottom of the table is the total value of the productivity lost for a child who dies from a diarrhoeal disease. We assumed a monthly revenue of 15,000 FCFA (the current market minimum wage) and 11 working months in the year, resulting in a yearly revenue of 165,000 FCFA.

Table B6. Estimation of the Value of Lost Productivity Due to a Diarrhoea realted child death

Discount factor/lives saved	Yearly revenue	1.03	Discounted yearly revenue
1996	-	1.00	-
1997	-	0.97	-
1998	-	0.94	-
1999		0.92	-
2000	-	0.89	-
2001	-	0.86	-
2002	-	0.84	-
2003	-	0.81	-
2004	-	0.79	-
2005		0.77	-
2006	-	0.74	-
2007		0.72	-
2008	-	0.70	-
2009	-	0.68	-
2010	-	0.66	-
2011		0.64	-
2012	-	0.62	-
2013	165000	0.61	99,828
2014	165000	0.59	96,920
2015	165000	0.57	94,097
2016	165000	0.55	91,356
2017	165000	0.54	88,696
2018	165000	0.52	86,112
2019	165000	0.51	83,604
2020	165000	0.49	81,169

2021	165000	0.48	78,805
2022	165000	0.46	76,510
2023	165000	0.45	74,281
2024	165000	0.44	72,118
2025	165000	0.42	70,017
2026	165000	0.41	67,978
2027	165000	0.40	65,998
2028	165000	0.39	64,076
2029	165000	0.38	62,209
2030	165000	0.37	60,397
2031	165000	0.36	58,638
2032	165000	0.35	56,930
2033	165000	0.33	55,272
2034	165000	0.33	53,662
2035	165000	0.32	52,099
2036	165000	0.31	50,582
2037	165000	0.30	49,109
2038	165000	0.29	47,678
2040	165000	0.28	46,290
2041	165000	0.27	44,941
2042	165000	0.26	43,632
2043	165000	0.26	42,362
TOTAL	4,950,000		2,015,367

APPENDIX C

IMPACT OF SANIYA ON BEHAVIOUR

Table B7 Programme Impact: Behaviour Change

	1995	*1998*	*Increase*
% of mothers washing hands with soap after contact with child stools	12.7%	31.3%	18.5%
% of mothers disposing of child stools in a latrine	71.9%	79.2%	7.3%
Total number of mothers washing hands with soap after contact with child stools	4755	11671	6916
Total number of mothers disposing of child stools in a latrine	26831	29571	2740

Source: Curtis et al., 1999.

APPENDIX D1

PROPORTION OF CHILDREN UNDER 36 MONTHS IN THE GENERAL POPULATION

Calculation of the number of Children under 36 months in general population.
Assumes that those aged < 1 year: 4.5% of total population;
1>aged<2: 4.1% of total population
2>aged<3: 3.2% of total population
Total < 3 years: 11.7% of total population
Based on population pyramid of 1985.

APPENDIX D2

STATISTICS USED IN COST ANALYSIS

Inflation Rates used in Cost Analysis.

Year	Inflation Rate (%)
1995	7.8
1996	6.1
1997	2.3
1998	5.0
Average 95-98	5.3

Source: INSUD.

National Health Budget (in billions of FCFA).

Year	National Health Budget
1995	18
1996	30
1997	30
1998	33

Source: DEP Ministry of Health.

Population of Bobo, 1998: 341,523 **(source: DEP Ministry of Health).**

Exchange Rate: US Dollar

Date	Rate in FCFA	Average for year
03/01/1995 29/12/1995	536,950 490,000	513,45
02/01/1996 31/12/1996	488,950 523,700	506,33
02/01/1997 31/12/1997	521,420 598,810	560,12
02/01/1998 31/12/1998	603,120 562,210	582,66

Source: BCEAO (Banque Centrale des Etats de l'Afrique de l'Ouest).

Average rate over period (August 1995-August 1998): 549.7 FCFA

Estimated rate during formative research period: 268 FCFA

US Dollar Inflation Rates used to inflate costs of alternative interventions.

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
RATE	4.2	4.3	4.3	3.6	1.9	3.6	4.1	4.8	5.4	4.2	3.0	3.0	2.6	2.8	3.0	2.3	1.6

Source: World Bank Statistics Database.

APPENDIX E

SENSITIVITY ANALYSES

Figure E1 Sensitivity of Results to the Initial Incidence of Diarrhoea

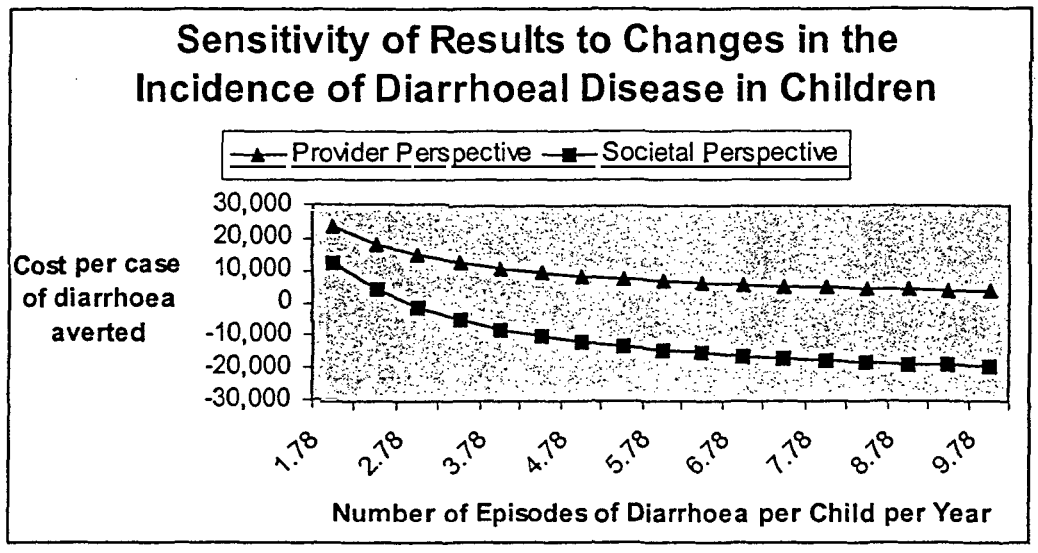


Figure E2 Sensitivity of Results to the Percentage reduction in the incidence of diarrhoea due to hand washing with soap

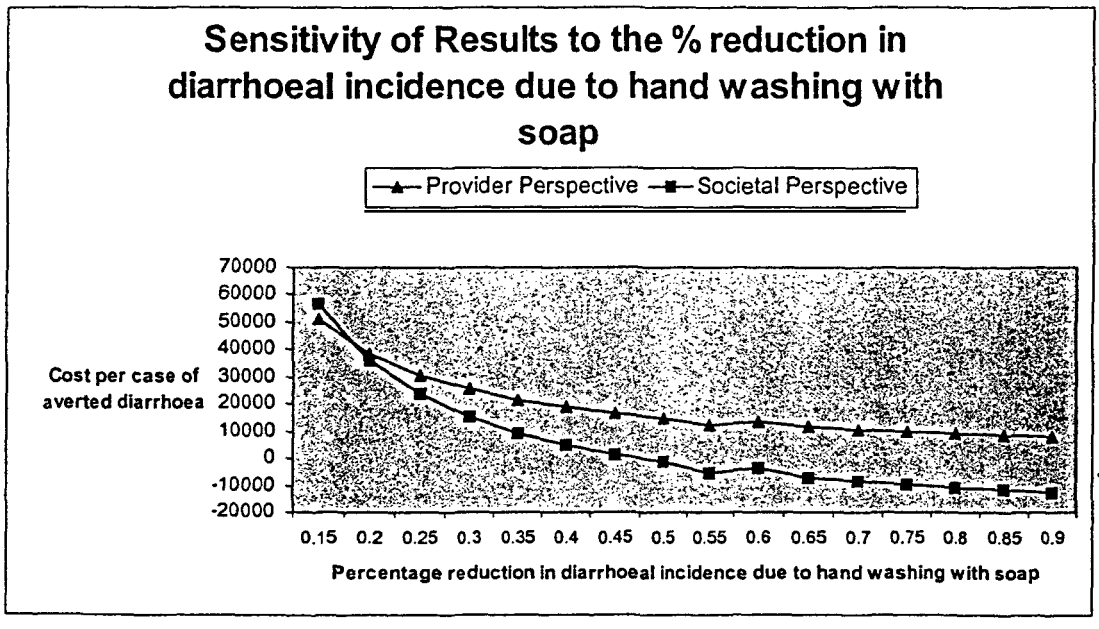


Figure E3 Sensitivity of Results to the Probability of Consulting a Health Agent

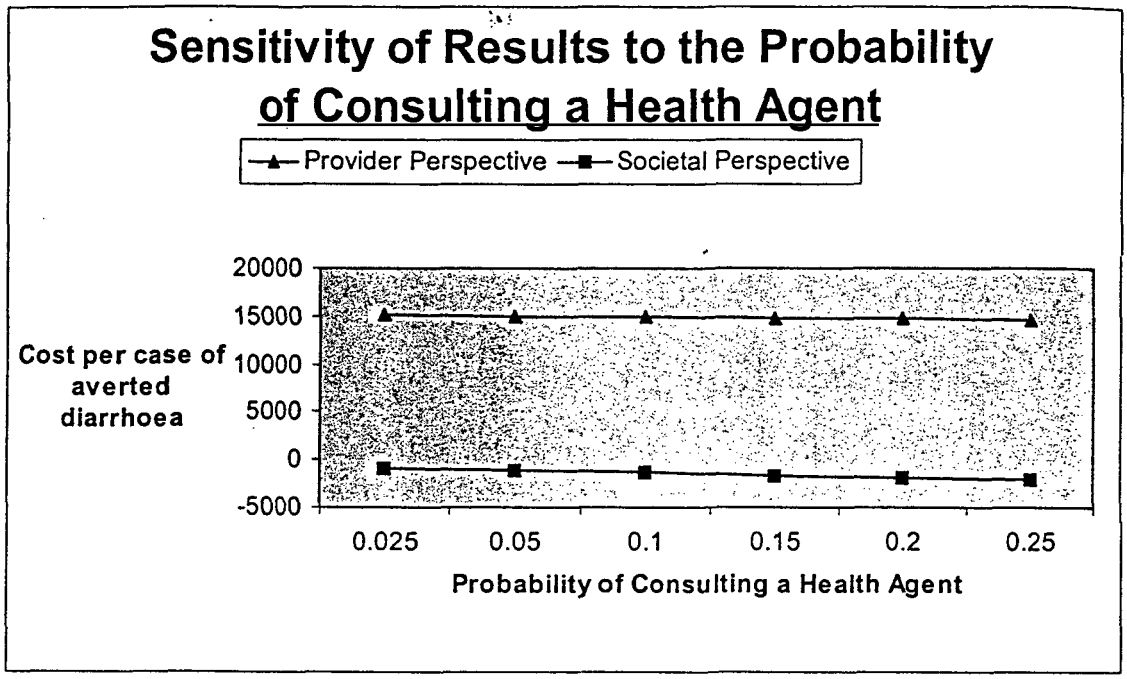


Figure E4. Sensitivity of Results to the probability of Hospitalisation.

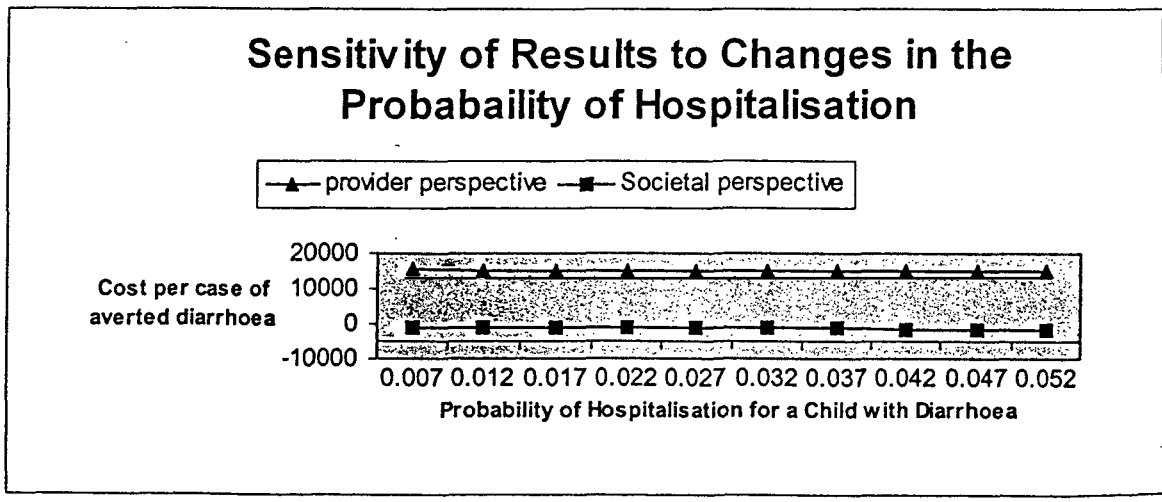


Figure E5 Sensitivity of Results to the risk of death.

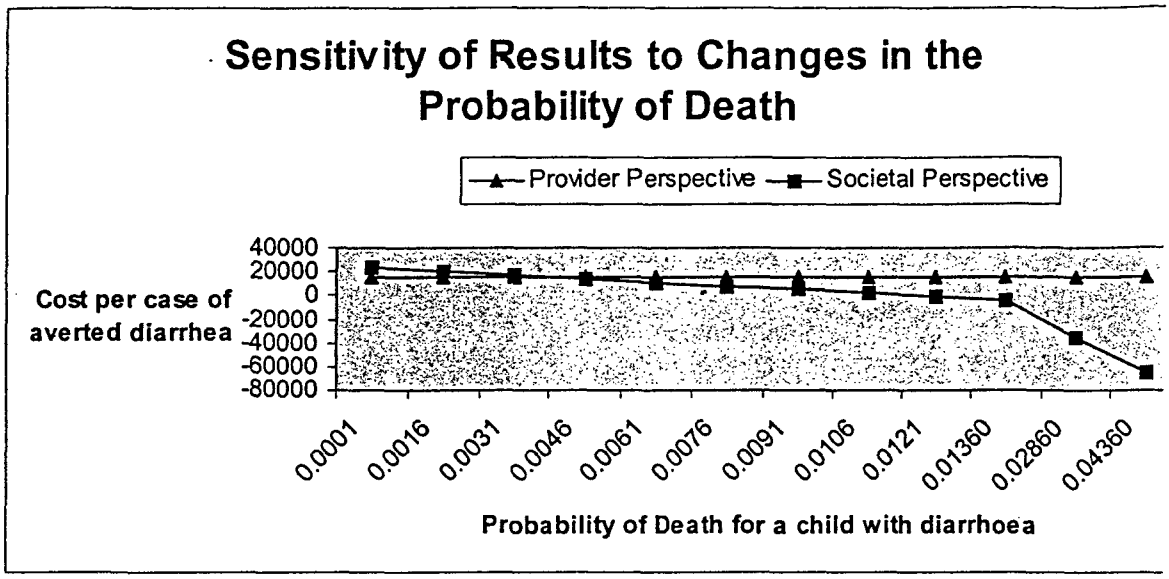


Figure E6. Sensitivity of Results to the percentage of soap used by households for Saniya.

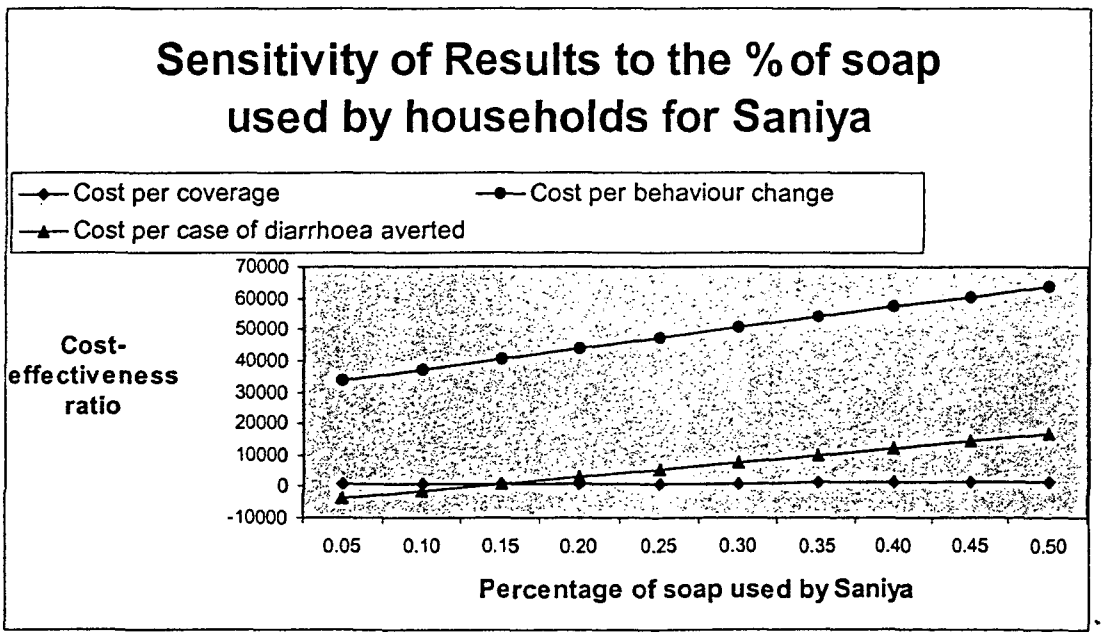


Figure E7. Sensitivity of Results to Changes in the value of volunteer time.

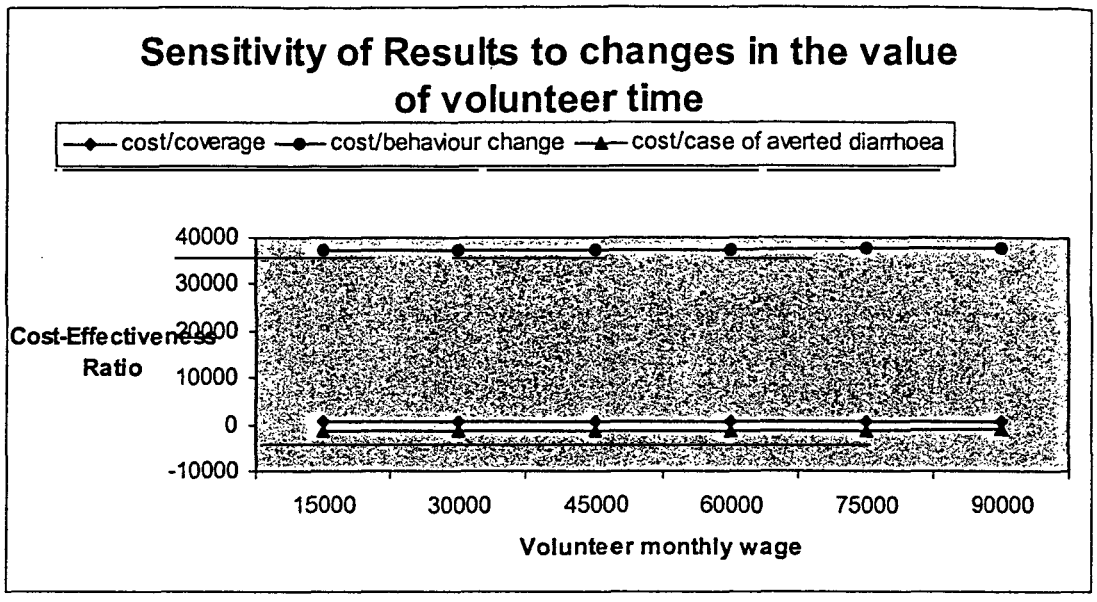
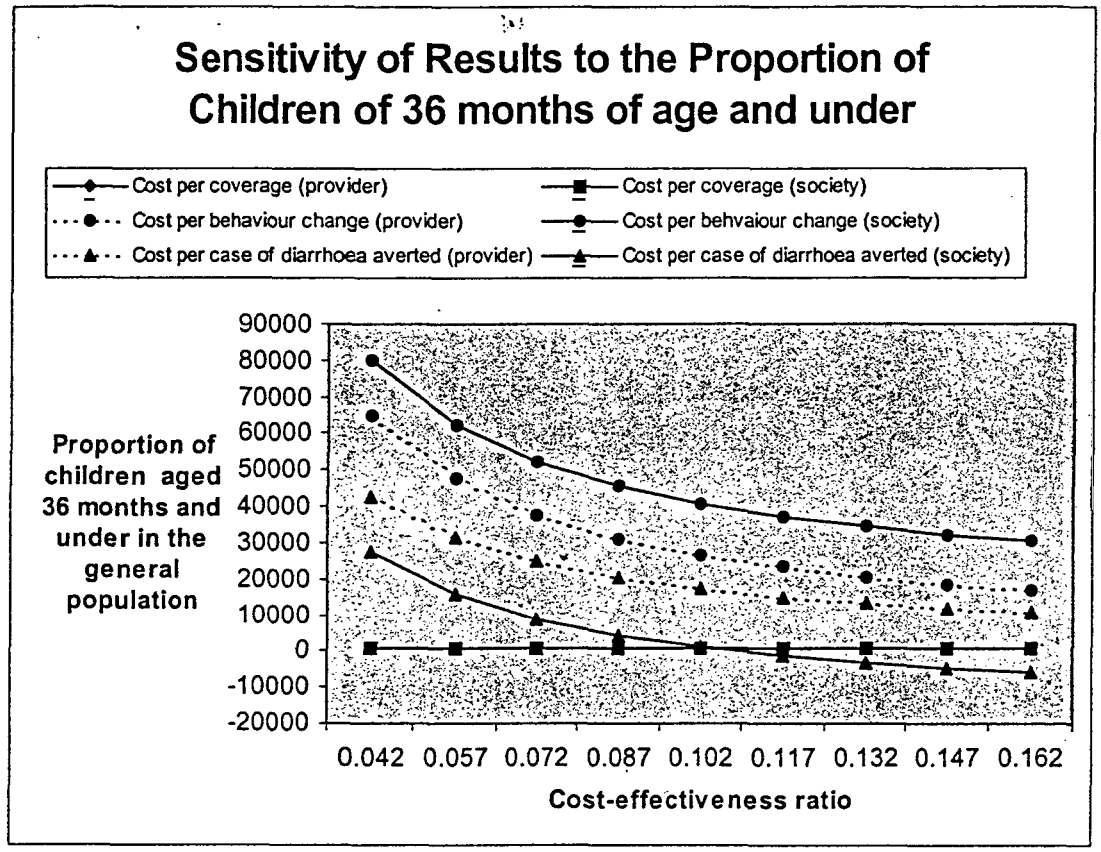


Figure E8. Sensitivity of Results to the Proportion of Children of 36 months and under.



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