Exercise 3.1: Decision tree exercise

1. Introduction

The purpose of the exercise is to replicate an economic evaluation based on a decision tree analysis. When you have attempted the model, we will provide you with an Excel-based answer and a copy of the original paper.

Note: the answers in the spreadsheet are not quite the same as those in the published paper.

2. Context

Box 1 below reproduces the abstract from the original paper. The aim is to build a decision tree model which evaluates the cost-effectiveness of community-based therapeutics (CTC).

Box 1 Abstract from the original paper

Abstract

Background: Children aged under five years with severe acute malnutrition (SAM) in Africa and Asia have high mortality rates without effective treatment. Primary care-based treatment of SAM can have good outcomes but its cost effectiveness is largely unknown.

Method: This study estimated the cost effectiveness of community-based therapeutic care (CTC) for children with severe acute malnutrition in government primary health care centres in Lusaka, Zambia, compared to no care. A decision tree model compared the costs (in year 2008 international dollars) and outcomes of CTC to a hypothetical 'do-nothing' alternative. The primary outcomes were mortality within one year, and disability adjusted life years (DALYs) after surviving one year. Outcomes and health service costs of CTC were obtained from the CTC programme, local health services and World Health Organization (WHO) estimates of unit costs. Outcomes of doing nothing were estimated from published African cohort studies. Probabilistic and deterministic sensitivity analyses were done.

Results: The mean cost of CTC per child was $203 (95% confidence interval (CI) $139–$274), of which ready to use therapeutic food (RUTF) cost 36%, health centre visits cost 13%, hospital admissions cost 17% and technical support while establishing the programme cost 34%. Expected death rates within one year of presentation were 9.2% with CTC and 20.8% with no treatment (risk difference 11.5% (95% CI 0.4–23.0%). CTC cost $1760 (95% CI $592–$10142) per life saved and $ 53 (95% CI $18–$306) per DALY gained. CTC was at least 80% likely to be cost effective if society was willing to pay at least $88 per DALY gained. Analyses were most sensitive to assumptions about mortality rates with no treatment, weeks of CTC per child and costs of purchasing RUTF.

Conclusion: CTC is relatively cost effective compared to other priority health care interventions in developing countries, for a wide range of assumptions.

3. Evidence and modelling

- The comparison is between CTC and a 'do nothing' comparator.

- For the 'do nothing' option, the mortality depends on a child's HIV status, the rate being higher in HIV positive children. For the CTC option, HIV status is not relevant as its impact is reflected in the CTC outcomes.

- Children receiving CTC could have one of four possible outcomes:
    - Referral to hospital
    - Child defaults treatment
    - Child dies
    - Child recovers

- Table 1 is taken from the Bachmann paper and details the clinical parameters for the model.

- The death rate among children who defaulted from CTC was assumed the same as for all other children, including those referred to hospital.

- Evidence also suggests that 3.64% of children who recovered during CTC would die within a year.

- If a child recovers until 1 year, they can be expected to experience 33.3 expected DALYs.

Table 1 Parameter estimates for the model

Parameter	Mean	Standard error*	Source and comments
Outcomes			
Do nothing option			
Mortality without CTC (HIV-)	0.18	0.045	[1-4] SE assumed.
Relative risk of death with HIV, no CTC	2.0	0.5	[18] SE assumed
Prevalence of HIV in under fives	0.15	0.0375	[16,17] SE assumed.
CTC option			
Death rate during CTC	0.026	0.0032	Programme data.
Proportion defaulting from CTC	0.172	0.0075	Programme data.
Death rate in defaulters from CTC	0.058	0.029	Assumed. SE set so 95% CI is +/- 100% of mean
Hospital referral rate from CTC	0.059	0.0047	Programme data.
Death rate in hospital	0.37	0.093	UTH data. SE assumed
Mortality within a year of recovery	0.0364	0.0091	[19]
Expected DALYs if child recovers	33.3	NA	[5]
Costs (CTC option only)			
No. weeks of CTC – recovered	6.6	1.6	Programme data.
No. weeks of CTC – referred	4.8	1.1	Programme data.
No. weeks of CTC – died	3.6	1.6	Programme data.
No. weeks of CTC – defaulted	5.1	1.5	Programme data.
Cost per health centre visit	$4.24	$1.06	LDMHT. SE assumed.
Cost per kg of RUTF	$6.10	$1.53	Valid International. SE assumed.
Kg of RUTF per week per child	1.90	0.016	Programme data.
Cost of community mobilisation per child	$1.06	$0.27	LDMHT. SE assumed
Valid cost per child	$68.69	$17.17	Valid International. SE assumed.
Cost per day in hospital	$41.35	$10.34	[24] SE assumed.
Days in hospital	14	3.5	UTH data. SE assumed.

- The data used to estimate the costs of CTC are set out in Table 1.

- Note that the cost per Kg of RUFT should be $6.20 rather than $6.10.

- The ‘do nothing’ option is assumed to cost zero.

- Some costs depend on the number of weeks of CTC. These are the health centre costs and the ready to use therapeutic food (RUFT). The cost of the latter also depends on the child’s weight.

- For hospitalised children, the hospital cost depends on the number of in-patient days.

- There are also fixed costs per child: (a) the costs of the technical support of a non-governmental organisation called Valid International; and (b) the cost of community mobilisation.

4. Your task

- Draw a decision tree representing the decision problem being modelled.

- Include the parameters outlined above.

- Calculate the following:

- Expected costs of CTC

- The proportion of children dead at 1 year

- The expected DALYs for each option and the incremental cost-effectiveness ratio for CTC