Guidelines for cost and cost-effectiveness analysis of tuberculosis control

DOCUMENT

3

WORKED EXAMPLES
USING DATA FROM
KENYA AND
SOUTH AFRICA

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WORKED EXAMPLE 1:

Cost and cost-effectiveness analysis of two alternative tuberculosis treatment strategies in Guguletu District, Cape Town, South Africa

1. COMPLETED EXERCISE 1 FROM CHAPTER 3

1. **At which sites will the cost analysis be undertaken?**

   Guguletu District, Cape Town, South Africa

2. **What question(s) is the cost and cost-effectiveness analysis addressing?**

   Is community-based DOT more affordable (i.e. lower cost) and more cost-effective than clinic-based DOT for new smear-positive pulmonary tuberculosis patients in Cape Town, South Africa?

3. **What will be the perspective of the evaluation?**

   Societal – patient, health system and NGO costs involved in tuberculosis treatment to be assessed

4. **What kind of evaluation is going to be undertaken?**

   Cost-effectiveness analysis

5. **Describe the existing approach to diagnosis and case management, and describe the alternatives (if any) with which this is to be compared**

   Patients are initially diagnosed at health clinics, using sputum microscopy and X-rays. For the first 2 weeks of treatment, patients must visit clinics daily Monday-Friday to have their treatment observed by a health worker. Subsequently, patients can choose to have their treatment observed by either a community treatment supporter, a health worker at a clinic, or a colleague at work. Patients are expected to visit the site/person they have chosen for observation of treatment daily Monday-Friday for the intensive phase of treatment, and three times a week in the continuation phase. Sputum smears are examined at 2, 5 and 6 months. Community treatment supporters are supervised and paid for by an NGO, called TB Care Committee. The NGO has a manager, who spends part of their time on overall supervision of community-based treatment; 2 social workers, who also help with overall supervision; and a part-time typist. Two vehicles are used to supervise community treatment supporters.

6. **What evidence will be used to establish each alternative's effectiveness and what measure(s) of effectiveness will be used?**

   Standard tuberculosis programme outcome data, available from the district tuberculosis register. Measures of effectiveness to be used are cure, deaths averted and DALYs gained.

7. **What are the costs to be identified?**

   Cost of a clinic visit; cost of a visit to a community treatment supporter; cost of a sputum smear; cost of an X-ray; cost of overall supervision provided by NGO; cost of drugs; cost of training provided to community treatment supporters. District, provincial and national programme management costs will not be assessed as these are the same for both management strategies being evaluated.

8. Are there any costs that will not be assessed? If not, why? Will this cause a problem?

Sputum culture costs per patient will not be assessed as the data available make it very difficult to assess the average number of sputum cultures done per patient. This should not be a problem for the purposes of the analysis because sputum cultures are not done for most patients and the costs are very minor compared to other aspects of treatment.

9. How will costs be measured in appropriate physical units?

Number of visits to clinics and community treatment supporters quantified based on number of visits required by case management strategy. Number of sputum smears per patient based on what is recommended in treatment guidelines. Number of X-rays per patient assumed to be 1, as staff in the district report that an X-ray is still done for almost all patients. For overall supervision, the number of people involved will be quantified and the proportion of their time spent on supervision identified. For transport, the type of vehicles used and the distances travelled per year will be quantified. Time and travel costs for patients associated with visits to community treatment supporters and health facilities will be quantified using a structured questionnaire. For clinic costs, all buildings and staff employed in them will be quantified. X-ray, sputum smear and sputum culture costs will be based on quotes rather than a detailed costing exercise.

10. What type of costs are to be assessed?

Focus will be on average costs

11. How will shared/joint costs be allocated?

Staff according to proportion of time spent on different activities; vehicles according to number of days used

12. What discount rate is to be used?

3%

13. Where can building cost data be found?

Cape Town Metropolitan City Council, Finance Department

14. Where can data on the annual number of inpatient days in a hospital, and the annual number of visits to other facilities, be found?

Hospital inpatient days not relevant as hospitalisation is not a standard part of case management in Guguletu. Number of clinic visits can be found from the statistics department at the Cape Town Metropolitan City Council

15. In what year of prices will costs be valued?

1998

16. How will costs in years prior to the most recent year for which costs are being assessed be converted into costs in the most recent year for which costs are being assessed?

Costs are being analysed for 1998 only

17. In what currency will costs be valued?

US$

2. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 4: HEALTH SERVICES (PROVIDER) COSTS ASSOCIATED WITH INDIVIDUAL COMPONENTS OF DIAGNOSIS AND TREATMENT

Important note 1

Protocols 1 and 2 were not relevant, because hospital admission is not a standard part of case management in Guguletu, and patients visit health clinics rather than the hospital outpatient department for collection of drugs, sputum smears, X-rays and directly observed therapy. Also, Protocols 10-12 (district, provincial and national supervision) were not completed, as the costs were the same for all strategies being evaluated and therefore it was not considered necessary to assess these costs.

Important note 2

Where parts of the data entry sheets were not necessary for the Guguletu study, they have been deleted for the purposes of this worked example.

Protocol 3: The cost of an outpatient visit to a clinic/health centre (or similar non-hospital facility)

Name of District on which data are based: Guguletu, Cape Town

Year on which data are based: 1998

Approach 1

1. Total annual cost of staff employed in clinics/other non-hospital facilities that exist =

2. Total annual non-staff related recurrent expenditure for clinics/other non-hospital facilities, excluding drugs, laboratory tests and X-rays =
   US$ 10 396

3. Cost to build, new, the clinics/other non-hospital facilities that exist =
   US$ 157 888

4. Annualized cost of clinics/other non-hospital facilities =
   US$ 6 136

5. Estimated annual cost of equipment used in clinics/other non-hospital facilities =
   US$ 613.6

6. Total cost for staff, buildings and equipment, and non-personnel recurrent expenditure =
   US$ 184,820.6

7. Total annual number of visits made to clinics/other non-hospital facilities =
   74 140

8. Average cost of a visit to a clinic/other non-hospital facility = (6) ÷ (7) =
   US$ 2.5

Cost item	Total cost in US$	Who pays?
Staff	167 675	Provincial government
Buildings and equipment	6 749.6	Provincial government
Non-staff recurrent expenditure, excluding drugs, laboratory tests and X-rays	10 936	Provincial government
TOTAL	184 820.6	Provincial government

Average incremental cost =
US$ 2.5 (since visits by TB patients account for approximately 50% of the total number of visits to clinics in the district)

Marginal cost =

US$ 2.5

(there is virtually no spare capacity in clinics)

Utilization

1. Clinic/other non-hospital outpatient services appear:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

2. Justification for choice:

It is difficult to see all patients within normal working hours

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Provincial government	184 820.6	100%
ALL SOURCES	184 820.6	100%

Protocol 4: The cost of a visit to a Community Health Worker

Name of District on which data are based: Guguletu, Cape Town

Year on which data are based: 1998

Approach 1

1. Payment to CHW per visit =
   US$ 0.4

Approach 2

1. Average annual cost of a CHW =

2. Fraction of their time a CHW spends on individual consultations/visits =

3. Annual cost for CHW time spent on individual consultations/visits =

4. Average number of visits/consultations done by a CHW in a year (estimate if necessary) =

5. Average cost of a CHW visit (i.e. 3 ÷ 4) =

   Average incremental cost =
   US$ 0.4

   Marginal cost =
   US$ 0.4

Utilization

1. Community health workers appear:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

2. Justification for choice:

Community health workers or "treatment supporters" are able to fulfill their role as treatment observer in addition to any other work (paid or household) in which they are involved, and the payment made appears to offer sufficient motivation for them to undertake the work

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
NGO "TB Care Committee"	5 200	100%
ALL SOURCES	5 200	100%

Protocol 5: The cost of a drug regimen

Year on which data are based: 1998

Cost of regimen for a new smear-positive pulmonary tuberculosis patient =
US$ 43.5

Cost of regimen for a new smear-negative pulmonary tuberculosis patient =
not relevant to this analysis

Cost of regimen for an new extra-pulmonary tuberculosis patient =
not relevant to this analysis

Cost of regimen for a re-treatment tuberculosis patient =
not relevant to this analysis

Cost of regimen for ..... =

Cost of regimen for ..... =

Cost or regimen for ..... =

Average cost of regimen for a new smear-positive pulmonary tuberculosis patient =

Average cost of regimen for a new smear-negative pulmonary tuberculosis patient =

Average cost of regimen for a new extra-pulmonary tuberculosis patient =

Average cost of regimen for a re-treatment patient =

Average cost of regimen for an adult tuberculosis patient =

Average cost of regimen for a child tuberculosis patient =

Note that the average cost of a regimen for (a) an adult patient and (b) a child patient will depend on (i) the weight distribution of patients and (ii) the proportion of patients who are new or re-treatment patients, and the proportions who are smear-positive/ smear-negative/extra-pulmonary, etc.

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Provincial government	16 881	100%
ALL SOURCES	16 881	100%

Protocol 6: The cost of a sputum smear

Name of District and department on which data are based:
Guguletu, Cape Town

Year on which data are based: 1998

Approach 1

1. Quoted average cost per smear =
   US$ 2.3

2. Source of quote =
   South African Institute of Medical Research

3. Source of financing for sputum smears =
   Provincial government

Approach 2

(a) Staff costs

Table 1

Grade of laboratory staff	Number of staff in each grade (a)	Annual cost (b)	Total annual cost (a x b)	Who pays?

2. Total annual cost of laboratory staff (all grades) =

3. Total annual number of sputum smears analysed =

4. Total annual number of laboratory tests done (ALL tests) =

5. Estimated proportion of laboratory staff time spent on sputum smears =

6. **Total annual staff costs to be allocated to sputum smears (i.e. 5 x 2) =**

Average incremental cost =
US$ 2.3

Marginal cost =
US$ 2.3

Utilization

1. **Laboratory services for sputum smear microscopy appear:**

   Very over-utilized

   Over-utilized to some extent

   Relatively optimally utilized

   Under-utilized to some extent

   Very under-utilized

   (circle as appropriate)

   Not possible to assess

2. **Justification for choice:**

   N.A. (as utilization not assessed)

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Provincial government	10 350	100%
ALL SOURCES	10 350	100%

Protocol 7: The cost of a sputum culture

Name of District and department on which data are based:
Guguletu, Cape Town

Year on which data are based: 1998

1. Quoted cost of a sputum culture =
US$ 4.7

2. Source of quote =
South African Institute of Medical Research

3. Source of funds for sputum cultures =
Provincial government

OR:

1. Estimated average cost of a sputum culture = average cost of a sputum smear x 1.6 =

2. Source of funds for sputum cultures =

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Provincial government	63.5	100%
ALL SOURCES	63.5	100%

Protocol 8: The cost of an X-ray

Name of District and department on which data are based*:
Guguletu, Cape Town

Year on which data are based: 1998

Approach 1

1. Quoted average cost of an X-ray =
US$ 9.9

2. Source of average cost figure =
Cape Metropolitan Council

3. Source of funds for X-rays =
Provincial government

Average incremental cost =
US$ 9.9

Marginal cost =
US$ 9.9

Utilization

1. X-ray department appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A. (as not possible to assess utilization)

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Provincial government	5 000	100%
ALL SOURCES	5 000	100%

Protocol 9: The cost of outpatient supervision of patients/ health staff/supervisors of DOT to encourage compliance with treatment

Name of District on which data are based: Guguletu, Cape Town

Year on which data are based: 1998

Note: these costs only apply for patients whose treatment is being observed by community "treatment supporters"; such overall supervision is not provided to patients who have their treatment observed in clinics.

1. Inputs required for outpatient supervision =

Manager of NGO, Social worker, Social worker assistant, typist, 2 vehicles

(a) Staff costs

Table 1

Staff who undertake or are involved in organising supervision	Annual cost (a) in US$	Proportion of time spent on supervision/ organisation of supervision (b)	Total annual cost of staff involved in supervision (c) in US$	Who pays?
Manager, NGO	16,727	0.18	3,011	NGO "TB Care committee"
Social worker	11,645	0.41	4,774	NGO "TB Care committee"
Social worker assistant	4,780	0.32	1,530	NGO "TB Care committee"
Typist (part-time)	412	0.69	284	NGO "TB Care committee"

Total annual cost of staff involved in supervision (all members) = US$ 9,599

(b) Fuel costs/~~ALL costs associated with vehicles/motorbikes usage~~ * (delete as appropriate, depending on the mileage/km rate data available and what costs these rates cover)

1. Number of miles/kilometres travelled by vehicles per year for supervision of patients/their supervisors = 5 880 km

2. Rate per km/mile paid for fuel OR ~~rate per km/mile paid for all costs associated~~ (delete as appropriate) = US$ 0.22

3. Annual cost for fuel/~~ALL costs associated with vehicle usage~~*(delete as appropriate) {i.e. 1 x 2} = US$ 1,294

4. Number of miles/kilometres travelled by motorbikes per year for supervision of patients/ their supervisors = N.A., no motorbikes used

5. Rate per km/mile paid for fuel OR rate per km/mile paid for all costs associated with motorbike usage* (delete as appropriate) = N.A., no motorbikes used

6. Annual cost for fuel/ALL costs associated with motorbike usage*(delete as appropriate) {i.e. 4 x 5} = N.A., no motorbikes used

7. Total annual cost of fuel/~~ALL costs associated with use of vehicles and motorbikes~~* (delete as appropriate) for overall supervision = US$1,294

8. Source of funds for fuel/~~ALL costs associated with vehicle usage*~~ (delete as appropriate) associated with use of vehicles and motorbikes = NGO "TB Care Committee"

(c) Vehicles/motorbikes/other transport costs

Table 2

Vehicles/motorbikes/ other transport used for supervision	Purchase price new in US$	Expected years of useful life when new	Annualized cost in US$
Opel Astra	9,000	10	1,056
Toyota Corolla	10,922	10	1,280

Table 3

Vehicles/ motorbikes/ other transport used for supervision	Annualized cost (a) in US$	Number of days used for supervision each year (b)	Total number of days used per year, all purposes (c)	Cost of supervision of tuberculosis patients/their supervisors [i.e. {(b)÷(c)} x (a)] in US$	Who pays?
Opel Astra	1,056	72	264	288	NGO "TB Care Committee"
Toyota Corolla	1,280	12	264	58	NGO "TB Care Committee"

Total annual cost of vehicles/motorbikes etc. = US$ 346

(this is the sum of the totals entered in column 5 of table 3)

(d) Maintenance costs

1. Estimated annual cost for maintenance = US$ 1,294 x 0.15 = US$ 194

2. Source of funds for maintenance costs = NGO "TB Care Committee"

(e) Other costs

Other costs = Annual cost of travel fares for "treatment supporters", US$ 867

Source of funds for "other costs" = NGO "TB Care Committee"

Table 4

Cost item	Annual cost in US$
Staff	9,599
Vehicles/motorbikes etc.	346
Fuel/All costs associated with vehicle usage	1,294
Maintenance	194
Other	867
TOTAL	12,300
Annual number of patients being treated in the area	316
Average cost per patient	39

Average cost per patient = US$ 39

Average incremental cost per patient = US$ 39

Marginal cost per patient = US$ 39

Utilization

1. Outpatient supervision of patients/health staff/supervisors of DOT appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

2. Justification for choice:

The amount of time spent on supervision allows regular management meetings and visits to workplaces and does not appear excessive

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
NGO "TB Care Committee"	12,300	100%
ALL SOURCES	12,300	100%

Protocol 13: The cost of training

District on which data are based: Guguletu

Year on which data are based: 1998

1. Training typically provided to staff involved in delivery of tuberculosis services in a year =

One week training course for new community "treatment supporters"

Refresher training for all community "treatment supporters" once per year

(a) Staff providing training

Table 1

Staff involved in providing training	Annual cost (a) in US$	Number of days spent providing training per year (b)	Total number of days staff work per year (c)	Cost per day (d) {i.e. (a) ÷ (c) in US$	Cost for provision of training {(b) x (d)}	Who pays?
Trainer	17,504	8.5	264	66	561	NGO "TB Care committee"
Trainer	17,504	8.5	264	66	561	NGO "TB Care committee"

Total costs associated with staff providing training = US$ 1,122

(b) Costs associated with staff receiving training

Table 2

Staff type	Number who typically receive training each year (a)	Number of days per year spent receiving training (b)	Annual cost (c) in US$	Number of days staff are expected to work per year (d)
Treatment supporter	14	5	807	264

Table 3

Staff type	Total number of day spent receiving training i.e. column 2 x column 3 from Table 2 (a)	Cost per day (b) {i.e. (e) ÷ (d) in Table 2} in US$	Subsistence rate + other payments made per day (c)	Total annual cost of training [(a) x {(b) + (c)}] in US$	Who pays?
Treatment supporter	70	3	0	210	NGO "TB Care Committee"

Total annual costs associated with staff being trained = US$ 210

(c) Other costs associated with staff being trained =
US$ 36 for snacks, US$ 8 for hire of venue, US$ 253 for training materials

Estimated total annual costs for all other costs associated with provision of training = US$ 307

Table 4

Cost item	Annual cost in US$
Staff providing training	1,122
Staff providing training	210
Other costs	307
TOTAL	1,639

Total number of patients in the area for which training costs have been estimated = 315

Average cost of training per patient = US$ 5.2

Average incremental cost per patient = US$ 5.2

Marginal cost per patient = US$ 5.2

Utilization

1. Training appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

not possible to assess from available data

2. Justification for choice:

N.A. as not possible to assess utilization

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
NGO "TB Care Committee"	1,639	100%
ALL SOURCES	1,639	100%

3. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS/ GUIDELINES IN CHAPTER 5

Important note: Family cost data were not collected as patients are not usually accompanied to health facilities or admitted to hospital. Community member costs were covered under "CHW" costs in the data collection sheets for Chapter 4, as in Guguletu the cost of community treatment supporters is borne by an NGO (a health service provider).

Protocol 1: Patient costs

Name of District on which data are based: Guguletu

Year on which data are based: 1998

1. Average income among interviewed tuberculosis patients who are in paid employment or self-employment = US$ 200/month

Estimated average income per hour = US$ 1.1

2. Average income among all interviewed patients = US$ 106/month

(note this is equivalent to valuing the cost of time of those who are not in paid employment as zero)

Estimated average income per hour = US$ 0.6

3. Average wage in the area being studied = US$ 120/month

Average income per hour = US$ 0.7

Table 1: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average wage rate among tuberculosis patients who are in paid work (either employed or self-employed)

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours}	Average time cost {estimated monetary value}	Total average cost {(i.e. (a) + (c)}
Day in hospital	N.A.	N.A.	N.A.	N.A.
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	0.2	1 hour and 5 minutes	1.2	1.4
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	N.A.	N.A.	N.A.	N.A
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	0	18 minutes	0.3	0.3
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT	0.2	47 minutes	0.9	1.1
Overall (i.e. across all sites) cost of a DOT visit				

Table 2: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average wage rate among tuberculosis patients who are in paid work (either employed or self-employed), but as zero for those who are not in paid employment

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	N.A.	N.A.	N.A.
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	0.2	1 hour and 5 minutes	0.7	0.9
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	N.A.	N.A.	N.A.	N.A.
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	0	18 minutes	0.2	0.2
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT	0.2	47 minutes	0.5	0.7
Overall (i.e. across all sites) cost of a DOT visit				

Table 3: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average wage rate in the area being studied.

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	N.A.	N.A.	N.A.
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	0.2	1 hour and 5 minutes	0.7	0.9
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	N.A.	N.A.	N.A.	N.A.
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	0	18 minutes	0.2	0.2
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT	0.2	47 minutes	0.5	0.7
Overall (i.e. across all sites) cost of a DOT visit				

Table 4: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as zero for all patients

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	N.A.	0.	N.A.
Visit to hospital	N.A.	N.A.	0	N.A.
Visit to a health clinic/other non-hospital facility	0.2	1 hour and 5 minutes	0	0.2
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	N.A.	N.A.	0	N.A.
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	0	18 minutes	0	0
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT	0.2	47 minutes	0	0.2
Overall (i.e. across all sites) cost of a DOT visit			0	

4. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 6

Important note: Tables 1 and 2 only were used, as the focus chosen for this evaluation was average costs. Two copies of Table 2 were used – one for the community-based approach to care, one for the clinic-based approach to care.

Protocol 1: Summary of the costs of individual components of diagnosis and treatment

Name of District on which data are based: Guguletu

Table 1: Average, average incremental and marginal costs associated with different components of tuberculosis services

(a) Health services (Provider) costs

Care component	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Day in hospital (government facility)	N.A.	N.A.	N.A.
Day in hospital (mission/NGO facility)	N.A.	N.A.	N.A.
Hospital outpatient visit	N.A.	N.A.	N.A
Visit to clinic/similar non-hospital facility	2.5	2.5	2.5
CHW visit	0.4	0.4	0.4
DOT visit* (overall, across all sites used for DOT)	1.9	1.9	1.9
Drug regimen (new sm+ pulmonary TB)	43.4	43.4	43.4
Drug regimen (new sm- pulmonary TB)	N.A.	N.A.	N.A.
Drug regimen (extra-pulmonary TB)	N.A.	N.A.	N.A.
Drug regimen (retreatment patients)	N.A.	N.A.	N.A.
Sputum smear	2.3	2.3	2.3
Sputum culture	4.7	5.7	5.7
X-ray	9.9	9.9	9.9
Overall patient follow-up/supervision (per patient)	39	39	39
Programme management: district level (per patient)	N.A.	N.A.	N.A.
Programme management: regional/ provincial level (per patient)	N.A.	N.A.	N.A
Programme management: national level (per patient)	N.A.	N.A.	N.A.
Training (per patient)	5.2	5.2	5.2

(b) Patient costs

Cost item	Average cost in US$
Day in hospital	N.A.
Hospital outpatient visit	N.A.
Visit to a health clinic/similar non-hospital facility	0.9
CHW visit	0.2
DOT visit to hospital outpatient department, where hospital outpatient department chosen for DOT supervision	N.A.
DOT visit to a health clinic/similar non-hospital facility, where a health clinic/similar non-hospital facility chosen for supervision	0.7
DOT visit to a CHW, where CHW chosen for DOT supervision	0.2
DOT visit to a non-health worker, where a non-health worker chosen for supervision	0.2
DOT visit (overall, across all sites used for DOT)*	1.9

**see comment for provider costs above*

Important note: the figures used in this worked example are those that take a relatively conservative approach to the valuation of time costs i.e. the cost of time was valued as the average income among interviewed TB patients. This meant that the cost of time for those not employed was valued as zero.

(c) Family costs

Cost item	Average cost in US$
Day in hospital	N.A.
Visit to hospital	N.A.

(d) Volunteer costs

Cost item	Average Cost in US$
DOT visit	N.A.
Visit to health facility to collect drugs	N.A.
Training	N.A.

Protocol 2: Calculating the cost of managing a tuberculosis patient from diagnosis to treatment completion, for any defined case management strategy and type of tuberculosis patient

1. Name of strategy: Clinic-based DOT

2. Type of patient: New smear-positive pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	0	0	0
Hospital outpatient visits for monitoring/collection of drugs	0	0	0
Visits to a clinic/similar non-hospital facility for monitoring/collection of drugs	3	2.5	7.5
DOT visits	130	2.5	325
Drug regimen	1	43.4	43.4
Sputum smears	3	6.9	20.7
Sputum cultures	0	4.7	0
X-rays	2	9.9	19.8
Overall follow-up/ Supervision of patients	N.A.	N.A.	N.A.
Programme management at district level	N.A.	N.A.	N.A.
Programme management at regional/provincial level	N.A.	N.A.	N.A.
Programme management at national level	N.A.	N.A.	N.A.
Training	N.A.	N.A.	N.A.
TOTAL	N.A.	N.A.	**416.4**

Total cost of managing a patient to treatment completion, government services = 416.4

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	N.A.	N.A.	N.A.
Hospital outpatient visits for collection of drugs/monitoring	N.A.	N.A.	N.A.
Visits to a clinic/similar non-hospital facility for collection of drugs/monitoring	3	0.7	2.1
DOT visits	130	0.7	91
TOTAL	N.A.	N.A.	93.1

(c) Family costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	N.A.	N.A.	N.A.
Visits to hospital	N.A.	N.A.	N.A.
TOTAL	N.A.	N.A.	N.A.

(d) Volunteer costs

Care component	Number of days/visits required per patient {average, across all patients} (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training			
TOTAL	N.A.	N.A.	N.A.

Name of strategy: Clinic-based DOT

Type of patient: New smear-positive pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Health Services (Provider)	416.4	N.A.	N.A.
Patient	93.1	N.A.	N.A.
Family	N.A.	N.A.	N.A.
Volunteer	N.A.	N.A.	N.A.
TOTAL	509.5	N.A.	N.A.

Protocol 2: Calculating the cost of managing a tuberculosis patient from diagnosis to treatment completion, for any defined cause management strategy and type of tuberculosis patient

1. Name of strategy: Community-based DOT

2. Type of patient: New smear-positive pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	0	0	0
Hospital outpatient visits for monitoring/collection of drugs	0	0	0
Visits to a clinic/similar non-hospital facility for monitoring/collection of drugs	3	2.5	7.5
DOT visits	130	0.4	52
Drug regimen	1	43.4	43.4
Sputum smears	3	6.9	20.7
Sputum cultures	0	4.7	0
X-rays	2	9.9	19.8
Overall follow-up/ Supervision of patients	1	39	39.
Programme management at district level	N.A.	N.A.	N.A.
Programme management at regional/provincial level	N.A.	N.A.	N.A.
Programme management at national level	N.A.	N.A.	N.A.
Training	1	5.2	5.2
TOTAL	N.A.	N.A.	**187.6**

Total cost of managing a patient to treatment completion, government services = 187.6

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	N.A.	N.A.	N.A.
Hospital outpatient visits for collection of drugs/monitoring	N.A.	N.A.	N.A.
Visits to a health facility for collection of drugs/monitoring	3	0.7	2.1
DOT visits	130	0.2	26
TOTAL	N.A.	N.A.	N.A.

(c) Family costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b)	Average cost to manage a patient to treatment completion {(a) x (b)}
Days in hospital	N.A.	N.A.	N.A.
Visits to hospital	N.A.	N.A.	N.A.
TOTAL	N.A.	N.A.	N.A.

(d) Volunteer costs

Care component	Number of visits/items required per patient {average, across all patients} (a)	Average cost of care component (b)	Average cost to manage a patient to treatment completion {(a) x (b)}
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training			
TOTAL	N.A.	N.A.	N.A.

Name of strategy: Community-based DOT

Type of patient: New smear-positive pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost	Average incremental cost	Marginal cost
Health services (Provider)	187.6	N.A.	N.A.
Patient	28.1	N.A.	N.A.
Family	N.A.	N.A.	N.A.
Volunteer	N.A.	N.A.	N.A.
TOTAL	215.7	N.A.	N.A.

5. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 7

Note: only Protocol 1 from Chapter 7 was completed, as the analysis focused on smear-positive patients.

Protocol 1: Cost-effectiveness analyses for smear-positive pulmonary tuberculosis patients

Name of District / Districts on which data are based: Guguletu, S. Africa

Type of strategy for which cost-effectiveness being assessed = Clinic-based DOT

Protocol 1a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-positive pulmonary tuberculosis patients

Type of health service provider	% of patients cured (a)	% of patients who completed treatment but for whom cure was not confirmed (b)	% of patients who failed treatment (c)	% of patients who died during treatment (d)	% of patients who defaulted from treatment (e)	% of patients who transferred out of the district during treatment (f)
Government services	60.0	12.0	1.0	2.0	19.0	6.0
Mission services	N.A.	N.A.	N.A.	N.A.	N.A.	N.A

(i) Government services

1. *Minimum* cure rate achieved, government services = (a) + (b)
= 72.0

2. *Maximum* cure rate achieved, government services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]
= 60.0 + 12.0 + [{72 ÷ (100 – 19.0 – 6.0)} x (19.0 + 6.0)] = 72.0 + 24.0
= 96.0

(ii) Mission services

3. *Minimum* cure rate achieved, mission services = (a) + (b)

= N.A., no mission services in the district

4. *Maximum* cure rate achieved, mission services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= N.A., no mission services in the district

=

Table 2: the average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	509.5	72.0	96.0
Mission services	N.A.	N.A.	N.A.

5. Estimated cure rate that would apply without the availability of tuberculosis treatment = {(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= {(35 x 0) + (65 x 20)} ÷ 100

= 13

(i) Government services

6. *Minimum* cost per patient cured, government services =

((average cost to manage a patient to treatment completion, government services) x 100) ÷ (maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (509.5 x 100) ÷ (96 – 13)

= 613.9

7. *Maximum* cost per patient cured, government services =
((average cost to manage a patient to treatment completion, government services) x 100) ÷ (minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (509.5 x 100) ÷ (72 – 13)

= 863.6

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =

((average cost to manage a patient to treatment completion, mission services) x 100) ÷ (maximum estimated cure rate – estimated cure rate that would apply without treatment)

= N.A., no mission services in the district

=

9. *Maximum* cost per patient cured, mission services =

((average cost to manage a patient to treatment completion, mission services) x 100) ÷ (minimum estimated cure rate – estimated cure rate that would apply without treatment)

= N.A., no mission services in the district

Protocol 1b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= 2.0 + [{2.0 ÷ (100 – 19.0 – 6.0)} x (19.0 + 6.0)]

= 2.0 + (0.027 x 25)

= 2.7

2. Estimated *minimum* death rate that would apply in the absence of treatment[1] = (0.6 x estimated percentage of patients who are HIV-negative) + (1 x estimated percentage of patients who are HIV-positive)

= (0.6 x 65) + (1 x 35)

= 74

3. Estimated *maximum* death rate that would apply in the absence of treatment = (0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.7 x 65) + (1 x 35)

= 80.5

4. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 3 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}÷ 100]

= 2.0 + [{80.5 x (19.0 + 6.0)} ÷ 100]

= 2 + 20.1

= 22.1

5. *Minimum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment estimated in 3 – minimum death rate in presence of treatment estimated in 1)

= (509.5 x 100) ÷ (80.5 – 2.7)

= 654.9

6. *Maximum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum[2] death rate in the absence of treatment estimated in 3 – maximum death rate in presence of treatment estimated in 4)

= (509.5 x 100) ÷ (80.5 – 22.1)

= 872.4

(ii) Mission services

7. Estimated *minimum* death rate that applies when tuberculosis treatment is available =
(percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}]

= N.A., no mission services in the district

8. Estimated *minimum* death rate that would apply in the absence of treatment[3] =
(0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= N.A., no mission services in the district

9. Estimated *maximum* death rate that would apply in the absence of treatment =
(0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= N.A., no mission services in the district

10. Estimated *maximum* death rate that applies when tuberculosis treatment is available =
(percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 9 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)} ÷ 100]

= N.A., no mission services in the district

11. *Minimum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment estimated in 9 – minimum death rate in presence of treatment estimated in 7)

= N.A., no mission services in the district

=

12. *Maximum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum[4] death rate in the absence of treatment estimated in 9 – maximum death rate in presence of treatment estimated in 10)

= N.A., no mission services in the district

=

Protocol 1c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 27

2. Estimated *net* number of DALYs gained per death averted for HIV- patients = 25

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated *overall net number* of DALYS gained per death averted =
[(Estimated percentage of patients who are HIV- x estimated net number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x 3)] ÷ 100

= [(65 x 25) + (35 x 3)] ÷ 100

= 17.3

(i) Government services

5. Minimum estimated cost per DALY gained in government services =

Estimated minimum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 654.9 ÷ 17.3

= 37.9

6. Maximum estimated cost per DALY gained in government services =

Estimated maximum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 872.4 ÷ 17.3

= 50.4

(ii) Mission services

7. Minimum estimated cost per DALY gained in mission services =

Estimated minimum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

=

N.A., no mission services in the district

8. Maximum estimated cost per DALY gained in mission services =
Estimated maximum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

= N.A., no mission services in the district

Protocol 1: Cost-effectiveness analyses for smear-positive pulmonary tuberculosis patients

Name of District/
Districts on which data are based: Guguletu, S. Africa

Type of strategy for which cost-effectiveness being assessed =

Community-based DOT

Protocol 1a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-positive pulmonary tuberculosis patients

Type of health service provider	% of patients cured (a)	% of patients who completed treatment but for whom cure was not confirmed (b)	% of patients who failed treatment (c)	% of patients who died during treatment (d)	% of patients who defaulted from treatment (e)	% of patients who transferred out of the district during treatment (f)
Government services	68.0	9.0	0.0	0.0	19.0	4.0
Mission services	N.A.	N.A.	N.A.	N.A.	N.A.	N.A

(i) Government services

1. *Minimum* cure rate achieved, government services = (a) + (b)

= 77.0

2. *Maximum* cure rate achieved, government services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= 68.0 + 9.0 + [{77 ÷ (100 – 19.0 – 4.0)} x (19.0 + 4.0)] = 77.0 + 23.0

= 100.0

(ii) Mission services

3. *Minimum* cure rate achieved, mission services = (a) + (b)

= N.A., no mission services in the district

4. *Maximum* cure rate achieved, mission services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= N.A., no mission services in the district

=

Table 2: the average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	215.7	77.0	100.0
Mission services	N.A.	N.A.	N.A.

5. Estimated cure rate that would apply without the availability of tuberculosis treatment = {(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= {(35 x 0) + (65 x 20)} ÷ 100

= 13

(i) Government services

6. *Minimum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (215.7 x 100) ÷ (100 – 13)

= 247.9

7. *Maximum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (215.7 x 100) ÷ (77 – 13)

= 337.0

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= N.A., no mission services in the district

=

9. *Maximum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= N.A., no mission services in the district

=

Protocol 1b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available =

(percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)]

= 0.0 + [{0.0 ÷ (100 – 19.0 – 4.0)} x (19.0 + 4.0)]

= 0.0

2. Estimated *minimum* death rate that would apply in the absence of treatment[5] =

(0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.6 x 65) + (1 x 35)

= 74

3. Estimated *maximum* death rate that would apply in the absence of treatment =

(0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.7 x 65) + (1 x 35)

= 80.5

4. Estimated *maximum* death rate that applies when tuberculosis treatment is available =

(percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 3 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}÷ 100]

= 0.0 + [{80.5 x (19.0 + 4.0)} ÷ 100]

= 18.5

5. *Minimum* estimated cost per death averted =

(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment estimated in 3 – minimum death rate in presence of treatment estimated in 1)

= (215.7 x 100) ÷ (80.5 – 0.0)

= 267.0

6. *Maximum* estimated cost per death averted =

(average cost to manage a patient to treatment completion x 100) ÷ (maximum[6] death rate in the absence of treatment estimated in 3 – maximum death rate in presence of treatment estimated in 4)

= (215.7 x 100) ÷ (80.5 – 18.5)

= 347.9

(ii) Mission services

7. Estimated *minimum* death rate that applies when tuberculosis treatment is available =

(percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)]

= N.A., no mission services in the district

8. Estimated *minimum* death rate that would apply in the absence of treatment[7] =

(0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= N.A., no mission services in the district

9. Estimated *maximum* death rate that would apply in the absence of treatment =

(0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= N.A., no mission services in the district

10. Estimated *maximum* death rate that applies when tuberculosis treatment is available =

(percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 9 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)} ÷ 100]

= N.A., no mission services in the district

11. *Minimum* estimated cost per death averted =

(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment estimated in 9 – minimum death rate in presence of treatment estimated in 7)

= N.A., no mission services in the district

=

12. *Maximum* estimated cost per death averted =

(average cost to manage a patient to treatment completion x 100) ÷ (maximum[8] death rate in the absence of treatment estimated in 9 – maximum death rate in presence of treatment estimated in 10.)

= N.A., no mission services in the district

=

Protocol 1c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 27

2. Estimated *net* number of DALYs gained per death averted for HIV- patients = 25

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated *overall net number* of DALYs gained per death averted =

[(Estimated percentage of patients who are HIV- x estimated net number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x 3)] ÷ 100

= [(65 x 25) + (35 x 3)] ÷ 100

= 17.3

(i) Government services

5. Minimum estimated cost per DALY gained in government services =

Estimated minimum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 267.0 ÷ 17.3

= 15.4

6. Maximum estimated cost per DALY gained in government services =

Estimated maximum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 347.9 ÷ 17.3

= 20.1

(ii) Mission services

7. Minimum estimated cost per DALY gained in mission services =

Estimated minimum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

=

N.A., no mission services in the district

8. Maximum estimated cost per DALY gained in mission services =

Estimated maximum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

= N.A., no mission services in the district

Protocol 3: Summary of cost-effectiveness indicators

1. Strategy for which cost-effectiveness is being assessed:

Community-based DOT

Table 1: Summary of cost-effectiveness results, smear-positive pulmonary tuberculosis patients (US$)

Type of provider	Cost per patient cured in US$	Cost per death averted in US$	Cost per DALY gained in US$
Government services	247.9-337.0	267.0-347.9	15.4-20.1
Mission services	N.A.	N.A.	N.A

WORKED EXAMPLE 2:

Cost and cost-effectiveness analysis of alternative tuberculosis treatment strategies for new smear-positive and new smear-negative pulmonary tuberculosis patients in Machakos District, Kenya

1. COMPLETED EXERCISE 1 FROM CHAPTER 3

1. At which sites will the cost analysis be undertaken?

Machakos District, Kenya. The analysis will be district-wide except for hospital costs – it is not efficient to collect cost data at all hospitals so 2 representative sites will be used. Within Machakos, hospital cost data will be taken from 2 hospitals (i) Machakos Provincial Hospital, which is representative of government facilities in the district and (ii) Kikoko mission hospital, which is representative of mission facilities in the district.

2. What question(s) is the cost and cost-effectiveness analysis addressing?

Is the decentralized outpatient approach to treatment that involves the community in provision of DOT, introduced in October 1997 for new adult smear-negative, new adult smear-positive and new adult extra-pulmonary tuberculosis patients, more affordable (i.e. lower cost) and more cost-effective than the conventional hospital-based approach to care used until November 1997?

3. What will be the perspective of the evaluation?

Societal – patient, family, community and health system costs involved in tuberculosis treatment will be assessed.

4. What kind of evaluation is going to be undertaken?

Cost-effectiveness analysis.

5. Describe the existing approach to diagnosis and case management, and describe the alternatives (if any) with which this is to be compared

Patients are initially diagnosed in hospital or at a tuberculosis clinic, using sputum swear microscopy and X-rays.

Existing approach: All patients are diagnosed in hospital or at a tuberculosis clinic, using sputum smear microscopy and X-rays. After diagnosis, patients are only hospitalised if their clinical condition necessitates this. Otherwise, the first 2 months of treatment must be directly observed by either a health worker, a community volunteer, or a family member on an outpatient basis. Patients are expected to visit the site/person designated for observation of treatment on a daily basis. In the continuation phase, which lasts 6 months, treatment is taken on an unsupervised basis. Patients are expected to visit a health facility once per month to collect their drugs. Sputum smears are taken at 2, 6 and 8 months. Overall supervision of tuberculosis treatment is provided by a district tuberculosis and leprosy officer, who is in turn supervised by a provincial tuberculosis officer. The only difference in management between smear-positive and smear-negative/extra-pulmonary patients is in the drug regimens used.

This outpatient approach to care, involving volunteer and family member input, is very new and unusual in Kenya. Special additional inputs have been made to support its introduction. Training has been provided to health staff, to volunteers, and to the general community; and district and provincial supervision has been increased compared to that which existed when the previous hospital-based approach to care was used.

Alternative approach: Until November 1997, all smear-positive pulmonary tuberculosis patients were admitted to hospital for the first 2 months of treatment. This is the conventional approach that is currently implemented throughout Kenya. For the six-month continuation phase, treatment was taken on an outpatient, unsupervised basis, with patients collecting their drugs once per month from a health facility. Sputum smears were done at 2, 6, and 8 months for smear-positive patients.

Smear-negative and extra-pulmonary tuberculosis patients were also diagnosed at hospital or at a tuberculosis clinic, and then admitted for the first month of treatment. They then were treated on an unsupervised outpatient basis, with the drug regimen lasting 12 months and visits to collect drugs from a health facility required once per month. Overall supervision of tuberculosis treatment in the district was provided by the district tuberculosis and leprosy officer, who was in turn supervised by the Provincial Tuberculosis Officer.

6. What evidence will be used to establish each alternative's effectiveness and what measure(s) of effectiveness will be used?

Standard tuberculosis programme outcome data, available from the district tuberculosis register. Measures of effectiveness to be used will be cure, deaths averted and DALYs gained.

7. What are the costs to be identified?

Health system costs: cost of a day in hospital, at both government and mission facilities; cost of a visit to the tuberculosis clinic at Machakos hospital; cost of a visit to a peripheral health facility (general health clinic or dispensary); cost of a sputum smear; cost of overall supervision provided by district tuberculosis and leprosy officer; cost of overall supervision provided by provincial officer; cost of drugs; cost of training provided to health workers and volunteers.

Patient costs: time costs associated with a day in hospital; time and travel costs for visits to the tuberculosis clinic; and time and travel costs associated with visits to the site chosen for DOT in the decentralized/community-based approach.

Family costs: time and travel costs associated with hospitalisation of patients, estimated on a per day basis. Cost of special items bought for patients during hospitalisation. Time and travel costs associated with visits to accompany patients on visits to health facilities.

Community costs: time spent observing therapy; time spent receiving training.

8. Are there any costs that will not be assessed? If not, why? Will this cause a problem?

X-ray costs will not be assessed - the focus will be on costs after diagnosis, which is where the strategies being compared differ. This should not cause a problem – excluding X-rays from the analysis will not affect the conclusions to be drawn from the results and X-ray costs will be relatively minor anyway. National programme management costs will not be considered – they are the same for all strategies.

9. How will costs be measured in appropriate physical units?

For hospital-based approach, the number of days in hospital and the number of visits to clinics will be quantified based on the number of days/visits required by the case

management strategy (i.e. 60 days and 5 visits for smear-positive patients; 30 days and 10 visits for smear-negative patients). For the decentralized/community-based approach, the average number of days in hospital per patient will be calculated from patient treatment cards. The average number of DOT visits to different types of site (e.g. tuberculosis clinic, dispensary, volunteer) will be based on patient interviews. The number of sputum smears per patient will be based on what is recommended in treatment guidelines. For overall supervision, the number of people involved will be quantified and the proportion of their time spent on supervision identified. For transport, the type of vehicles used and the distances travelled per year will be quantified. Time and travel costs for patients associated with days in hospital, and visits to health facilities and volunteers will be quantified using a structured questionnaire. For hospital costs, the type of staff working on the relevant wards will be quantified and the proportion of their time spent with tuberculosis patients quantified. Staff not involved in direct patient care, and the locations at which they work, will also be quantified. Non-personnel recurrent overhead expenditure will be quantified using expenditure records. Buildings will be quantified in terms of floor area. For clinic costs, all buildings and staff employed in them will be quantified. Sputum smear costs will be based on quotes rather than a detailed costing exercise.

10. What type of costs are to be assessed?

Focus will be on average costs.

11. How will shared/joint costs be allocated?

Staff according to proportion of time spent on different activities; vehicles according to number of days used; hospital overheads to inpatient and outpatient care in proportion to the share of total direct staff costs accounted for by inpatient care; then to different wards on the basis of patient days.

12. What discount rate is to be used?

10%.

13. Where can building cost data be found?

Public Works officer, Machakos.

14. Where can data on the annual number of inpatient days in a hospital, and the annual number of visits to other facilities, be found?

Hospital inpatient days from Chief Matron/Hospital Administrator at Machakos Provincial Hospital; from senior sister at Kikoko Mission hospital. Number of general clinic/dispensary visits can be found from the Hospital administrator/Medical-superintendent, Machakos Provincial Hospital. Number of tuberculosis clinic visits per year from the district tuberculosis and leprosy officer.

15. In what year of prices will costs be valued?

1998

16. How will costs in years prior to the most recent year for which costs are being assessed be converted into costs in the most recent year for which costs are being assessed?

For 1997, use of staff, buildings, equipment, vehicles and motorbikes will be quantified in non-monetary terms and then quantities will be multiplied by unit prices in 1998. For non-personnel recurrent expenditure, costs in 1997 will be inflated to costs in 1998 according to the consumer price index.

17. In what currency will costs be valued?

US$

2. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 4: HEALTH SERVICES (PROVIDER) COSTS ASSOCIATED WITH INDIVIDUAL COMPONENTS OF DIAGNOSIS AND TREATMENT

Important note: Protocol 2 was not relevant, because patients visit a specialized tuberculosis clinic rather than the hospital outpatient department. Therefore, the data entry sheets for this protocol were modified (as there was no specific protocol for a visit to a dedicated tuberculosis clinic). Also, Protocols 4, 7, 8 and 12 were not used as community health worker visits were not relevant, sputum cultures and X-rays were not costed, and national programme management costs were not considered. Protocol 9 was not used as the costs were all covered under "district management", i.e. Protocol 10. Two copies of the data entry sheets for Protocols 10 and 11 were used, one for 1997 and one for 1998 (when more intensified supervision was provided as part of the community-based approach). Visits to health centres (Protocol 3) were only costed in 1998, as there was no reason why costs should have been different in 1997 compared to 1998 and visits to health centres were a relatively minor part of the hospital-based management strategy.

It is also important to note that some modifications were made to the data entry sheets for Protocol 1 (hospital costs), since only 9 months of 1997 (rather than the whole year) were considered. This was because this was the period in which decentralized/community-based care was not available.

Finally, it is important to highlight that costs for 1997 have been converted into 1998US$, so that they are comparable with the costs estimated for 1998.

Protocol 1: The cost of a day in hospital

Name of District on which data are based: Machakos

Type of hospital: government/~~mission/other NGO~~

(delete as appropriate)

Name of Hospital on which data are based:

Machakos Provincial Hospital

Year on which data are based: 1997 (first 9 months only)

(a) Nursing staff costs

Type of nursing staff who work on the TB ward (e.g. profes-sional and enrolled nurses)	Number who work on TB ward (a)	Annual cost (b) in US$	Proportion of time (on average) spent working on the TB ward (c)	Total ~~annual~~ cost in US$ for work on the TB ward, first 9 months of the year {i.e. (a) x (b) x (c)} x 0.75	Who pays?
Registered nurse	8	1,673	1	8 x 1,673 x 1x 0.75 = 10,039	Ministry of Health

Total ~~annual~~ cost of nursing staff (all types) = US$10,039 for 9 months

(b) Medical staff costs

Type of medical staff who work on the TB ward (e.g. doctors, clinical officers)	Number who work on TB ward (a)	Annual cost (b) in US$	Proportion of time (on average) spent working on the TB ward (c)	Total ~~annual~~ cost in US$ for work on the TB ward, first 9 months of the year {i.e. (a) x (b) x (c)} x 0.75	Who pays?
Clinic officer	1	1,485	0.15	167	Ministry of Health
Doctor	1	3,080	0.10	231	Ministry of Health

Total ~~annual~~ cost of medical staff (all types) for 9 months = US$ 398

(c) Support staff costs

Type of support staff who work on the TB ward (e.g. cleaners, clerks)	Number who work on TB ward (a)	Annual cost (b)	Proportion of time (on average) spent working on the TB ward (c)	Total annual cost for work on the TB ward {i.e. (a) x (b) x (c)}	Who pays?
N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Total annual cost of support staff (all types) = N.A.

(d) Buildings costs

Cost to build TB ward new in US$	Annualized cost of TB ward {i.e. (a) ÷ ~~25.73~~ 9.43}	Who pays?
25,862	2,743	Ministry of Health

Cost for 9 months = US$ 0.75 x 2,743 = US$ 2,057

Note: in this study, it was considered appropriate to use a discount rate of 10% and an expected years of useful life for buildings of 30 years. Therefore, the relevant annualization factor to divide by was 9.43, rather than 25.73.

(e) Staff overhead costs, *excluding* kitchen and laundry staff

Type of staff who are not involved in direct patient care, *excluding* those working in kitchen/laundry services, the laboratory and X-ray departments, and any support staff already included in (c)	Annual cost (a) in US$	Number employed (b)	Total annual cost in US$ for 9 months {i.e. (a) x (b)} x 0.75	Who pays?
Important note: Protocol 1 and this accompanying section of the data entry sheets were modified after data were collected from Machakos. Therefore, while the quantities and annual costs of each type of support staff working in the hospital were recorded, the analysis available aggregated these data. Therefore, in this worked example, only the total cost is recorded. It is, however, recommended that, as indicated in the final version of the protocol and accompanying data entry sheets, the details regarding the number and cost of each type of staff should be recorded.				
ALL	N.A.	N.A.	104,444 for 9 months	

1. Total annual costs of hospital staff not involved in direct patient care, excluding kitchen and laundry staff, laboratory and X-ray staff, and other support staff already included in part (c) =
Cost for 9 months = US$ 104,444

2. Total annual cost of staff involved in administrative/general management duties =
US$ 20,000 for 9 months

3. Total annual cost of all hospital staff not involved in direct patient care *excluding* both kitchen/laundry staff *and* those involved in administration/general management *and* any support staff listed in part (c) *and* those who work in the laboratory and X-ray departments =
US$ 84,444

4. Fill in (i) and (ii) below

(i) Total annual cost of staff who typically work in inpatient services and are involved in direct patient care =
US$ 112,345

(ii) Total annual cost of staff who typically work in outpatient services and are involved in direct patient care =
US$ 30,406

5. Proportion of total overhead staff costs to be allocated to inpatient care [1] =
0.787

6. (i) Administrative/general management staff costs to be allocated to inpatient services =
0.787 x US$ 20,000 = US$ 15,740

(ii) General overhead staff costs (*excluding* staff involved in administration/general management, and excluding kitchen/laundry staff) to be allocated to inpatient services =
0.787 x US$ 84,444 = US$ 66,457

Note that in each case this is the proportion calculated in 5 multiplied by the appropriate total cost recorded in 2 and 3.

7. Total ~~annual~~ number of hospital inpatient days accounted for by tuberculosis patients =
Total for first 9 months of the year = 9 200

8. Total ~~annual~~ number of hospital inpatient days =
Total for first 9 months of the year = 119 403

9. Proportion of all hospital inpatient days accounted for by tuberculosis patients =
{Note that this is total recorded in 7 ÷ total recorded in 8}
9 200 ÷ 119 403 = 0.077

10. Value of hospital-based administrative/general management staff overhead costs to be allocated to tuberculosis patients =
US$ 15,740 x 0.077 = US$ 1,212

This figure gives the total administrative/general management staff overhead costs associated with tuberculosis patients.

11. Cost of general overhead staff *excluding those involved in administration/general management, and excluding kitchen/laundry staff, and excluding support staff already identified in section (c), and excluding staff who work in the laboratory and X-ray departments* to be allocated to tuberculosis patients =
US$ 66,457 x 0.077 = US$ 5,117

This figure gives the total staff overhead costs (excluding staff involved in administration/general management) associated with tuberculosis patients.

(f) Kitchen and laundry service costs

1. The total annual cost of staff employed in kitchen/laundry services

Type of staff (e.g. job category, title, grade)	**Annual cost (a) in US$**	**Number employed in kitchen/laundry services (b)**	**Total ~~annual~~ cost in US$ for first 9 months of the year {i.e. (a) x (b)} x 0.75**	**Who pays?**
Cook	1,120	6	5,040	Ministry of Health
Laundry staff	1,120	5	4,200	Ministry of Health

2. Total ~~annual~~ cost of kitchen/laundry staff (all types) for 9 months =
US$ 9,240

3. Cost to build kitchen and laundry buildings new =
US$ 17,242

4. Annualized cost of kitchen and laundry buildings =
US$1,828, cost for 9 months = US$1,371
(as before, discount rate of 10% and expected useful life of 30 years assumed)

5. Total non-staff ~~annual~~ recurrent expenditure for kitchen and laundry services =
Cost for first 9 months = US$154,694

Cost item	~~Annual~~ cost for 9 months in US$	Who pays?
Staff	9,240	Ministry of Health
Kitchen and laundry buildings	1,371	Ministry of Health
Non-personnel recurrent expenditure (e.g. food)	154,694	Ministry of Health
TOTAL	165,305	Ministry of Health

6. Total ~~annual~~ costs of staff, buildings and non-staff recurrent expenditure associated with kitchen and laundry facilities for 9 months = US$ 165,305

7. Proportion of inpatient days for which tuberculosis patients account = 0.077

8. **Total annual costs of kitchen and laundry services to be allocated to tuberculosis patients =** 0.077 x 165,305 = US$ 12,728

(g) General hospital recurrent overhead costs, excluding staff, items associated with drugs, laboratory tests and X-rays, laundry and kitchen facilities, and any other items clearly irrelevant to tuberculosis patients

1. (i) Total annual cost of general non-personnel recurrent hospital expenditure for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients =
US$ 101,335 for the year, estimated as 0.75 x 101,335 for the first 9 months =
US$ 76,001

OR

(ii) Total annual cost of general non-personnel recurrent hospital expenditure *for inpatient services* for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients =

OR

(iii) Total annual cost of general non-personnel recurrent *district* expenditure for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients =

2. Proportion of total recurrent costs calculated in 1 to be allocated to inpatient services[2] = 0.787

3. Total non-personnel overhead recurrent costs associated with inpatient services = US$ 76,001 x 0.787 = US$ 59,813

4. Proportion of inpatient days for which tuberculosis patients account = 0.077

5. Overhead non-personnel recurrent costs to be allocated to tuberculosis patients = US$ 59,813 x 0.077 = US$ 4,606

Total ~~annual~~ non-staff recurrent overhead costs to be allocated to tuberculosis patients = US$ 4,606 for the first 9 months of 1997

Summary table for non-staff recurrent overhead costs to be allocated to tuberculosis patients

Total non-staff recurrent overhead costs to be allocated to tuberculosis patients in US$	Who pays?
4,606	Ministry of Health

(h) General building and equipment costs

1. Buildings in the hospital which are used for general support services = Administration block, Stores

2. Cost to construct buildings used for general support services new = US$36,207

3. Annualized cost of buildings used for general support services = US$ 3,840

(based on expected years of useful life of 30 years and a discount rate of 10%)

4. Estimated annualized cost of general equipment used by all services = US$ 384

5. Total annualized cost of buildings and equipment = US$ 384 + US$ 3,840 = US$ 4,224, US$ 3,168 for the first 9 months

6. Proportion of general building and equipment costs to be allocated to inpatient services = 0.787

7. Building and equipment costs associated with inpatient services = 0.787 x US$ 3,168 = US$ 2,493

8. Proportion of total inpatient days for which tuberculosis patients account = 0.077

9. Total annual building and equipment costs to be allocated to tuberculosis patients = US$ 2,493 x 0.077 = US$ 192

Total annual building and equipment costs to be allocated to tuberculosis patients = US$ 192

Summary table for the costs of general buildings and equipment to be allocated to tuberculosis patients

Item	Total ~~annual~~ cost for 9 months	Who pays?
General buildings	175	Ministry of Health
General equipment	17	Ministry of Health

The average cost of a day in hospital, excluding drugs, laboratory tests and X-rays

Cost item	Total ~~annual~~ cost in US$ for 9 months	Average cost per day (% total) in US$
Nursing staff	10,039	1.1 (28)
Medical staff	398	0.04 (1)
Support staff	0	0 (0)
TB ward buildings	2,057	0.2 (5)
Administrative/general management staff	1,212	0.1 (2.5)
Staff overheads *excluding* administration/general management staff	5,117	0.6 (15)
Kitchen and laundry services	12,728	1.4 (35)
General non-personnel recurrent overheads	4,606	0.5 (13)
General buildings and equipment	192	0.02 (0.5)
TOTAL	36,349	4.0

Note that to calculate the average cost per day, the total annual cost of each item needs to be divided by the total annual number of tuberculosis inpatient days

Estimated average incremental cost per day = US$ 3.9

Estimated marginal cost per day = US$ 1.4 in the short-run (kitchen and laundry costs)

Utilization

1. Bed occupancy rate for the hospital as a whole = 84%

2. Bed occupancy rate for the TB ward (or the main ward on which TB patients are cared for) = 90%

3. Hospital appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

4. Justification for choice: Bed occupancy averages 90% and is sometimes above 100%

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	36,349	100%
ALL SOURCES	US$ 36,349	100%

Protocol 1: The cost of a day in hospital

Name of District on which data are based: Machakos

Type of hospital: ~~government~~/mission/~~other NGO~~
(delete as appropriate)

Name of Hospital on which data are based: Kikoko

Year on which data are based: 1997

Important note: there is no dedicated TB ward. Therefore, as suggested in the protocol, "medical ward" has been substituted for "TB ward", and "medical patient" has been substituted for "TB patient" in using this set of data entry sheets

(a) Nursing staff costs

Type of nursing staff who work on ~~TB~~ medical ward (e.g. professional and enrolled nurses)	Number who work on ~~TB~~ medical ward (a)	Annual cost (b) in US$	Proportion of time (on average) spent working on the ~~TB~~ medical ward (c)	Total ~~annual~~ cost in US$ for work on the ~~TB~~ medical ward, first 9 months of the year {i.e. (a) x (b) x (c)} x 0.75	Who pays?
Enrolled nurse	9	1,673	1	11,293	Charitable funds from overseas

Total annual cost of nursing staff (all types) = US$ 11,293

(b) Medical staff costs

Type of medical staff who work on the ~~TB~~ medical ward (e.g. doctors, clinical officers)	Number who work on ~~TB~~ medical ward (a)	Annual cost (b) in US$	Proportion of time (on average) spent working on the ~~TB~~ medical ward (c)	Total ~~annual~~ cost in US$ for work on the ~~TB~~ medical ward, for first 9 months of year {i.e. (a) x (b) x (c)} x 0.75	Who pays?
Enrolled nurse	1	3,080	0.025 (1 half day per month)	11,293	Charitable funds from overseas

Total annual cost of medical staff (all types) = US$ 58

(c) Support staff costs

Type of support staff who work on the TB ward (e.g. cleaners, clerks)	Number who work on the TB ward (a)	Annual cost (b) in US$	Proportion of time (on average) spent working on the TB ward (c)	Total annual cost in US$ for work on the TB ward {i.e. (a) x (b) x (c)}	Who pays?
N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Total annual cost of support staff (all types) = US$ 0

(d) Building costs

Cost to build ~~TB~~ medical ward new in US$	Annualized cost of ~~TB~~ medical ward in US$ {i.e. (a) ÷ ~~25.73~~ 9.43)	Who pays?
5,180	412 for 9 months	Charitable funds from overseas

Note: in this study, it was considered appropriate to use a discount rate of 10% and an expected years of useful life for buildings of 30 years. Therefore, the relevant annualization factor to divide by was 9.43, rather than 25.73.

(e) Staff overhead costs, *excluding* kitchen and laundry staff

Type of staff who are not involved in direct patient care, excluding those working in kitchen/laundry services, the laboratory and X-ray departments, and any support staff already included in (c)	Annual cost (a) in US$	Number employed (b)	Total annual cost in US$ {i.e. (a) x (b)}	Who pays?
Important note: Protocol 1 and this accompanying section of the data entry sheets were modified after data were collected from Machakos. Therefore, while the quantities and annual costs of each type of support staff working in the hospital were recorded, the analysis available aggregated these data. Therefore, in this worked example, only the total cost is recorded. It is, however, recommended that, as indicated in the final version of the protocol and accompanying data entry sheets, the details regarding the number and cost of each type of staff should be recorded.				
ALL	N.A.	N.A.	15,771 per year 11,828 for 9 months	Charitable funds from overseas

1. Total ~~annual~~ costs for 9 months of hospital staff not involved in direct patient care, excluding kitchen and laundry staff, laboratory and X-ray staff, and other support staff already included in part (c) =
US$ 11,828

2. Total annual cost of staff involved in administrative/general management duties =
US$ 8,000, cost for 9 months = US$ 6,000

3. Total ~~annual~~ cost for 9 months of all hospital staff not involved in direct patient care *excluding* both kitchen/laundry staff *and* those involved in administration/general management *and* any support staff listed in part (c) *and* those who work in the laboratory and X-ray departments =
US$ 5,828

4. Fill in (i) and (ii) below

(i) Total annual cost of staff who typically work in inpatient services and are involved in direct patient care =
US$ 13,891

(ii) Total annual cost of staff who typically work in outpatient services and are involved in direct patient care =
US$ 4,631

5. Proportion of total overhead staff costs to be allocated to inpatient care =
0.75

6. Fill in (i) and (ii) below

(i) Administrative/general management staff costs to be allocated to inpatient services =
US$ 6,000 x 0.75 = US$ 4,500

(ii) General overhead staff costs (*excluding* staff involved in administration/general management, and excluding kitchen/laundry staff) to be allocated to inpatient services =
US$ 5,828 x 0.75 = US$ 4,371

Note that in each case this is the proportion calculated in 5 multiplied by the appropriate total cost recorded in 2 and 3.

7. Total annual number of hospital inpatient days accounted for by ~~tuberculosis~~ medical patients = Total for first 9 months of 1997 = 2 025

8. Total ~~annual~~ number of hospital inpatient days =
Total for first 9 months = 4 604

9. Proportion of all hospital inpatient days accounted for by ~~tuberculosis~~ medical patients =
0.44

{Note that this is total recorded in 7 ÷ total recorded in 8}

10. Value of hospital-based administrative/general management staff overhead costs to be allocated to ~~tuberculosis~~ medical patients = 0.44 x US$ 4,500 = US$ 1,980

This figure gives the total administrative/general management staff overhead costs associated with tuberculosis patients.

11. Cost of general overhead staff *excluding those involved in administration/general management, and excluding kitchen/laundry staff, and excluding support staff already identified in section (c), and excluding staff who work in the laboratory and X-ray departments* to be allocated to ~~tuberculosis~~ medical patients = 0.44 x US$ 4,371 = US$ 1,923

This figure gives the total staff overhead costs (excluding staff involved in administration/general management) associated with ~~tuberculosis~~ medical patients.

(f) Kitchen and laundry service costs

1. The total annual cost of staff employed in kitchen/laundry services

Type of staff (e.g. job category, title, grade)	**Annual cost (a) in US$**	**Number employed in kitchen/laundry services (b)**	**Total ~~annual~~ cost in US$ for 9 months {i.e. (a) x (b)} x 0.75**	**Who pays?**
Cook	1,120	1	840	Charitable funds from overseas
Laundry staff	1,120	1	840	Charitable funds from overseas

2. Total annual cost of kitchen/laundry staff (all types) = US$ 1,680

3. Cost to build kitchen and laundry buildings new = US$ 1,724

4. Annualized cost of kitchen and laundry buildings = US$ 183
(assumes discount rate of 10% and expected years of useful life of 30 years)

5. Total non-staff ~~annual~~ recurrent expenditure for kitchen and laundry services = US$ 9,207 for 9 months

Cost item	~~Annual~~ cost for 9 months in US$	Who pays?
Staff	1,680	Charitable funds from overseas
Kitchen and laundry buildings	137	Charitable funds from overseas
Non-personnel recurrent expenditure (e.g. food)	9,027	Charitable funds from overseas
TOTAL	10,844	Charitable funds from overseas

6. Total ~~annual~~ costs for 9 months of staff, buildings and non-staff recurrent expenditure associated with kitchen and laundry facilities = US$ 10,844

7. Proportion of inpatient days for which tuberculosis patients account = 0.44

8. **Total annual costs of kitchen and laundry services to be allocated to ~~tuberculosis~~ medical patients = 4,771**

(g) General hospital recurrent overhead costs, excluding staff, items associated with drugs, laboratory tests and X-rays, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients

1. (i) Total annual cost of general non-personnel recurrent hospital expenditure for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients = US$ 38,136 for first 9 months of the year

OR

(ii) Total annual cost of general non-personnel recurrent hospital expenditure *for inpatient services* for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients =

OR

(iii) Total annual cost of general non-personnel recurrent *district* expenditure for all items except those associated with drugs, the laboratory and the X-ray department, kitchen and laundry facilities, and any other items clearly irrelevant to tuberculosis patients =

2. Proportion of total recurrent costs calculated in 1 to be allocated to inpatient services = 0.75

3. Total non-personnel overhead recurrent costs associated with inpatient services = 0.75 x US$ 38,136 = US$ 28,602

4. Proportion of inpatient days for which ~~tuberculosis~~ medical patients account = 0.44

5. Overhead non-personnel recurrent costs to be allocated to ~~tuberculosis~~ medical patients = 0.44 x US$ 28,602 = US$ 12,585

Total ~~annual~~ non-staff recurrent overhead costs to be allocated to ~~tuberculosis~~ medical patients for first 9 months of year = US$ 12,585

Summary table for non-staff recurrent overhead costs to be allocated to tuberculosis patients

Total non-staff recurrent overhead costs to be allocated to ~~tuberculosis~~ medical patients in US$	**Who pays?**
12,585	Charitable funds from overseas

(h) General building and equipment costs

1. Buildings in the hospital which are used for general support services = None, there are no other general buildings e.g. there is no administration block

2. Cost to construct buildings used for general support services new = N.A.

3. Annualized cost of buildings used for general support services = N.A.

4. Estimated annualized cost of general equipment used by all services = N.A.

5. Total annualized cost of buildings and equipment = N.A.

6. Proportion of general building and equipment costs to be allocated to inpatient services = N.A.

7. Building and equipment costs associated with inpatient services = N.A.

8. Proportion of total inpatient days for which tuberculosis patients account = N.A.

9. Total annual building and equipment costs to be allocated to tuberculosis patients = N.A.

Total annual building and equipment costs to be allocated to tuberculosis patients = N.A.

Summary table for the costs of general buildings and equipment to be allocated to tuberculosis patients

Item	Total annual cost in US$	Who pays?
General buildings	N.A.	N.A.
General equipment	N.A.	N.A.

The average cost of a day in hospital, excluding drugs, laboratory tests and X-rays

Cost item	Total ~~annual~~ cost for 9 months in US$	Average cost per day (% total)	
Nursing staff	11,293	5.6	(34)
Medical staff	58	0.03	(0.1)
Support staff	0	0	(0)
~~TB~~ Medical ward buildings	412	0.2	(1)
Administrative/general management staff	1,980	1.0	(6)
Staff overheads *excluding* administration/general management staff	1,923	0.9	(6)
Kitchen and laundry services	4,771	2.4	(15)
General non-personnel recurrent overheads	12,585	6.2	(38)
General buildings and equipment	0	0	(0)
Total (all items)	33,022	16.3	

Note that to calculate the average cost per day, the total annual cost of each item needs to be divided by the total annual number of ~~tuberculosis~~ medical inpatient days

Estimated average incremental cost per day = US$ 15.3

Estimated marginal cost per day = US$ 2.4 in short-run (kitchen and laundry)

Utilization

1. Bed occupancy rate for the hospital as a whole = 70%

2. Bed occupancy rate for the ~~TB~~ medical ward (or the main ward on which TB patients are cared for) = 60%

3. Hospital appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

4. Justification for choice:

Bed occupancy rate is less than 85% on average and rarely reaches 85%

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Charitable funds from overseas	33,022	100%
ALL SOURCES	33,022	100%

Protocol 3: The cost of an outpatient visit to a ~~clinic/health centre (or similar non-hospital facility)~~ specialized TB clinic

Name of District on which data are based: Machakos, Kenya

Year on which data are based: 1998

Important note: many patients use the specialized TB clinic at Machakos Provincial Hospital for DOT during the first 2 months of treatment, and others visit for collection of drugs/monitoring visits. Since there was no protocol specifically for such a dedicated clinic, Protocol 3 for clinics/other non-hospital facilities was used (and Approach 1 was chosen)

Approach 1

1. Total ~~annual~~ cost of staff employed in clinics/other non-hospital facilities that exist for 9 months = US$ 5,845 x 0.75 = US$ 4,384

(for 1 clinical officer, 2 nurses and 1 clerk)

2. Total annual non-staff related recurrent expenditure for ~~clinics/other non-hospital facilities~~ specialized TB clinic, excluding drugs, laboratory tests and X-rays = estimated to be negligible

3. Cost to build, new, the clinics/other non-hospital facilities that exist = US$ 12,069

4. Annualized cost of clinics/other non-hospital facilities = US$ 1,280, cost for 9 months = US$ 960

5. Estimated annual cost of equipment used in clinics/other non-hospital facilities = US$ 96

6. Total cost for staff, buildings and equipment, and non-personnel recurrent expenditure = US$ 5,440

7. Total ~~annual~~ number of visits made to ~~clinics/other non-hospital facilities~~ specialized TB clinic, first 9 months 1998 = 3 487

8. Average cost of a visit to a clinic/other non-hospital facility = (6) ÷ (7) = US$ 1.5

Cost item	Total cost in US$	Who pays?
Staff	4,384	Ministry of Health
Buildings and equipment	1,056	Ministry of Health
Non-staff recurrent expenditure, excluding drugs, laboratory tests and X-rays	0 (negligible)	Ministry of Health
TOTAL	5,440	Ministry of Health

Protocol 3: The cost of an outpatient visit to a clinic/health centre (or similar non-hospital facility)

Name of District on which data are based: Machakos

Year on which data are based: 1998

Approach 2

Nursing staff

Type of staff who work in clinics/other non-hospital facilities	Annual cost (a)	Number employed in clinics/other non-hospital facilities (b)	Total ~~annual~~ cost in US$ for first 9 months of the year {i.e. (a) x (b)} x 0.75	Who pays?
Enrolled nurse	US$1,673	47	US$ 58,973	Ministry of Health

(a) Total ~~annual~~ cost of nursing staff who work in clinics/other non-hospital facilities for 9 months = US$ 58,973

Medical and other staff

Type of medical staff and other staff who work in clinics/other non-hospital facilities	Annual cost for each type of staff (a) in US$	Number of medical staff/ other types of staff who work in clinics/other non-hospital facilities (b)	Estimated proportion of time spent working in clinics/other non-hospital facilities (c)	Total annual cost of medical/ other types of staff who work in clinics/ other non-hospital facilities {i.e. (a) x (b) x (c)} in US$	Who pays?
Doctor	3,080	1	1	3,080	Ministry of Health
Clinical officer	1,485	5	1	7,425	As above
Laboratory staff	1,671	5	1	8,355	As above
Administrator	1,869	1	1	1,869	As above
Driver	1,553	2	1	3,106	As above
Support staff	621	28	1	17,388	As above
Public health technician	1,711	28	1	47,908	As above
Clerk	911	10	1	9,110	As above
Health educator	1,633	8	1	13,064	As above
Nutritionist	1,119	3	1	3,357	As above

(b) Total annual cost of medical and other staff who work in clinics = US$ 114,662, US$ 85,997 for first 9 months of 1998

(c) Total annual recurrent expenditure excluding staff costs and any costs associated with drugs, laboratory tests and X-rays = US$ 15,697 for first 9 months

(d) Cost to build clinics/other non-hospital facilities new = US$ 793,103

(e) Annualized cost of clinic/other non-hospital facility buildings = US$ 84,104, US$ 63,078 for 9 months

(f) Estimated annualized cost of equipment used in clinics = US$ 6,307.8

(g) Total annual costs of staff, recurrent expenditure (excluding staff, and any items associated with drugs, laboratory tests, and X-rays) {(a) + (b) + (c) + (e) + (f)} =

Cost item	**Total ~~annual~~ cost for first 9 months of 1998 in US$**	**Who pays?**
Nursing staff	58,973	Ministry of Health
Medical staff	85,997	Ministry of Health
Non-staff recurrent expenditure, excluding drugs, laboratory tests and X-rays	15,697	Ministry of Health
Buildings and equipment	69,385.8	Ministry of Health
TOTAL	230,052.8	Ministry of Health

(h) Total annual number of visits to clinics/other non-hospital facilities = 91 489 for first 9 months of 1998

Average cost per visit to a clinic/other non-hospital facility = (g) ÷ (h) = 230,052.8 ÷ 91 489 = US$ 2.5

Average incremental cost = US$ 1.8

Marginal cost = US$ 0 in the short-run (there appears to be some spare capacity)

Utilization

1. Clinic/other non-hospital outpatient services appear:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

2. Justification for choice:

Clinics, and dispensaries in particular, are not busy throughout the day

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	230,052.8	100%
ALL SOURCES	230,052.8	**100%**

Protocol 5: The cost of a drug regimen

Year on which data are based: 1998

Cost of regimen for a new smear-positive pulmonary tuberculosis patient =
Regimen used in 1997 = US$ 43 for an adult
Regimen used in 1998 = US$ 28 for an adult (streptomycin replaced with ethambutol)

Cost of regimen for a new smear-negative pulmonary tuberculosis patient =
Regimen used in 1997 and 1998 = US$ 25

Cost of regimen for an new extra-pulmonary tuberculosis patient =
As for smear-negative pulmonary patients

Cost of regimen for a re-treatment tuberculosis patient =
not relevant to this analysis

Cost of regimen for ..... =

Cost of regimen for ..... =

Cost or regimen for ..... =

Average cost of regimen for a new smear-positive pulmonary tuberculosis patient =

Average cost of regimen for a new smear-negative pulmonary tuberculosis patient =

Average cost of regimen for a new extra-pulmonary tuberculosis patient =

Average cost of regimen for a re-treatment patient =

Average cost of regimen for an adult tuberculosis patient =

Average cost of regimen for a child tuberculosis patient =

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	230,052.8	100%
ALL SOURCES	230,052.8	**100%**

Protocol 6: The cost of a sputum smear

Name of District and department on which data are based:

Machakos District, Kenya
(not based on a particular department as a quoted figure from private facilities, where most sputum smears are done, was used)

Year on which data are based: 1998

Approach 1

1. Quoted average cost per smear = US$0.9
2. Source of quote = Private laboratories in Machakos

3. Source of financing for sputum smears = patients pay out-of-pocket

Average incremental cost = US$ 0.9

Marginal cost = US$ 0.9

Utilization

1. Laboratory services for sputum smear microscopy appear:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A. as not utilization not assessed.

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Patients out-of-pocket expenditure	**Not known**	**100%**
ALL SOURCES	Not known	100%

Protocol 10: The cost of TB programme management at district level

Name of District on which data are based: Machakos

Year on which data are based: 1997

(a) Staff costs

Staff involved in district TB programme management	Annual cost (a) in US$	Proportion of time spent on district TB programme management (b)	~~Annual~~ cost in US$ of time spent on district TB programme management for 9 months i.e. {(a) x (b)} x 0.75	Who pays?
1 district tuberculosis and leprosy officer	2,192	1	1,644	Ministry of Health

Total cost of staff involved in district TB programme management = US$ 1,644

(b) Building costs

Cost to build those buildings used for district TB programme management new in US$	Annualized cost of buildings used for district TB programme management {i.e. (a) ÷ 25.73) in US$	Who pays?
N.A.	N.A.	N.A.

Note: no buildings are used for district programme management

(c) Fuel costs/~~ALL costs~~ associated with vehicle usage* (delete as appropriate, depending on the mileage/km rate available and what this rate covers)

1. Total miles/kilometres travelled by district vehicles for TB programme management each year = N.A. (no vehicle)

2. Rate paid per km/mile for vehicle usage = N.A.

3. Total annual cost of fuel/ALL costs* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district vehicles for TB programme management = N.A.

4. Total miles/kilometres travelled by district motorbikes each year for district TB programme management = N.A. – see 6 and 7.

5. Rate paid per km/mile for motorbike usage = N.A. – see 6 and 7.

6. Total annual cost of fuel/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district motorbikes for TB programme management = US$ 1,080 for 9 months

7. Total ~~annual~~ cost for fuel for 9 months/~~ALL costs~~*** (delete as appropriate, depending on the mileage/km rate available and what this rate covers) associated with use of district vehicles and motorbikes for district TB programme management** = US$ 1,080 for 9 months

8. Source of funds for fuel/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district vehicles and motorbikes for TB programme management =
Ministry of Health

(d) Vehicles/motorbikes/other transport costs

Table 1a

Vehicles/motorbikes/ other transport used for district TB programme management	Purchase price new in US$	Expected years of useful life when new	Annualized cost in US$
1 motorbike	1,034	10	168

Note: annualized cost based on discount rate of 10%

Table 1b

Vehicles/ motorbikes/ other transport used for district TB programme management	Annualized cost (a) in US$	Number of days used for district TB programme management each year (b)	Total number of days used per year, all purposes (c)	Cost of vehicles/ motorbikes/ other transport used for district TB programme management in US$ [i.e. {(b)÷(c)} x (a)]	Who pays?
1 motorbike	168	250	250	168	Ministry of Health

Total annual cost of vehicles/motorbikes etc. = US$ 168, US$126 for 9 months

(this is the sum of the totals entered in column 5 of table 1b)

(e) Maintenance costs

1. Estimated annual cost for maintenance = 0.15 x US$ 1,080 = US$ 162

2. Source of funds for maintenance costs = Ministry of Health

(f) Other costs

1. Other costs (e.g. supplies, stationery etc.) = 0

2. Source of funds for "other costs" = N.A.

The cost of district tuberculosis programme management

Cost item	Total ~~annual~~ cost for 9 months in US$
Staff	1,644
Buildings	0
Fuel	1,080
Vehicles and motorbikes	126
Maintenance	162
Other general recurrent costs	0
TOTAL	3,012

Annual number of tuberculosis patients in the district = 3 808 over 9 months

Average cost of district TB programme management per patient = US$ 0.8

Average incremental cost of district TB programme management per patient = US$ 0.8

Marginal cost of district TB programme management per patient = US$ 0.8

Utilization

1. District TB programme management appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A. as utilization not assessed

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	3,012	100%
ALL SOURCES	3,012	**100%**

Protocol 10: The cost of TB programme management at district level

Name of District on which data are based: Machakos

Year on which data are based: 1998

(a) Staff costs

Staff involved in district TB programme management	Annual cost (a) in US$	Proportion of time spent on district TB programme management (b)	~~Annual~~ cost in US$ of time spent on district TB programme management for 9 months i.e. {(a) x (b)} x 0.75	Who pays?
1 district tuberculosis and leprosy officer	2,192	1	1,644	Ministry of Health

Total cost of staff involved in district TB programme management = US$ 231 for 9 months

(b) Building costs

Cost to build those buildings used for district TB programme management new in US$	Annualized cost of buildings used for district TB programme management {i.e. (a) ÷ 25.73) in US$	Who pays?
N.A.	N.A.	N.A.

Note: no buildings used for district programme management

(c) Fuel costs/~~ALL costs~~ associated with vehicle/motorbike usage* (delete as appropriate, depending on the mileage/km rate available and what this rate covers)

1. Total miles/kilometres travelled by district vehicles for TB programme management each year = N.A., no vehicle used

2. Rate paid per km/mile for vehicle usage = N.A.

3. Total annual cost of fuel/ALL costs* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district vehicles for TB programme management = N.A.

4. Total miles/kilometres travelled by district motorbikes each year for district TB programme management = N.A., see 7.

5. Rate paid per km/mile for motorbike usage = N.A., see 7.

6. Total ~~annual~~ cost of fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district motorbikes for TB programme management = US$ 2,160

7. Total ~~annual~~ cost for fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) associated with use of district vehicles and motorbikes for district TB programme management = US$ 2,160

8. Source of funds for fuel/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of district vehicles and motorbikes for TB programme management =
Ministry of Health

(d) Vehicles/motorbikes/other transport costs

Table 1a

Vehicles/motorbikes/ other transport used for district TB programme management	Purchase price new in US$	Expected years of useful life when new	Annualized cost in US$
1 motorbike	1,034	10	168

Note: annualized cost based on discount rate of 10%

Table 1b

Vehicles/ motorbikes/ other transport used for district TB programme management	Annualized cost (a) in US$	Number of days used for district TB programme management each year (b)	Total number of days used per year, all purposes (c)	Cost of vehicles/ motorbikes/ other transport used for district TB programme management in US$ [i.e. {(b)÷(c)} x (a)]	Who pays?
1 motorbike	168	250	250	168	Ministry of Health

Total annual cost of vehicles/motorbikes etc. = US$ 168, US$ 126 for 9 months

(this is the sum of the totals entered in column 5 of table 1b)

(e) Maintenance costs

1. Estimated annual cost for maintenance = 0.15 x US$ 2,160 = US$ 324

2. Source of funds for maintenance costs = Ministry of Health

(f) Other costs

1. Other costs (e.g. supplies, stationery etc.) = 0

2. Source of funds for "other costs" = N.A.

The cost of district tuberculosis programme management

Cost item	Total ~~annual~~ cost for 9 months in US$
Staff	1,644
Buildings	0
Fuel	1,080
Vehicles and motorbikes	126
Maintenance	162
Other general recurrent costs	0
TOTAL	3,012

Annual number of tuberculosis patients in the district = 3 567

Average cost of district TB programme management per patient =
US$ 1.2

Average incremental cost of district TB programme management per patient =
US$ 1.2

Marginal cost of district TB programme management per patient =
US$ 1.2

Utilization

1. District TB programme management appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A.

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	4,254	100%
ALL SOURCES	4,254	**100%**

Protocol 11: The cost of TB programme management at regional/provincial level

Name of Region/Province on which data are based:

Eastern Province, Kenya

Year on which data are based: 1997

(a) Staff costs

Staff involved in regional/ provincial TB management	Annual cost (a) in US$	Proportion of time spent on regional/ provincial TB programme management (b)	Annual cost of time spent on regional/ provincial TB programme management i.e. {(a) x (b)}	Who pays?
1 provincial TB officer	3,724	0.05 in Machakos	US$186, for 9 months US$ 140	Ministry of Health
1 driver	1,890	0.05 in Machakos	US$95, for 9 months US$ 71	Ministry of Health

Total cost of staff involved in regional/provincial TB programme management = US$ 231 for 9 months

(b) Building costs

Cost to build those buildings used for regional/ provincial TB programme management new in US$	Annualized cost of buildings used for regional/provincial TB programme management {i.e. (a) ÷ 25.73) in US$	Who pays?
N.A.	N.A.	N.A.

Note: no buildings used for provincial programme management

(c) Fuel costs/~~ALL costs~~ associated with vehicle/motorbike usage* (delete as appropriate, depending on the mileage/km rate available and what this rate covers)

1. Total miles/kilometres travelled by regional/provincial vehicles for TB programme management each year = see 7.

2. Rate paid per km/mile for vehicle usage = N.A. see 7.

3. Total annual cost of fuel/ALL costs* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial vehicles for TB programme management = N.A. see 7.

4. Total miles/kilometres travelled by regional/provincial motorbikes each year for regional/provincial TB programme management = N.A., no motorbikes used

5. Rate paid per km/mile for motorbike usage = N.A.

6. Total ~~annual~~ cost of fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial motorbikes for TB programme management =
US$ 450 in Machakos

7. Total ~~annual~~ cost for fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) associated with use of regional/provincial vehicles and motorbikes for regional/provincial TB programme management = US$ 450 in Machakos

8. Source of funds for fuel/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial vehicles and motorbikes for TB programme management =
Ministry of Health

(d) Vehicles/motorbikes/other transport costs

Table 1a

Vehicles/motorbikes etc. used for regional/provincial TB programme management	Purchase price new in US$	Expected years of useful life when new	Annualized cost in US$
1 vehicle	34,483	10	5,612

Table 1b

Vehicles/ motorbikes/ other transport used for regional/ provincial TB programme management	Annualized cost (a) in US$	Number of days used for regional/ provincial TB programme management each year (b)	Total number of days used per year, all purposes (c)	Cost of vehicles/ motorbikes/ other transport used for regional/ provincial TB programme management in US$ [i.e. {(b)÷(c)} x (a)]	Who pays?
1 vehicle	5,612	12.5 in Machakos	250	281	Ministry of Health

Total annual cost of vehicles/motorbikes etc. = US$ 281, US$ 211 for 9 months

(this is the sum of the totals entered in column 5 of table 1b)

(e) Maintenance costs

1. Estimated annual cost for maintenance = 0.15 x US$ 450 = US$ 67.5

2. Source of funds for maintenance costs = Ministry of Health

(f) Other costs

1. Other costs (e.g. supplies, stationery etc.) = 0

2. Source of funds for "other costs" = N.A.

The cost of regional/provincial tuberculosis programme management

Cost item	Total ~~annual~~ cost for 9 months in US$
Staff	231
Buildings	0
Fuel	450
Vehicles and motorbikes	211
Maintenance	67.5
Other general recurrent costs	
TOTAL	959.5

Annual number of tuberculosis patients in the region/province = 3 808 in Machakos

Average cost of regional/provincial TB programme management per patient = US$ 0.25

Average incremental cost of regional/provincial TB programme management per patient = US$ 0.25

Marginal cost of regional/provincial TB programme management per patient = US$ 0.25

Utilization

1. Regional/provincial TB programme management appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A. as utilization not assessed

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	959.5	100%
ALL SOURCES	959.5	**100%**

Protocol 11: The cost of TB programme management at regional/provincial level

Name of Region/Province on which data are based: Machakos

Year on which data are based: 1998

(a) Staff costs

Staff involved in regional/ provincial TB management	Annual cost (a) in US$	Proportion of time spent on regional/ provincial TB programme management (b)	~~Annual~~ cost of time spent on regional/ provincial TB programme management for 9 months i.e. {(a) x (b)}x 0.75	Who pays?
1 provincial tuberculosis officer	3,724	0.11 in Machakos	US$ 410, US$ 307 for 9 months	Ministry of Health
1 driver	1,890	0.11 in Machakos	US$ 208, US$ 156 for 9 months	Ministry of Health

Total cost of staff involved in regional/provincial TB programme management = US$ 463 for 9 months

(b) Building costs

Cost to build those buildings used for regional/ provincial TB programme management new in US$	Annualized cost of buildings used for regional/provincial TB programme management {i.e. (a) ÷ 25.73) in US$	Who pays?
N.A.	N.A.	N.A.

Note: No buildings used for provincial programme management

(c) Fuel costs/~~ALL costs~~ associated with vehicle/motorbike usage* (delete as appropriate, depending on the mileage/km rate available and what this rate covers)

1. Total miles/kilometres travelled by regional/provincial vehicles for TB programme management each year = N.A. see 7.

2. Rate paid per km/mile for vehicle usage = N.A. see 7.

3. Total annual cost of fuel/ALL costs* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial vehicles for TB programme management = see 7.

4. Total miles/kilometres travelled by regional/provincial motorbikes each year for regional/provincial TB programme management = N.A., no motorbikes used for provincial programme management

5. Rate paid per km/mile for motorbike usage = N.A.

6. Total ~~annual~~ cost of fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial motorbikes for TB programme management = US$ 656

7. Total ~~annual~~ cost for fuel for 9 months/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) associated with use of regional/provincial vehicles and motorbikes for regional/provincial TB programme management = US$ 656

8. Source of funds for fuel/~~ALL costs~~* (delete as appropriate, depending on the mileage/km rate available and what this rate covers) that are associated with use of regional/provincial vehicles and motorbikes for TB programme management = Ministry of Health

(d) Vehicles/motorbikes/other transport costs

Table 1a

Vehicles/motorbikes etc. used for regional/provincial TB programme management	Purchase price new in US$	Expected years of useful life when new	Annualized cost in US$
1 vehicle	34,483	10	5,612

Table 1b

Vehicles/ motorbikes/ other transport used for regional/ provincial TB programme management	Annualized cost (a) in US$	Number of days used for regional/ provincial TB programme management each year (b)	Total number of days used per year, all purposes (c)	Cost of vehicles/ motorbikes/ other transport used for regional/ provincial TB programme management in US$ [i.e. {(b)÷(c)} x (a)]	Who pays?
1 vehicle	5,612	27.5	250	US$ 617, US$ 463 for 9 months	Ministry of Health

Total ~~annual~~ cost of vehicles/motorbikes etc. for 9 months = US$ 463

(this is the sum of the totals entered in column 5 of table 1b)

(e) Maintenance costs

1. Estimated annual cost for maintenance = 0.15 x US$ 656 = US$ 98

2. Source of funds for maintenance costs = Ministry of Health

(f) Other costs

1. Other costs (e.g. supplies, stationery etc.) = allowances for provincial TB officer = US$ 1164, of which 11% allocated to Machakos (in proportion to staff time spent in Machakos) i.e. US$ 128

2. Source of funds for "other costs" = Ministry of Health

The cost of regional/provincial tuberculosis programme management

Cost item	Total ~~annual~~ cost for 9 months in US$
Staff	463
Buildings	0
Fuel	656
Vehicles and motorbikes	463
Maintenance	98
Other general recurrent costs	128
TOTAL	1,808

Annual number of tuberculosis patients in the region/province = 3 567 for first 9 months

Average cost of regional/provincial TB programme management per patient = US$ 0.5

Average incremental cost of regional/provincial TB programme management per patient =

US$ 0.5

Marginal cost of regional/provincial TB programme management per patient = US$ 0.5

Utilization

1. Regional/provincial TB programme management appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess

2. Justification for choice:

N.A. as utilization not assessed

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	1,808	100%
ALL SOURCES	1,808	100%

Protocol 13: The cost of training

District on which data are based: Machakos

Year on which data are based: 1998

Training typically provided to staff involved in delivery of tuberculosis services in a year =
Note: data entered in these data entry sheets focus on the training that was provided specifically for the implementation of decentralized/community-based care, as other types of training were assumed to be the same for each strategy being evaluated

(a) Costs associated with staff providing training

Table 1

Staff involved in providing training	Annual cost (a) in US$	Number of days spent providing training per year (b)	Total number of days staff work per year (c)	Cost per day (d) {i.e. (a) ÷ (c)} in US$	Cost for provision of training {(b) x (d)} in US$	Who pays?
Provincial TB Officer	3,724	5	240	15.5	77.5	Ministry of Health
District TB Officer	2,192	11	240	9.1	100.1	Ministry of Health
1 Field Health Educator (for health worker seminars)	1,633	3	240	6.8	20.4	Ministry of Health
1 doctor from Machakos (for health worker seminars)	3,080	3	240	12.8	38.4	Ministry of Health
Field Health Educators (for public awareness campaigns)	1,633	10	240	6.8	68.0	Ministry of Health

Total costs associated with staff providing training = US$ 304.4

(b) Costs associated with staff receiving training

Table 2

Staff type	Number who typically receive training each year (a)	Number of days per year spent receiving training (b)	Annual cost (c) in US$	Number of days staff are expected to work per year (d)
Doctor	12	1	3,080	240
Clinical Officer	7	1	1,485	240
Public Health Officer	4	1	1,711	240
Administrator	2	1	1,869	240
Statistical Officer	2	1	1,750	240
Nurse (enrolled or registered)	21	1	1,673	240
Community project manager	2	1	3,080	240
Medical Board members	2	1	3,724	240
Health Board members	2	1	3,274	240
Provincial Board members	2	1	3,274	240

Note: this table is actually more one-off training required to facilitate implementation of a new approach to tuberculosis case management, not the type of training that would typically occur every year (as implied by the title in column 2).

Table 3

Staff type	Total number of days spent receiving training i.e. column 2 x column 3 from Table 2 (a)	Cost per day (b) {i.e. (c) ÷ (d) in Table 2} in US$	Subsistence rate + other payments made per day (c)	Total annual cost of training [(a) x {(b) + (c)}] in US$	Who pays?
Doctor	12	12.8	N.A. here, total cost covered in section on "other costs"	153.6	Ministry of Health
Clinical Officer	7	6.2		43.4	Ministry of Health
Public Health Officer	4	7.1		28.4	Ministry of Health
Administrator	2	7.8		15.6	Ministry of Health
Statistical Officer	2	7.3		14.6	Ministry of Health
Nurse (enrolled or registered)	21	7.0		147.0	Ministry of Health
Community project manager	2	12.8		25.6	Ministry of Health
Medical Board members	2	15.5		31.0	Ministry of Health
Health Board members	2	15.5		31.0	Ministry of Health
Provincial Board members	2	15.5		31.0	Ministry of Health

Total annual costs associated with staff being trained = US$ 521.2

(c) Other costs =
Total allowances for accommodation and transport = US$ 16,551
Health education materials = US$ 2,550

Estimated total annual costs for all other costs associated with provision of training = US$ 19,101

Table 4

Cost item	**Annual cost in US$**
Staff providing training	304.4
Staff receiving training	521.2
Other costs	19,101
TOTAL	19,926.6

Total annual number of patients in the area for which training costs have been estimated = approximately 5 000

Average cost of training per patient = US$ 4.0

Average incremental cost per patient = US$ 4.0

Marginal cost per patient = US$ 4.0

Note: training costs have arguably been over-estimated, because the training provided in 1998 was probably more than would normally be required on an annual basis. However, a high estimate was used because it was considered useful to estimate an upper limit for the cost of training.

Utilization

1. Training appears:

Very over-utilized

Over-utilized to some extent

Relatively optimally utilized

Under-utilized to some extent

Very under-utilized

(circle as appropriate)

Not possible to assess as training has already happened and utilization is difficult to assess retrospectively

2. Justification for choice:

N.A. not possible to assess utilization

Financing

Source of finance	Total funding in US$	% of total funding that source accounts for
Ministry of Health	19,926.6	100%
ALL SOURCES	19,926.6	100%

3. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS/ GUIDELINES IN CHAPTER 5

Protocol 1: Analysis of patient cost questionnaire data

Name of District on which data are based: Machakos

Year on which data are based: 1998

1. Average income among interviewed tuberculosis patients who are in paid employment or self-employment = US$ 46 per month

Estimated average income per hour = US$ 0.26

2. Average income among all interviewed patients = US$ 37 per month

(note this is equivalent to valuing the cost of time of those who are not in paid employment as zero)

Estimated average income per hour = US$ 0.21

3. Average wage in the area being studied = US$ 50 per month

Average income per hour = US$ 0.28

Table 1: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average income among tuberculosis patients who are in paid work (either employed or self-employed)

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	1 day	2.1	2.1
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	1.4	1 hour and 46 minutes	0.5	1.9
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	0	0 minutes	Estimated as zero (the community members being used are from the neighbouring household or the same household)	0
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	As above	As above	As above	As above
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT				
Overall (i.e. across all sites) cost of a DOT visit	0.9	1 hour and 33 minutes	0.4	US$ 1.3

Table 2: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average income among tuberculosis patients who are in paid work (employed or self-employed), but as zero for those who are not in paid employment

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	1 day	1.7	1.7
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	1.4	1 hour and 46 minutes	0.4	1.8
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	0	0 minutes	Estimated as zero	0
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	As above	As above	As above	
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT				
Overall (i.e. across all sites) cost of a DOT visit	0.9	1 hour and 33 minutes	0.3	1.2

Table 3: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as the average wage rate in the area being studied

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	1 day	2.3	2.3
Visit to hospital	N.A.	N.A.	N.A.	N.A.
Visit to a health clinic/other non-hospital facility	1.4	1 hour and 46 minutes	0.5	1.9
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	0	0 minutes	Estimated as zero	0
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	As above	As above	As above	As above
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT				
Overall (i.e. across all sites) cost of a DOT visit	0.9	1 hour and 33 minutes	0.4	1.3

Table 4: Average patient costs associated with tuberculosis diagnosis and treatment, assuming time is valued as zero for all patients

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day in hospital	N.A.	1 day	0	0
Visit to hospital	N.A.	N.A.	0	N.A.
Visit to a health clinic/other non-hospital facility	1.4	1 hour and 46 minutes	0	1.4
Visit to a volunteer for DOT, where volunteer chosen for supervision of therapy	0	0	0	0
Visit to a CHW for DOT, where a CHW is chosen for supervision of therapy	As above	As above	0	0
Visit to a health clinic/other non-hospital facility for DOT, where such a site is chosen for DOT			0	
Overall (i.e. across all sites) cost of a DOT visit	0.9	1 hour and 33 minutes	0	0.9

Data entry sheets for analysis of family member costs

Name of District on which data are based: Machakos

Year on which data are based: 1998

1. Average income among interviewed family members who are in paid employment or self-employment = US$ 30 per month

Estimated average income per hour = US$ 0.17

2. Average income among all interviewed family members = US$ 24 per month

(note this is equivalent to valuing the cost of time of those who are not in paid employment as zero)

Estimated average income per hour = US$ 0.14

3. Average wage in the area being studied = US$ 50 per month

Average income per hour = US$ 0.28

Table 1: Data for the average costs associated with providing care for a tuberculosis patient, with time costs valued according to the average income of those family members who are in paid work (either employed or self-employed)

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day spent in hospital	Not applicable			
Visit to hospital				
Visit to patient (per day)	1.4	6 hours and 6 minutes	1.0	2.4
Special items brought for patients	N.A.	N.A.	N.A.	0.5
Accompanying patients on outpatient visits	0.4*	58 minutes*	0.2	0.6

**These average figures are much lower than those for patients because family members did not always accompany patients on such visits*

Table 2: Data for the average costs of providing care for a tuberculosis patient, with time valued as the average income for those family members who are in paid work (employed or self-employed) and as zero for those who are not

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day spent in hospital	Not applicable			
Visit to hospital				
Visit to patient (per day)	1.4	6 hours and 6 minutes	0.8	2.2
Special items brought for patients	N.A.	N.A.	N.A.	0.5
Accompanying patients on outpatient visits	0.4*	58 minutes*	0.1	0.5

**These average figures are much lower than those for patients because family members did not always accompany patients on such visits*

Table 3: Data for the average costs of providing care for a tuberculosis patient, with the time of family members valued as the average wage rate in the area being studied

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day spent in hospital	Not applicable			
Visit to hospital				
Visit to patient (per day)	1.4	6 hours and 6 minutes	1.7	3.1
Special items brought for patients	N.A.	N.A.	N.A.	0.5
Accompanying patients on outpatient visits	0.4*	58 minutes*	0.3	0.7

**These average figures are much lower than those for patients because family members did not always accompany patients on such visits*

Table 4: Data for the average costs of providing care for a tuberculosis patient, with the time of family members valued as zero

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/ hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
Day spent in hospital	Not applicable		0	
Visit to hospital			0	
Visit to patient (per day)	1.4	6 hours and 6 minutes	0	3.1
Special items brought for patients	N.A.	N.A.	0	0.5
Accompanying patients on outpatient visits	0.4*	58 minutes*	0	0.7

**These average figures are much lower than those for patients because family members did not always accompany patients on such visits*

Data entry sheets for analysis of volunteer costs

Name of district on which data are based: Machakos

Year on which data are based: 1998

1. Average income among interviewed volunteers who are in paid employment or self-employment = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

Estimated average income per hour = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

2. Average income among all interviewed volunteers = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

(note this is equivalent to valuing the cost of time of those who are not in paid employment as zero)

Estimated average income per hour = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

3. Average wage in the area being studied = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

Average income per hour = Not asked (see explanation on pages 116-118 for how volunteer costs were estimated)

How community costs were estimated

To facilitate implementation of community-based DOT, training was provided *by* Chiefs and *to* community volunteers and general community members. In total, 10 days were spent by Chiefs in providing training. 182 community volunteers received training, for 1 day each i.e. 182 days in total. 1 400 general members of the community attended training seminars, which took up one half-day i.e. 700 full days.

The economic cost of this time (see Chapter 2 for the distinction between financial and economic costs – no financial costs were incurred by Chiefs or community members) was difficult to estimate. Since the cost of this time indicates the extent to which the new approach to care may impose an economic burden on the community as a whole, a relatively generous time cost per day was assumed. This is useful as representing an upper estimate of the costs imposed by the new approach. The time of Chiefs was valued as similar to that of a senior doctor (given the importance of Chiefs in the community, this may be too low; however, the results are more affected by the cost assigned to members of the general community, whose time at 700 full days was much higher than the 10 days for Chiefs). The time of general community members (who were usually people with relatively high status e.g. teachers, church leaders) who attended seminars was valued as similar to that of a doctor. The time of community volunteers was valued as similar to that of a Field Health Educator.

The results are shown on pages 117-118.

(a) Costs associated with provision of training

Table 1: Provision of training

Type of person providing training	Annual cost (a) in US$	Number of days spent providing training (b)	Days worked per year (c)	Cost per day (d) {i.e. (a) ÷ (c)} in US$	Total cost {i.e. (d) x (b)} in US$
Chief	estimated as for Provincial TB Officer, 3,724	10	No official figure, use figure of 240 (as for health staff)	15.5	155

(b) Costs associated with people receiving training

Table 2: Costs for those receiving training

Person receiving training	Number receiving training (a)	Number of days training provided (b)	Annual cost (c) in US$	Number of days worked per year (d)
Community volunteers	182	1	1,633	240
General community members	1 400	0.5	3,080	240

Table 3

Staff type	Total number of days spent receiving training i.e. column 2 x column 3 from Table 2 (a)	Cost per day (b) {i.e. (c) ÷(d) in Table 2} in US$	Total annual cost of training (a) x (b) in US$
Community volunteers	182	6.8	1,237.6
General community members	700	12.8	8,960.0

Total estimated costs incurred by volunteers and general community members *in providing* training = US$ 155

Total estimated costs incurred by volunteers and general community members *to receive* training = US$ 10,197.6

Total estimated costs incurred by volunteers and general community members to *provide or receive* training = US$ 10,334.6

Cost per patient = US$ 10,334.6 ÷ 5 000 = 2.1

Cost per person receiving training = US$ 10,334.6 ÷ 882 = US$ 11.7

Data for the average costs associated with providing care for a tuberculosis patient

Cost item	Average travel cost (a) in US$	Average time cost {in minutes/hours} (b)	Average time cost {estimated monetary value} (c)	Total average cost {(i.e. (a) + (c)} in US$
DOT visit	0 (qualitative research shows volunteer supervisors usually live in a neighbouring or the same household, and travel costs are never incurred)	0 (reason as for travel costs)	0	0
Training (per patient)	0 (these costs borne by health services – see Protocol 13)	892 days in total, approximately 0.2 per patient	2.1	2.1
Visit to a health facility for collection of drugs	N.A.	N.A.	N.A.	N.A.

4. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 6

Important note: Tables 1 and 2 only were used, as the focus chosen for this evaluation was average costs. 4 copies of Table 2 were used – one for the decentralized/community-based approach to care, one for the hospital-based approach to care, for each of (a) smear-positive pulmonary tuberculosis patients and (b) smear-negative and extra-pulmonary tuberculosis patients.

Protocol 1: Summary of the costs of individual components of diagnosis and treatment

Name of District on which data are based: Machakos, Kenya

Table 1: Average, average incremental and marginal costs associated with different components of tuberculosis services

(a) Health services (Provider) costs

Care component	Average cost in US$	Average incremental cost in US$	Marginal cost
Days in hospital (government facility)	4.0	N.A.	N.A.
Day in hospital (mission/NGO facility)	16.3	N.A.	N.A.
Visits to a clinic/similar non-hospital facility	1.6	N.A.	N.A.
CHW visit	N.A.	N.A.	N.A.
DOT visit* (overall, across all sites used for DOT)	1.4	N.A.	N.A.
Drug regimen (new sm+ pulmonary TB)	43 in 1997 28 in 1998	N.A.	N.A.
Drug regimen (new sm- pulmonary TB)	25	N.A.	N.A.
Drug regimen (extra-pulmonary TB)	25	N.A.	N.A.
Drug regimen (retreatment patients)	N.A.	N.A.	N.A.
Sputum smear	0.9	N.A.	N.A.
Sputum culture	N.A.	N.A.	N.A.
X-ray	N.A.	N.A.	N.A.
Overall patient follow-up/ supervision (per patient)	N.A.	N.A.	N.A.
Programme management: district level (per patient)	0.8 in 1997 1.2 in 1998	N.A.	N.A.
Programme management: regional/provincial level (per patient)	0.25 in 1997 0.5 in 1998	N.A.	N.A.
Programme management: national level (per patient)	N.A.	N.A.	N.A.
Training (per patient)	4	N.A.	N.A.
Visit to specialized TB clinic	1.5	N.A.	N.A.

**** based on 30% of patients visit volunteers (cost to health system = 0), 26% use health centres, 44% use the TB clinic***

(b) Patient costs

Note: for this worked example, patient costs were estimated according to average reported incomes among TB patients (a relatively conservative estimate since it means that the cost of the time of those people who are not earning cash income is valued as zero)

Cost item	Average cost in US$
Day in hospital	1.7
Hospital outpatient visit	N.A.
Visit to a health clinic/similar non-hospital facility	1.8
CHW visit	N.A.
DOT visit to hospital outpatient department, where hospital outpatient department chosen for DOT supervision	N.A.
DOT visit to a health clinic/similar non-hospital facility, where a health clinic/similar non-hospital facility chosen for supervision	Not specifically calculated
DOT visit to a CHW, where CHW chosen for DOT supervision	N.A.
DOT visit to a non-health worker, where a non-health worker chosen for supervision	0
DOT visit (overall, across all sites used for DOT)*	1.2

**see comment for provider costs above*

(c) Family costs

Cost item	Average cost in US$
Day in hospital	
Visit to hospital	2.2
Visits to accompany patients on DOT visits to health facilities (per visit)	0.5
Items brought for patients while in hospital (per day)	0.5

(d) Volunteer costs

Cost item	Average cost in US$
DOT visit	N.A.
Visit to a health facility to collect drugs	N.A.
Training (per patient)	2.1

Protocol 2: Calculating the cost of managing a tuberculosis patient to treatment completion, for any defined case management strategy and type of tuberculosis patient

1. Name of strategy: Conventional, Hospital-based strategy used until October 1997

2. Type of patient: New smear-positive pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital*	60	4.0 (16.3)	240 (978)
Hospital outpatient visits for monitoring/collection of drugs	N.A.	N.A.	N.A.
Visits to a clinic/similar non-hospital facility for monitoring/collection of drugs	5	2.5	12.5
DOT visits	0	N.A.	N.A.
Drug regimen	1	43	43
Sputum smears	3	0.9	2.7
Sputum cultures	N.A.	N.A.	N.A.
X-rays	N.A.	N.A.	N.A.
Overall follow-up/ supervision of patients	N.A.	N.A.	N.A.
Programme management at district level	1	0.8	0.8
Programme management at regional/provincial level	1	0.25	0.25
Programme management at national level	N.A.	N.A.	N.A.
Training	N.A.	N.A.	N.A.
TOTAL*	N.A.	N.A.	299.25 (1,037.25)

** figure in brackets is when mission facilities are used*

Total cost of managing a patient to treatment completion, government services = US$ 299.25

Total cost of managing a patient to treatment completion, mission services = US$ 1,037.25

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	60	1.7	102
Hospital outpatient visits for monitoring	N.A.	N.A.	N.A.
Visits to a health facility for collection of drugs/monitoring	5	1.8	9
DOT visits	N.A.	N.A.	N.A.
TOTAL	N.A.	N.A.	111

(c) Family costs

Care component	Number of days/visits per patient (a)	Average cost of care component (b)	Average cost to manage a patient to treatment completion {(a) x (b)}
Day in hospital	N.A.	N.A.	N.A.
Visit to hospital	60	2.2	132
Other items	60	0.5	30
TOTAL	N.A.	N.A.	162

(d) Volunteer costs

Care component	Number of visits/items required per patient {average, across *all* patients} (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training (per patient)			
TOTAL	N.A.	N.A.	N.A.

Name of strategy: Conventional, Hospital-based strategy used until October 1997

Type of patient: New smear-positive pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Health Services (Provider)	299.25 to 1,037.25	N.A.	N.A.
Patient	111	N.A.	N.A.
Family	162	N.A.	N.A.
Volunteer	N.A.	N.A.	N.A.
TOTAL	572.25 to 1,310.25	N.A.	N.A.

Protocol 2: Calculating the cost of managing a tuberculosis patient to treatment completion, for any defined case management strategy and type of tuberculosis patient

1. Name of strategy: Decentralized/Community-based DOT, introduced in November 1997

2. Type of patient: New smear-positive pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital*	1	4.0 (16.3)	4.0 (16.3)
Hospital outpatient visits for monitoring/collection of drugs	N.A.	N.A.	N.A.
Visits to a clinic/ similar non-hospital facility for monitoring /collection of drugs	5	2.5	12.5
DOT visits	35	1.4	49.0
Drug regimen	1	28	28
Sputum smears	3	0.7	2.1
Sputum cultures	N.A.	N.A.	N.A.
X-rays	N.A.	N.A.	N.A.
Overall follow-up/ supervision of patients	N.A.	N.A.	N.A.
Programme management at district level	1	1.2	1.2
Programme management at regional/provincial level	1	0.5	0.5
Programme management at national level	N.A.	N.A.	N.A.
Training	1	4.0	4.0
TOTAL*	N.A.	N.A.	101.3 (113.6)

** figure in brackets is when mission facilities are used*

Total cost of managing a patient to treatment completion, government services = US$ 101.3

Total cost of managing a patient to treatment completion, mission services = US$ 113.6

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	1	1.7	1.7
Hospital outpatient visits for collection of drugs/monitoring	N.A.	N.A.	N.A.
Visits to a clinic/similar non-hospital facility for collection of drugs/monitoring	5	1.8	9
DOT visits	35	1.2	42
TOTAL	N.A.	N.A.	52.7

(c) Family costs

Care component	Number of days/visits per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	N.A.	N.A.	N.A.
Visits to hospital	1	2.2	2.2
Other items	1	0.5	0.5
Visits to accompany patients on DOT visits	35	0.5	17.5
TOTAL	N.A.	N.A.	20.2

(d) Volunteer costs

Care component	Number of visits/items required per patient (a) {average, across *all* patients} (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training	1	2.1	2.1
TOTAL	N.A.	N.A.	2.1

Name of strategy: Decentralized/Community-based DOT, introduced in October 1997

Type of patient: New smear-positive pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Health Services (Provider)	101.3 to 113.6	N.A.	N.A.
Patient	52.7	N.A.	N.A.
Family	20.2	N.A.	N.A.
Volunteer	2.1	N.A.	N.A.
TOTAL	176.2 to 188.6	N.A.	N.A.

Protocol 2: Calculating the cost of managing a tuberculosis patient from diagnosis to treatment completion, for any defined case management strategy and type of tuberculosis patient

1. Name of strategy: Conventional, Hospital-based strategy used until October 1997

2. Type of patient: New smear-negative and extra-pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital*	30	4.0 (16.3)	120 (489)
Hospital outpatient visits for monitoring/collection of drugs	N.A.	N.A.	N.A.
Visits to a clinic/similar non-hospital facility for monitoring/collection of drugs	10	2.5	25
DOT visits	0	N.A.	N.A.
Drug regimen	1	25	25
Sputum smears	N.A.	N.A.	N.A.
Sputum cultures	N.A.	N.A.	N.A.
X-rays	N.A.	N.A.	N.A.
Overall follow-up/ supervision of patients	N.A.	N.A.	N.A.
Programme management at district level	1	0.8	0.8
Programme management at regional/provincial level	1	0.25	0.25
Programme management at national level	N.A.	N.A.	N.A.
Training	N.A.	N.A.	N.A.
TOTAL*	N.A.	N.A.	171.05 (540.05)

** figure in brackets is when mission facilities are used*

Total cost of managing a patient to treatment completion, government services = US$ 171.05

Total cost of managing a patient to treatment completion, mission services = US$ 540.05

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	30	1.7	51
Hospital outpatient visits for monitoring	N.A.	N.A.	N.A.
Visits to a health facility for collection of drugs/monitoring	10	1.8	18
DOT visits	N.A.	N.A.	N.A.
TOTAL	N.A.	N.A.	69

(c) Family costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Day in hospital	N.A.	N.A.	N.A.
Visit to hospital	30	2.2	66
Other items	30	0.5	15
TOTAL	N.A.	N.A.	81

(d) Volunteer costs

Care component	Number of visits/items required per patient {average, across *all* patients} (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training (per patient)			
TOTAL	N.A.	N.A.	N.A.

Name of strategy: Conventional, Hospital-based strategy used until October 1997

Type of patient: New smear-negative and extra-pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Health Services (Provider)	171.05 to 540.05	N.A.	N.A.
Patient	69	N.A.	N.A.
Family	81	N.A.	N.A.
Volunteer	N.A.	N.A.	N.A.
TOTAL	321.05 to 690.05	N.A.	N.A

Protocol 2: Calculating the cost of managing a tuberculosis patient from diagnosis to treatment completion, for any defined case management strategy and type of tuberculosis patient

1. Name of strategy: Decentralized/Community-based DOT, introduced in November 1997

2. Type of patient: New smear-negative and extra-pulmonary tuberculosis

Table 2: Average cost of managing a patient to treatment completion

(a) Health services (Provider) costs

Care component	Number of days/visits/items required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital*	1	4.0 (16.3)	4.0 (16.3)
Hospital outpatient visits for monitoring/ collection of drugs	N.A.	N.A.	N.A.
Visits to a clinic/ similar non-hospital facility for monitoring /collection of drugs	5	2.5	12.5
DOT visits	35 (as reported by patients)	1.4	49.0
Drug regimen	1	25	25
Sputum smears	N.A.	N.A.	N.A.
Sputum cultures	N.A.	N.A.	N.A.
X-rays	N.A.	N.A.	N.A.
Overall follow-up/ supervision of patients	N.A.	N.A.	N.A.
Programme management at district level	1	1.2	1.2
Programme management at regional/provincial level	1	0.5	0.5
Programme management at national level	N.A.	N.A.	N.A.
Training	1	4.0	4.0
TOTAL*	N.A.	N.A.	96.2 (88.5)

Total cost of managing a patient to treatment completion, government services = US$ 96.2

Total cost of managing a patient to treatment completion, mission services = US$ 108.5

(b) Patient costs

Care component	Number of days/visits required per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	1	1.7	1.7
Hospital outpatient visits for collection of drugs/monitoring	N.A.	N.A.	N.A.
Visits to a clinic/similar non-hospital facility for collection of drugs/ monitoring	5	1.8	9
DOT visits	35	1.2	42
TOTAL	N.A.	N.A.	52.7

(c) Family costs

Care component	Number of days/visits per patient (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
Days in hospital	N.A.	N.A.	N.A.
Visits to hospital	1	2.2	2.2
Other items	1	0.5	0.5
Visits to accompany patients on DOT visits	35	0.5	17.5
TOTAL	N.A.	N.A.	20.2

(d) Volunteer costs

Care component	Number of visits/items per patient {average, across *all* patients} (a)	Average cost of care component (b) in US$	Average cost to manage a patient to treatment completion {(a) x (b)} in US$
DOT visits	N.A.	N.A.	N.A.
Visits to health facilities for collection of drugs	N.A.	N.A.	N.A.
Training	1	2.1	2.1
TOTAL	N.A.	N.A.	2.1

Name of strategy: Decentralized/Community-based DOT, introduced in October 1997

Type of patient: New smear-negative/extra-pulmonary tuberculosis

Table 4: Summary of the average, average incremental and marginal cost of managing a patient to treatment completion

Type of cost	Average cost in US$	Average incremental cost in US$	Marginal cost in US$
Health Services (Provider)	96.2 (108.5)	N.A.	N.A.
Patient	52.7	N.A.	N.A.
Family	20.2	N.A.	N.A.
Lay person	2.1	N.A.	N.A.
TOTAL	171.2 to 183.5	N.A.	N.A.

5. COMPLETED DATA ENTRY SHEETS USING PROTOCOLS IN CHAPTER 7

Protocol 1: Cost-effectiveness analyses for smear-positive pulmonary tuberculosis patients

Name of District/

Districts on which data are based: Machakos, Kenya

Type of strategy for which cost-effectiveness being assessed =

Community-based/Decentralized DOT

Protocol 1a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-positive pulmonary tuberculosis patients

Type of health service provider	% of patients cured (a)	% of patients who completed treatment but for whom cure was not confirmed (b)	% of patients who failed treatment (c)	% of patients who died during treatment (d)	% of patients who defaulted from treatment (e)	% of patients who transferred out of the district during treatment (f)
Government services	74.8	7.6	2.2	7.0	3.6	4.8
Mission services	74.8	7.6	2.2	7.0	3.6	4.8

(i) Government services

1. *Minimum* cure rate achieved, government services = (a) + (b)
= 82.4

2. *Maximum* cure rate achieved, government services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= 74.8 + 7.6 + [{82.4 ÷ (100 – 3.6 – 4.8)} x (3.6 + 4.8)] = 74.8 + 7.6 + 7.6

= 90.0

(ii) Mission services

3. *Minimum* cure rate achieved, mission services = (a) + (b)
= 82.4, as for government services

4. *Maximum* cure rate achieved, mission services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]
= 90.0, as for government services

=

Table 2: the average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	176.2	82.4	90.0
Mission services	188.6	82.4	90.0

5. Estimated cure rate that would apply without the availability of tuberculosis treatment = {(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= {(40 x 0) + (60 x 20)} ÷ 100

= 12

(i) Government services

6. *Minimum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷ (maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (176.2 x 100) ÷ (90 – 12)

= 225.9

7. *Maximum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (176.2 x 100) ÷ (82.4 – 12)

= 250.3

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (188.6 x 100) ÷ (90 – 12)

= 241.8

9. *Maximum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (188.6 x 100) ÷ (82.4 – 12)

= 267.9

Protocol 1b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= 7.0 + [{7 ÷ (100 – 3.6 – 4.8)} x (3.6 + 4.8)]

= 7.0 + (0.076 x 8.4)

= 7.64

2. Estimated *minimum* death rate that would apply in the absence of treatment[13] = (0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)
= (0.6 x 60) + (1 x 40)

= 76

3. Estimated *maximum* death rate that would apply in the absence of treatment = (0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.7 x 60) + (1 x 40)

= 82

4. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 3 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}÷ 100]

= 7.0 + [{82 x (3.6 + 4.8)} ÷ 100]

= 7 + 6.9

= 13.9

5. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 1)

= (176.2 x 100) ÷ (82 – 7.6)

= 236.8

6. *Maximum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum[14] death rate in the absence of treatment estimated in 3 – maximum death rate in presence of treatment estimated in 4)

= (176.2 x 100) ÷ (82 – 13.9)

= 258.7

(ii) Mission services

7. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}]

= as for government services, 7.6%

8. Estimated *minimum* death rate that would apply in the absence of treatment[15] =
(0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services, 76%

9. Estimated *maximum* death rate that would apply in the absence of treatment =
(0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services, 82%

10. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 9 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)} ÷ 100]

= as for government services, 13.9%

11. *Minimum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 7)

= (188.6 x 100) ÷ (82 – 7.6)

= 253.5

12. *Maximum* estimated cost per death averted =

(average cost to manage a patient to treatment completion x 100) ÷ (maximum[16] death rate in the absence of treatment estimated in 9 – maximum death rate in presence of treatment estimated in 10.)

= (188.6 x 100) ÷ (82 – 13.9)

= 276.9

Protocol 1c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 29

2. Estimated *net* number of DALYs gained per death averted for HIV- patients = 27

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated *overall net number* of DALYS gained per death averted =

[(Estimated percentage of patients who are HIV- x estimated *net* number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x 3)] ÷ 100

= {(60 x 27) + (40 x 3)} ÷ 100

= 17.4

(i) Government services

5. *Minimum* estimated cost per DALY gained in government services =

Estimated minimum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 236.1 ÷ 17.4

= 13.6

6. *Maximum* estimated cost per DALY gained in government services =
Estimated maximum cost per death averted in government services ÷ estimated *overall net number* of DALYs gained per death averted

= 258.7 ÷ 17.4

= 14.9

(ii) Mission services

7. *Minimum* estimated cost per DALY gained in mission services =
Estimated minimum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

= 253.5 ÷ 17.4

= 14.6

8. *Maximum* estimated cost per DALY gained in mission services =
Estimated maximum cost per death averted in mission services ÷ estimated *overall net number* of DALYs gained per death averted

= 276.9 ÷ 17.4

= 15.9

Protocol 2: Cost-effectiveness analyses for smear-negative pulmonary and extra-pulmonary tuberculosis patients

Name of District/

Districts on which data are based: Machakos, Kenya

Type of strategy for which cost-effectiveness is being assessed =

Decentralized/Community-based DOT

Protocol 2a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-negative/extra-pulmonary tuberculosis patients

Type of health service provider	% of patients who completed treatment (a)	% of patients who died during treatment (b)	% of patients who defaulted from treatment (c)	% of patients who transferred out of the district during treatment (d)
Government services	77.9	7.5	13.4	2.2
Mission services	77.9	7.5	13.4	2.2

(i) Government services

1. *Minimum* cure rate achieved, government services = (a)

= 77.9

2. *Maximum* cure rate achieved, government services = (a) + [{a ÷ (100 – c – d)} x {c + d}]

= 77.9 + [{77.9 ÷ (100 – 13.4 – 2.2)} x (13.4 + 2.2)]

= 77.9 + 14.4

= 92.3

(ii) Mission services

3. Minimum cure rate achieved, mission services = (a)

= 77.9, as for government services

4. Maximum cure rate achieved, mission services =
(a) + [{a ÷ (100 – c – d)} x {c + d}]

= 92.3, as for government services

Table 2: the average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	171.2	77.9	92.3
Mission services	183.5	77.9	92.3

5. Estimated cure rate that would apply without the availability of tuberculosis treatment =
{(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= (40 x 0) + (60 x 20) ÷ 100

= 12

(i) Government services

6. *Minimum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷ (maximum cure rate – estimated cure rate that would apply without treatment)

= (171.2 x 100) ÷ (92.3 – 12.0)

= 213.2

7. *Maximum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷ (minimum estimated cure rate – estimated cure rate that would apply without treatment)

= {(171.2 x 100) ÷ (77.9 – 12)}

= 259.8

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= {(183.5 x 100) ÷ (92.3 – 12)}

= 228.5

9. *Maximum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= {(183.5 x 100) ÷ (77.9 – 12)}

= 278.5

Protocol 2b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – c – d)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= 19.8 + [{19.8 ÷ (100 – 4.6 – 9.2)} x (4.6 + 9.2)]

= 19.8 + 3.2

= 23.0

2. Estimated death rate that would apply in the absence of treatment[17] = (0.4 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.4 x 60) + (1 x 40)

= 64.0

3. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{death rate in the absence of treatment estimated in 2 x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}÷ 100]

= 19.8 + [{64.0 x (4.6 + 9.2)} ÷ 100]

= 28.6

4. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 1)

= (156.7 x 100) ÷ (64 – 23)

= 382.2

5. *Maximum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – maximum death rate in presence of treatment estimated in 3)

= (156.7 x 100) ÷ (64 – 28.6)

= 442.7

(ii) Mission services

6. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – c – d)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= as for government services = 23.0

7. Estimated death rate that would apply in the absence of treatment[18] = (0.4 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services = 64.0

8. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{death rate in the absence of treatment estimated in 2 x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}÷ 100]

= as for government services, 28.6

9. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 6)

= (163.8 x 100) ÷ (64 – 23)

= 399.5

10. *Maximum* estimated cost per death averted = (average cost per patient treated x 100) ÷ (estimated death rate in the absence of treatment – maximum death rate in presence of treatment estimated in 8)

= (163.8 x 100) ÷ (64 – 28.6)

= 462.7

Protocol 2c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 29

2. Estimated net number of DALYs gained per death averted for HIV- patients = 27

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated number of DALYS gained per death averted =
[(Estimated percentage of patients who are HIV- x estimated number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x estimated number of DALYs gained per death averted in HIV+ patients)] ÷ 100

= 17.4

(i) Government services

5. *Minimum* estimated cost per DALY gained in government services =
Estimated minimum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 382.2 ÷ 17.4

= 22.0

6. *Maximum* estimated cost per DALY gained in government services =
Estimated maximum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 442.7 ÷ 17.4

= 25.4

(ii) Mission services

7. *Minimum* estimated cost per DALY gained in mission services =
Estimated minimum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 399.5 ÷ 17.4

= 23.0

8. *Maximum* estimated cost per DALY gained in mission services =
Estimated maximum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 462.7 ÷ 17.4

= 26.6

Protocol 3: Summary of cost-effectiveness indicators

1. Strategy for which cost-effectiveness is being assessed:

Decentralized/Community-based DOT

Table 1: Summary of cost-effectiveness results, smear-positive pulmonary tuberculosis patients (US$)

Type of provider	Cost per patient cured in US$	Cost per death averted in US$	Cost per DALY gained in US$
Government services	207.0-230.0	217.6-237.7	11.7-12.8
Mission services	216.5-239.9	227.0-248.0	12.2-13.3

Table 2: Summary of cost-effectiveness results, smear-negative pulmonary and extra-pulmonary tuberculosis patients (US$)

Type of provider	Cost per patient cured in US$	Cost per death averted in US$	Cost per DALY gained in US$
Government services	241.0-288.1	382.2-442.7	22.4-25.0
Mission services	252.0-301.1	399.5-462.7	23.0-26.6

Protocol 1: Cost-effectiveness analyses for smear-positive pulmonary tuberculosis patients

Name of District/
Districts on which data are based: Machakos, Kenya

Type of strategy for which cost-effectiveness being assessed =

Conventional hospital-based DOT

Protocol 1a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-positive pulmonary tuberculosis patients

Type of health service provider	% of patients cured (a)	% of patients who completed treatment but for whom cure was not confirmed (b)	% of patients who failed treatment (c)	% of patients who died during treatment (d)	% of patients who defaulted from treatment (e)	% of patients who transferred out of the district during treatment (f)
Government services	52.8	27.6	1.5	8.6	6.2	3.3
Mission services	52.8	27.6	1.5	8.6	6.2	3.3

Note: data only available for district as a whole: outcomes assumed to be the same for government and mission services.

(i) Government services

1. *Minimum* cure rate achieved, government services = (a) + (b)

= 80.4

2. *Maximum* cure rate achieved, government services =
a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= 52.8 + 27.6 + [{80.4 ÷ (100 – 6.2 – 3.3)} x (6.2 + 3.3)] = 80.4 + 8.4

= 89.2

(ii) Mission services

3. *Minimum* cure rate achieved, mission services = (a) + (b)

= 80.4, as for government services

4. *Maximum* cure rate achieved, mission services =

a + b + [{(a + b) ÷ (100 – e – f)} x (e + f)]

= 89.2, as for government services

Table 2: the average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	597.7	80.4	89.2
Mission services	1 023.7	80.4	89.2

5. Estimated cure rate that would apply without the availability of tuberculosis treatment = {(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= {(40 x 0) + (60 x 20)} ÷ 100

= 12

(i) Government services

6. *Minimum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (597.7 x 100) ÷ (89.2 – 12)

= 774.2

7. *Maximum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (597.7 x 100) ÷ (80.4 – 12)

= 873.8

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= (1 023.7 x 100) ÷ (89.2 – 12)

= 1,326.0

9. *Maximum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= (1,023.7 x 100) ÷ (80.4 – 12)

= 1,496.6

Protocol 1b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= 8.6 + [{8.6 ÷ (100 - 6.2 – 3.3)} x (6.2 + 3.3)]

= 8.6 + (0.095 x 9.5)

= 9.5

2. Estimated *minimum* death rate that would apply in the absence of treatment[19] = (0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.6 x 60) + (1 x 40)

= 76

3. Estimated *maximum* death rate that would apply in the absence of treatment = (0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.7 x 60) + (1 x 40)

= 82

4. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 3 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)} ÷ 100]

= 8.6 + [{82 x (6.2 + 3.3)} ÷ 100]

= 8.6 + 7.8

= 16.4

5. *Minimum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 1)

= (597.7 x 100) ÷ (82 – 9.5)

= 818.8

6. *Maximum* estimated cost per death averted =
(average cost to manage a patient to treatment completion x 100) ÷ (maximum[20] death rate in the absence of treatment estimated in 3 – maximum death rate in presence of treatment estimated in 4)

= (597.7 x 100) ÷ (82 – 16.4)

= 911.1

(ii) Mission services

7. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – e – f)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)}]

= as for government services, 9.5%

8. Estimated *minimum* death rate that would apply in the absence of treatment[21] =
(0.6 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services, 76%

9. Estimated *maximum* death rate that would apply in the absence of treatment = (0.7 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services, 82%

10. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{maximum death rate in the absence of treatment estimated in 3 x (percentage of patients who defaulted from treatment + percentage of patients who transferred out of the district during treatment)} ÷ 100]

= as for government services, 16.4%

11. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (maximum estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 7)

= (1 023.7 x 100) ÷ (82 – 9.5)

= 1,412

12. *Maximum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (maximum[22] death rate in the absence of treatment estimated in 8 – maximum death rate in presence of treatment estimated in 10)

= (1 023.7 x 100) ÷ (82 – 16.4)

= 1,560.5

Protocol 1c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 29

2. Estimated net number of DALYs gained per death averted for HIV- patients = 27

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated number of DALYS gained per death averted =
[(Estimated percentage of patients who are HIV- x estimated number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x estimated number of DALYs gained per death averted in HIV+ patients)] ÷ 100

= [(60 x 27) + (40 x 3)] ÷ 100

= 17.4

(i) Government services

5. *Minimum* estimated cost per DALY gained in government services =
Estimated minimum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 818.8 ÷ 17.4

= 47.1

6. *Maximum* estimated cost per DALY gained in government services =
Estimated maximum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 911.1 ÷ 17.4

= 52.4

(ii) Mission services

7. *Minimum* estimated cost per DALY gained in mission services =
Estimated minimum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 1,412 ÷ 17.4

= 81.1

8. *Maximum* estimated cost per DALY gained in mission services =
Estimated maximum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 1,560.5 ÷ 17.4

= 89.7

Protocol 2: Cost-effectiveness analyses for smear-negative pulmonary and extra-pulmonary tuberculosis patients

Type of strategy for which cost-effectiveness is being assessed =

Conventional hospital-based DOT

Protocol 2a: Cost per patient cured

Table 1: Standard treatment outcomes for smear-negative/extra-pulmonary tuberculosis patients

Type of health service provider	% of patients who completed treatment (a)	% of patients who died during treatment (b)	% of patients who defaulted from treatment (c)	% of patients who transferred out of the district during treatment (d)
Government services	77.8	11.2	5.4	5.6
Mission services	77.8	11.2	5.4	5.6

(i) Government services

1. *Minimum* cure rate achieved, government services = (a)

= 77.8

2. *Maximum* cure rate achieved, government services =
(a) + [{a ÷ (100 – c – d)} x {c + d}]

= 77.8 + [{77.8 ÷ (100 – 5.4 – 5.6)} x (5.4 + 5.6}]

= 77.8 + 9.6

= 87.4

(ii) Mission services

3. Minimum cure rate achieved, mission services = (a)

= 77.8, as for government services

4. *Maximum* cure rate achieved, mission services =
(a) + [{a ÷ (100 – c – d)} x {c + d}]

= 87.4, as for government services

Table 2: The average cost of managing a patient to treatment completion and the effectiveness of treatment

Type of health service provider	Average cost to manage a patient to treatment completion in US$	Minimum cure rate	Maximum cure rate
Government services	327	77.8	87.4
Mission services	540	77.8	87.4

5. Estimated cure rate that would apply without the availability of tuberculosis treatment = {(estimated % of patients who are HIV+ x 0) + (estimated percentage of patients who are HIV- x 20)} ÷ 100

= (40 x 0) + (60 x 20) ÷ 100

= 12

(i) Government services

6. *Minimum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(maximum cure rate – estimated cure rate that would apply without treatment)

= (327 x 100) ÷ (87.4 – 12.0)

= 433.7

7. *Maximum* cost per patient cured, government services =
{(average cost to manage a patient to treatment completion, government services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= {(327 x 100) ÷ (77.8 – 12)}

= 497.0

(ii) Mission services

8. *Minimum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(maximum estimated cure rate – estimated cure rate that would apply without treatment)

= {(540 x 100) ÷ (87.4 – 12)}

= 716.1

9. *Maximum* cost per patient cured, mission services =
{(average cost to manage a patient to treatment completion, mission services) x 100} ÷
(minimum estimated cure rate – estimated cure rate that would apply without treatment)

= {(540 x 100) ÷ (77.8 – 12)}

= 820.7

Protocol 2b: Cost per death averted

(i) Government services

1. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – c – d)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= 11.2 + [{11.2 ÷ (100 – 5.4 – 5.6)} x (5.4 + 5.6)]

= 11.2 + 1.5

= 12.7

2. Estimated death rate that would apply in the absence of treatment[23] = (0.4 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= (0.4 x 60) + (1 x 40)

= 64.0

3. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{death rate in the absence of treatment estimated in 2 x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}÷ 100]

= 11.2 + [{64.0 x (5.4 + 5.6)} ÷ 100]

= 18.2

4. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 1)

= (327 x 100) ÷ (64 – 12.7)

= 637.4

5. *Maximum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – maximum death rate in presence of treatment estimated in 3)

= (327 x 100) ÷ (64 – 18.2)

= 714.0

(ii) Mission services

6. Estimated *minimum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{percentage of patients who died during treatment ÷ (100 – c – d)} x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)}]

= as for government services = 12.7

7. Estimated death rate that would apply in the absence of treatment[24] = (0.4 x estimated percentage of patients who are HIV-) + (1 x estimated percentage of patients who are HIV+)

= as for government services = 64.0

8. Estimated *maximum* death rate that applies when tuberculosis treatment is available = (percentage of patients who died during treatment) + [{death rate in the absence of treatment estimated in 2. x (percentage of patients who defaulted from treatment + percentage of patients who transferred during treatment)} ÷ 100]

= as for government services, 18.2

9. *Minimum* estimated cost per death averted = (average cost to manage a patient to treatment completion x 100) ÷ (estimated death rate in the absence of treatment – minimum death rate in presence of treatment estimated in 6.)

= (540 x 100) ÷ (64 – 12.7)

= 1,052.6

10. *Maximum* estimated cost per death averted = (average cost per patient treated x 100) ÷ (estimated death rate in the absence of treatment – maximum death rate in presence of treatment estimated in 8)

= (540 x 100) ÷ (64 – 18.2)

= 1,179.0

Protocol 2c: Cost per DALY gained

1. Estimated number of DALYs gained per death averted for HIV- patients = 29

2. Estimated *net* number of DALYs gained per death averted for HIV- patients = 27

3. Estimated number of DALYs gained per death averted for HIV+ patients = 3

4. Estimated number of DALYS gained per death averted =
[(Estimated percentage of patients who are HIV- x estimated number of DALYs gained per death averted in HIV- patients) + (Estimated percentage of patients who are HIV+ x estimated number of DALYs gained per death averted in HIV+ patients)] ÷ 100

= 17.4

(i) Government services

5. *Minimum* estimated cost per DALY gained in government services =

Estimated minimum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 637.4 ÷ 17.4

= 36.6

6. *Maximum* estimated cost per DALY gained in government services =
Estimated maximum cost per death averted in government services ÷ estimated number of DALYs gained per death averted

= 714 ÷ 17.4

= 41.0

(ii) Mission services

7. *Minimum* estimated cost per DALY gained in mission services =
Estimated minimum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 1,052.6 ÷ 17.4

= 60.5

8. *Maximum* estimated cost per DALY gained in mission services =
Estimated maximum cost per death averted in mission services ÷ estimated number of DALYs gained per death averted

= 1,179 ÷ 17.4

= 67.8

Protocol 3: Summary of cost-effectiveness indicators

1. Strategy for which cost-effectiveness is being assessed:

Conventional hospital-based DOT

Table 1: Summary of cost-effectiveness results, smear-positive pulmonary tuberculosis patients (US$)

Type of provider	Cost per patient cured	Cost per death averted	Cost per DALY gained
Government services	774.2-873.8	818.8-911.1	47.1-52.4
Mission services	1,326.0-1,496.6	1,412-1,560.5	81.1-89.7

Table 2: Summary of cost-effectiveness results, smear-negative pulmonary and extra-pulmonary tuberculosis patients (US$)

Type of provider	Cost per patient cured	Cost per death averted	Cost per DALY gained
Government services	433.7-497.0	637.4-714.0	36.6-41.0
Mission services	716.1-820.7	1,052.6-1,179	60.5.-67.8

Notes

[1] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[2] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[3] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[4] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[5] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[6] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[7] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[8] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[9] This is [4(i) ÷ {4(i) + 4(ii)}]

[10] This should be the same figure as that calculated in (e) step 5, unless this type of expenditure is recorded for the district as a whole rather than for the hospital only, or unless inpatient recurrent expenditure already recorded separately from outpatient services. See instructions for guidance.

[11] This is [4(ii) ÷ {4(i) + 4(ii)}]

[12] This should be the same figure as that calculated in (e) step 5, unless this type of expenditure is recorded for the district as a whole rather than for the hospital only, or unless inpatient recurrent expenditure already recorded separately from outpatient services. See instructions for guidance.

[13] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[14] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[15] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[16] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[17] 0.4 represents the proportion of patients who would be expected to die in the absence of treatment in the absence of HIV infection (see DeJonghe E, Murray CJL et al., 1994). 1 is the proportion of HIV+ patients estimated to die in the absence of treatment.

[18] 0.4 represents the proportion of patients who would be expected to die in the absence of treatment (see DeJonghe E, Murray CJL et al., 1994). 1 is the proportion of HIV+ patients estimated to die in the absence of treatment.

[19] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[20] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[21] 0.6 and 0.7 represent the range in the proportion of cases estimated to die in the absence of treatment for HIV- patients, based on Murray et al. 1990. 1 is the proportion of HIV+ patients estimated to die in the absence of treatment, based on the figure used in a recently published modelling study (Dye et al., 1998)

[22] The maximum is used in this case, rather than the minimum, because it would be inconsistent to use a different assumed death rate among those defaulting/ transferring from the death rate assumed in the absence of treatment

[23] 0.4 represents the proportion of patients who would be expected to die in the absence of treatment in the absence of HIV infection (see DeJonghe E, Murray CJL et al., 1994). 1 is the proportion of HIV+ patients estimated to die in the absence of treatment.

[24] 0.4 represents the proportion of patients who would be expected to die in the absence of treatment (see DeJonghe E, Murray CJL et al., 1994). 1 is the proportion of HIV+ patients estimated to die in the absence of treatment.