Cost-effectiveness analysis of the impacts on infection and morbidity attributable to three chemotherapy schemes against Schistosoma japonicum in hyperendemic areas of the Dongting Lake region, China.

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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
The study examined the use of praziquantel chemotherapy for Schistosoma japonicum. Three mainstay chemotherapy schedules currently recommended and used in endemic areas in China were evaluated. These were clue chemotherapy, mass chemotherapy and screen chemotherapy. Clue chemotherapy aims to identify high-risk groups (those in contact with infected water and/or symptoms of infection) through a simple questionnaire, and treats them with a single dose of praziquantel. Mass chemotherapy involves all villagers receiving a dose of praziquantel. Screen chemotherapy involves treating those found with positive stool eggs samples (after Kato-Katz examination).

Type of intervention
Treatment and screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised villagers from farming villages in the Dongting Lake Region of China.

Setting
The setting was the community. The economic study was conducted in Hunan Province, China.

Dates to which data relate
The effectiveness and resource use data were gathered during 1998 to 2000. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The effectiveness and resource use (cost) data were collected prospectively from the same sample of patients. Where data on costs were missing, expert assumptions were made on the basis of values reported in the literature.

Study sample
A random cluster sampling procedure was used to select participants from the study population. Residential clusters (10 to 15 people within an administrative village) were the unit for sampling. The list of residential clusters of each selected village was obtained from the local anti-schistosomiasis stations. Two to three residential clusters were randomly chosen...
from each village, with the numbers of residents ranging from 350 to 500 depending on the size of the population of each residential cluster. All villagers aged 3 to 65 years in the selected residential clusters were recruited as participants for evaluation. For clue and mass chemotherapy groups, 100 additional school children aged 7 to 12 years were also chosen from the corresponding villages (to reflect high-risk groups). The study sample contained a total of 2,615 individuals (1,451 males and 1,164 females). Of these, 905 were allocated to the clue chemotherapy group, 900 to the mass chemotherapy group and 810 to the screen chemotherapy group.

Study design
This was a quasi-experimental multi-centred cross-sectional study that involved three interventions across eight villages in Hunan Province, China. Data were collected at baseline prior to the intervention being undertaken (using a structured interview and medical examination), and the follow-up survey was conducted 6 months after the second year of chemotherapy. The three chemotherapy schemes were randomly allocated to the study villages as described above.

Analysis of effectiveness
The primary measures of effectiveness were:

- the number of schistosome infections prevented;
- the number of morbidity cases prevented, where morbidity is measured by abdominal pain, diarrhoea, liver abnormality and spleen abnormality; and
- the reduction in infection intensity, as measured by eggs per gramme faeces (EPGF).

The proportions of males and females in each intervention group were similar at baseline. The screening group had a larger proportion of 45- to 65-year-olds and a smaller proportion of 3- to 14-year-olds than the clue and mass groups, but these groups had an additional 100 school aged children added who were thought to be of high risk.

Effectiveness results
The coverage was:

- in the clue group, 83.6% in year one and 78.0% in year two;
- in the mass group, 97.9% in year one and 94.0% in year two; and
- in the screen group, 97.1% in year one and 94.1% in year two.

The crude prevalence ratios and standardised prevalence ratios were significantly greater than 1, indicating a statistically significant reduction in infection. The crude prevalence ratio was 3.64 for the screen group, 2.32 for the mass group and 2.04 for the clue group.

There were variations reported within the morbidity measures. The prevalence ratios were significantly greater than 1 for abdominal pain and diarrhoea in the clue and mass groups, but not in the screen group. The prevalence ratio of liver abnormality was only significantly greater than 1 in the mass group. For spleen abnormality, the prevalence ratios were all significantly greater than 1.

The intensity of infections in the three groups was shown to be significantly reduced when comparing the EPGF. The mean difference was 5.49 in the clue group, (p=0.000), 4.91 in the mass group, (p=0.000), and 5.72 in the screen group, (p=0.034).

Clinical conclusions
The current study demonstrated that chemotherapy with praziquantel resulted in a significant and concrete impact on
Schistosoma japonicum infections in the residents. In all three areas, there were significant reductions in both the prevalence and intensity of schistosome infection after the two-year chemotherapy campaign in the villages. However, the impact on morbidity, as indicated by cases of diarrhoea and abdominal pain, and abnormality of liver and spleen prevented by the intervention, were not straightforward and were found to vary considerably.

**Measure of benefits used in the economic analysis**
The measures of effectiveness in the economic analysis were the prevention of one case of infection, a 1% reduction in intensity of infection (EPGF), the prevention of one case with liver abnormality, and the prevention of one case with spleen abnormality.

**Direct costs**
The study was undertaken between 1998 and 2000. The authors stated that the costs in later years were not discounted because inflation in China during this time was between 1% and 2%. The quantities of resource use and the costs were not analysed separately. A detailed record form was used to collect cost data on the inputs of personnel (supervisors, medical officers, laboratory technicians and medical assistants), consumables (treatment, and treatment for side effects, slides, Kato plates for stool examination), vehicle and capital (microscopes, scales). The unit cost values were derived from an itemised cost menu. This was based on actual inputs for different activities (supervision, mobilisation, training, diagnosis, treatment) and, where data were missing, on expert assumptions based on values reported in the literature. The unit costs were not reported separately. Only the costs of the intervention were included in the study, and not those of the research.

**Statistical analysis of costs**
No statistical comparisons were reported.

**Indirect Costs**
No indirect costs were included.

**Currency**
Chinese yuan renminbi (CNY).

**Sensitivity analysis**
A one-way sensitivity analysis was performed on the prices of praziquantel and personnel.

**Estimated benefits used in the economic analysis**
Eighty-six cases of infection were prevented in the clue group, versus 83 in the mass group and 59 in the screen group. The reduction in EPGF was 71.2% in the clue group, 75.9% in the mass group and 77.3% in the screen group. Forty-one cases with liver abnormality were prevented in the clue group, versus 134 in the mass group and zero in the clue screen group. Twenty cases with spleen abnormality were prevented in the clue group, versus 61 in the mass group and 25 in the screen group.

**Cost results**
The total cost was CNY 12,053.3 in the clue group, CNY 13,379.0 in the mass group and CNY 11,210.6 in the screen group.
Synthesis of costs and benefits

The cost per infected case prevented, cost per 1% reduction in EPGF, cost per case of liver abnormality prevented and cost per case of spleen abnormality prevented were estimated. To provide a summary score of cost-effectiveness, scores from 1 to 3 were given from the highest to the lowest unit cost, and then weights between 1 and 3 were given to each of the outcome indicators, with a weight of 1 assigned to the indicator with the lowest importance and a weight of 3 assigned to the indicator with the highest importance (morbidity indicators were given higher weights and infection indicators lower weights). A weighted average ranking for each intervention was then calculated. The intervention with the highest weighted average rank was considered to be the most cost-effective.

The cost per case of schistosome infection case prevented during the two-year period was CNY 140.2 for the clue group, CNY 161.2 for the mass group and CNY 190.0 for the screen group. More detailed results were presented in the paper. Using the summary weighted average ranking, the mass group was found to be the most cost-effective, with the highest weighted ranking. Screen chemotherapy was the least cost-effective.

The total costs were found to be sensitive to changes in personnel costs in all three groups, but this did not change the cost-effectiveness results significantly. Reducing the number of targets for clue chemotherapy would reduce the cost of it and make the clue chemotherapy scheme more favourable than the mass chemotherapy scheme.

Authors' conclusions

Chemotherapy with praziquantel could significantly reduce the prevalence and intensity of schistosome infection in the hyperendemic areas of Schistosomiasis japonica in the Hunan Province of China. The mass chemotherapy scheme was the most cost-effective in terms of infections and morbidity prevented and percentage reduction in intensity of infection. The second most cost-effective strategy was the clue chemotherapy scheme, while the least cost-effective was the screen chemotherapy scheme. It was also demonstrated that this conclusion could be further strengthened if the price of praziquantel was reduced, which is likely to be the case in the near future.

CRD COMMENTARY - Selection of comparators

A justification was given for the comparators used. All three are mainstay chemotherapy schedules recommended and used in endemic areas in China. You should decide if these are widely used health technologies in your own setting.

Validity of estimate of measure of effectiveness

The analysis was based on a quasi-experimental study, where residential clusters within villages were randomised to a particular intervention and all villagers within these clusters were required - which seemed appropriate to the study question - such that the study sample was wholly representative of the study population. The groups were relatively similar at baseline, although the baseline prevalence within the screening group was found to be lower. Caution should therefore be taken when interpreting the results as the estimation of outcome assumes similar levels of prevalence. The methods of the study were well reported.

Validity of estimate of measure of benefit

The estimation of benefits was obtained directly from the effectiveness analysis and was appropriately justified. In addition, there was an attempt to combine the four benefit measures by ranking them according to their importance, whereby morbidity indicators were given higher weights and infection indicators lower weights. This overcomes the issue of conflicting cost-effectiveness results, but the sensitivity around these weights should have been tested.

Validity of estimate of costs

All the categories of cost relevant to the perspective adopted (i.e. the health sector) appear to have been included in the analysis. The costs and the quantities of resource use were not reported separately. Some unit cost information was reported. There was no statistical analysis of the costs, although some sensitivity analysis around the price of personnel was reported. The price year was not reported, but the discussion of inflation and why costs were not discounted would
suggest that all resources were priced in 1998 yuan.

**Other issues**
The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was addressed. The authors do not appear to have presented their results selectively. The study enrolled a wide cross-section of whole village populations with varying disease risks and this was reflected in the authors’ conclusions. The authors reported a number of further limitations to their study. In particular, the length of follow-up, the unreliability of indicators of morbidity, and increased exposure to schistosomiasis due to flooding in 1998.

**Implications of the study**
Mass chemotherapy should be the preferred choice in areas where the prevalence of infection and frequency of contact with infested water by residents are high, especially if the drug cost can be reduced. Clue chemotherapy could be an alternative if the frequency of water contact is less than 80%. The study found that the reduction in symptoms varied among groups, which indicates that the use of these symptoms as indicators of morbidity is unreliable.

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