Cost-effectiveness of Chagas disease interventions in Latin America and the Caribbean: Markov models

Wilson L. S, Strosberg A M, Barrio K

Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Several current and potential strategies for the eradication and treatment of Chagas disease (CHD) were evaluated. Specifically, the strategies examined were:

- a vector control programme alone;
- no vector control programme; and
- a vector control programme in combination with a potential new drug treatment, given after the acute disease phase and having various cure rates.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised healthy newborns in 1990 for the incidence model and the LA and Caribbean population for the prevalence model.

Setting
The setting was the community. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence was obtained from studies published between 1985 and 2003. The resource use data were obtained from a study published in 1998. The price year was 2003.

Source of effectiveness data
The effectiveness evidence was derived from a review of published studies and from authors’ assumptions.

Modelling
Two steady-state Markov models (incidence and population prevalence) were used to estimate the costs and benefits of the strategies evaluated. In the incidence model, only the newborn population entered the model at the no disease state. In the prevalence model, patients could enter the model at all health states except death, according to the prevalence figures on state of disease and allowing incidence of disease at any age from no disease state. The time horizon for both
models was 100 years (with 1-year cycles). The health states considered in the models were no disease, acute stage, indeterminate stage, general chronic stage, cardiomyopathy with chronic heart failure (CHF), cardiomyopathy without CHF, and two death states (one due to CHD and one due to all other causes). Patients were allowed to stay only a maximum of 1 year in the acute stage. Patients stayed a minimum of 10 years in the indeterminate stage before being allowed to progress to the chronic stage.

**Outcomes assessed in the review**
The outcomes assessed were:

- the CHD age-specific incidence and the CHD mean annual incidence with and without vector control;
- the decrease in incidence due to vector control programmes;
- the mortality rates due to all causes and to CHD; and
- the transition probabilities between the health states considered in the model.

**Study designs and other criteria for inclusion in the review**
Not reported.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
At least 11 studies were included in the review.

**Methods of combining primary studies**
A narrative method was used to combine the primary studies.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
There were too many clinical and epidemiological parameters to report in this abstract. The only value that will be reported here is the decrease in incidence due to vector control programmes, which was 70% (range: 70 to 90).

**Methods used to derive estimates of effectiveness**
Some of the parameters used in the model were obtained from authors' assumptions.
Estimates of effectiveness and key assumptions
The authors assumed that the prevalence of acute CHD was 0.00001. They also assumed that 20% of patients who were in the megaviscera stage would have palliative surgery at some point and either improve or die. Death from megaviscera was assumed to occur as a surgical or post-surgical death only. Moreover, some patients might remain in the indeterminate stage for life, but the model assumed that eventually everyone would move to the chronic phase, and/or eventually die of either CHD related or other causes. Finally, it was assumed that a new potential drug treatment would cure 50% of patients at the indeterminate or mild chronic stage.

Measure of benefits used in the economic analysis
The summary measure of health benefits used was the quality-adjusted life-years (QALY) saved. Disability weights obtained from the literature were used to adjust the life-years gained (life expectancy) for the loss of quality of life due to the time with disease. The health benefits were discounted at a rate of 3%.

Direct costs
The costs were discounted at a rate of 3%. The costs and the quantities of resource used were not presented separately. The treatment costs were obtained from a study performed in Argentina and were divided by disease stage. The acute phase included medical consultation, general laboratory tests, parasitologic and conventional serologic tests for T-cruzi infection, drug treatment (benznidazole), electrocardiograms, chest radiographs and hepatograms. The indeterminate stage included periodic medical visits, laboratory testing, radiographs and electrocardiograms. The chronic phase included diagnosis and supportive treatment weighted according to the prevalence of the type and severity of symptoms.

The costs of vector programmes were obtained from the literature. Only data for the Southern Cone region of LA were available; the authors assumed the same cost for the other two regions. The cost of a potential new drug treatment was estimated, assuming a 6-month course of treatment given once per infected person. The authors determined a cost for a course of treatment based on currently available treatments for CHD, and estimated what the market would probably be willing to pay. It was assumed that all patients in the indeterminate and early chronic stages would receive drug treatment.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The authors did not evaluate productivity costs separately since they included these work losses as part of the quality of life adjustments.

Currency
US dollars ($).

Sensitivity analysis
One- and two-way sensitivity analyses were performed to test the robustness of the model results. All transition probabilities in the model were varied and half-cycle corrections were conducted.

Estimated benefits used in the economic analysis
Incidence model.

Although QALYs were used as a measure of health benefit in the incremental cost-effectiveness ratios, the authors just reported the life expectancy (years). The life expectancy was 67.91 years with no vector control programme, 68.19 years with a vector control programme, and 68.22 years with vector control plus potential new drug treatment.
Prevalence model.

No vector control programme resulted in 67.28 QALYs, the vector control programme alone saved 67.55 QALYs, and vector control plus potential new drug treatment saved 67.81 QALYs.

**Cost results**

**Incidence model.**

The mean cost per person was $39.7 with a vector control programme, $58.4 with vector control plus potential new drug treatment, and $165.6 with no vector control programme.

**Prevalence model.**

The mean cost per person was $153.5 with a vector control programme, $229 with vector control plus potential new drug treatment, and $275 with no vector control programme.

**Synthesis of costs and benefits**

Incremental cost-effectiveness ratios were calculated. Strategies were defined as cost-effective according to the gross national income and the health expenditure per capita in LA ($3,260 and $255.6, respectively).

**Incidence model.**

The no vector control programme strategy was more costly and less effective than the vector control programme strategy and the vector control plus potential new drug treatment strategy. Therefore, the no vector control programme strategy was dominated. The incremental cost per QALY of the vector control plus potential new drug treatment strategy compared with the vector control programme alone strategy was $698.63.

**Prevalence model.**

The no vector control programme strategy was more costly and less effective than the vector control programme strategy and the vector control plus new potential drug treatment strategy. Therefore, the no vector control programme strategy was dominated. The incremental cost per QALY of the vector control plus new potential drug treatment strategy compared with the vector control programme alone strategy was $288.78.

Sensitivity analyses suggested that the results obtained were quite robust. The price and effectiveness of the new potential drug treatment were influential parameters in calculating the cost-effectiveness ratios.

**Authors' conclusions**

The best strategy for the control and treatment of Chagas disease (CHD) in Latin America (LA) was a combination of a vector control programme plus new drug treatment.

**CRD COMMENTARY - Selection of comparators**

The authors estimated the active value of the current approach to control CHD in LA (vector control programmes) and the potential efficiency of adding a new drug treatment. The use of a potential new drug treatment as a comparator meant that the analysis works in a somewhat speculative scenario.

**Validity of estimate of measure of effectiveness**

The effectiveness evidence was obtained from published studies and authors' assumptions. There is no evidence that a systematic review of the literature was performed. The sources searched to identify the primary studies were not reported, nor was the methodology used to extract and combine the primary data. The authors stated that their specifications for the new potential drug treatment were plausible and conservative. However, the assumption that all
patients in the indeterminate and chronic stages would be treated with the new drug may be too optimistic given the current treatment rates. The authors investigated variability in the inputs using sensitivity analyses.

**Validity of estimate of measure of benefit**
The summary measure of benefit used in the economic evaluation (QALYs) allows comparisons with the results of other studies. Moreover, it incorporates quality of life issues into the analysis.

**Validity of estimate of costs**
The perspective adopted in the study was unclear. Most intervention costs appear to have been considered in the analysis. The price year was stated and the costs were appropriately discounted. Obviously there would be variations in costs across LA and Caribbean countries, but this issue was considered in the sensitivity analyses. Since the new drug treatment was only hypothetical, a threshold analysis was performed with the estimated cost of this drug treatment.

**Other issues**
The authors did not compare their results with those of other studies because there were little accurate data on the costs and benefits of the current strategies used to control and treat CHD.

**Implications of the study**
The results of this study suggest that vector control programmes in LA countries are highly cost-effective and that the addition of a new drug treatment to vector control programmes would also be cost-effective. As new drug treatments and new methods of case detection become better defined, a more accurate analysis could be performed using the model developed for this study.

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