Cost-effectiveness of regional poison control centers

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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 treatment of poison exposures with and without access to a Regional Poison Control Centre (RPCC). Four typical poison exposure cases were considered; (1) acute acetaminophen overdose in adults, (2) acute tricyclical antidepressant overdose in adults, (3) acute cleaning substance exposure in children younger than 13 years of age, and (4) acute cough or cold preparation overdose in children of younger than 13 years.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Hypothetical population with 4 typical poison exposures described above.

Setting
Community. The economic study was carried out in Arizona, USA.

Dates to which data relate
No date for the effectiveness data was given. Resource use quantities represent data from 1994. 1994 prices were quoted.

Source of effectiveness data
Estimates of the probability of on site versus emergency department attendance were derived from the published literature as were the on site success rates and the decision whether to admit or release patients from emergency departments. Probabilities attached to A&E admission rates as well as the success rate of those released direct from the emergency department were based on median expert panel responses.

Modelling
Decision trees were constructed using the decision analysis software DATA for Windows (version 2.6.6) in order to combine estimates of the probability, consequences and costs of the poison exposure treatments for the 2 alternative treatment modes considered. Separate trees were solved for the 4 types of poison exposure and the 2 clinical outcomes used.

Outcomes assessed in the review
The probability of treating a patient on site versus at an emergency department and the probability of admission or
release of patients from emergency department.

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

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

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

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

**Number of primary studies included**
Three published studies and data from the Arizona Poison and Drug Information Centre (APDIC) in the US were used to derive effectiveness information.

**Methods of combining primary studies**
Estimates were not combined.

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

**Results of the review**
The probability of treating a patient on site was estimated to be 0.77 for RPCC and 0.29 for no RPCC strategies. Corresponding probabilities for emergency department (ED) visit were 0.23 and 0.71, respectively. The probability of admission after ED visit was 0.26 for RPCC and 0.12 for no RPCC.

**Methods used to derive estimates of effectiveness**
Estimates of effectiveness were also derived from an expert panel of 5 practising, broad-certified toxicologists not affiliated with the APDIC. 4 of 5 panel members were not currently associated with RPCC. Median responses from the panel were used in the model.

**Estimates of effectiveness and key assumptions**
For cough preparation overdose the median (range) values were:

- morbidity: RPCC was 0.06 (0.07-0.3), non-RPCC was 0.14 (0.07-0.3);
- mortality: RPCC was 0.0001 (0.0001), non-RPCC was 0.0002 (0.0001-0.0003);
- treatment adverse effects: RPCC was 0.3 (0.1-0.5), non-RPCC was 0.15 (0.1-0.2).

For acetaminophen overdose the median (range) values were:
morbidity: RPCC was 0.2 (0.15-0.4), non-RPCC was 0.3 (0.2-0.4);
mortality: RPCC was 0.03 (0.01-0.05), non-RPCC was 0.09 (0.05-0.12);
treatment adverse effects: RPCC was 0.15 (0.1-0.2), non-RPCC was 0.25 (0.2-0.3).

For tricyclic antidepressant overdose the median (range) values were:
morbidity: RPCC was 0.3 (0.1-0.5), non-RPCC was 0.55 (0.4-0.65);
mortality: RPCC was 0.06 (0.02-0.1), non-RPCC was 0.1 (0.05-0.15);
treatment adverse effects: RPCC was 0.3 (0.1-0.5), non-RPCC was 0.45 (0.3-0.6).

For cleaning substance exposure the median (range) values were:
morbidity: RPCC was 0.13 (0.05-0.2), non-RPCC was 0.25 (0.2-0.3);
mortality: RPCC was 0.0001 (0.0001), non-RPCC was 0.0002 (0.0001-0.0003);
treatment adverse effects: RPCC was 0.09 (0.03-0.15), non-RPCC was 0.15 (0.05-0.25).

The main assumptions for the effectiveness analysis were that; (a) the two alternative treatments were independent of each other (b) physician responses were not biased (c) treatment in an RPCC and treatment without its services, have identical lower bounds of effectiveness.

Measure of benefits used in the economic analysis
The measure of effectiveness used was clinical success, which was measured in terms of morbidity and mortality avoided. Mortality and morbidity were analysed separately, and hence, no single index of effectiveness was constructed. Health states were not valued in utility terms.

Direct costs
Costs were not discounted as they were one-off costs. Costs and quantities were not reported separately. The costs measured included emergency department visit costs, inpatient costs and on site costs at the 2 alternative treatment sites explored. Quantities were derived from expert opinion and APDIC data. A health service and hospital boundary was adopted in calculating quantities and costs. Surveys were sent to four local hospitals in order to determine the emergency department and physician costs. Hospital cost data were obtained from the Arizona Department of Health Services. Estimates of poison exposure treatment costs for the RPCC were based on the average RPCC operational cost per poison exposure case treated. Although the price and quantity of resource data were not specified it seems that the date to which they relate is 1994. Average and incremental costs were reported.

Currency
US dollars ($).

Sensitivity analysis
Two-way sensitivity analysis was performed to test the sensitivity of results to a range of average in-patient and average emergency department visit costs. Also a 2-way sensitivity analysis was undertaken assuming equal probabilities of morbidity and treatment adverse effects (cost-minimisation approach) to test the sensitivity of results to a range of poison exposures treated on site by the RPCC as well as the average in-patient costs. The results of the sensitivity analysis were identical for the 4 poison exposures assessed.
**Estimated benefits used in the economic analysis**
The benefit was reported as a successful outcome per poison exposure treated for one of the 4 typical cases focused upon. A one-off benefit of the treatment, either with or without an RPCC, was considered. No discounting was undertaken. The effectiveness results were reported in terms of morbidity only. The morbidity rates (per 10,000 cases) were 36, 90, 180, and 78 with RPCC and 119, 250, 470, and 213 without RPCC for overdoses of cough preparation, acetaminophen, tricyclic antidepressant, and cleaning substance exposure, respectively.

**Cost results**
The average cost per patient treated were:

- overdoses of cough preparation: RPCC was $141, non-RPCC was $664;
- overdoses of acetaminophen: RPCC was $478, non-RPCC was $811;
- overdoses of tricyclic antidepressants: RPCC was $507, non-RPCC was $854;
- cleaning substance exposure: RPCC was $493, non-RPCC was $790.

In each event, treatment costs within the RPCC were substantially less than those without such a service. Costs were not discounted as they were one-off costs. The duration of the intervention and comparator was not stated.

**Synthesis of costs and benefits**
Cost per successful outcome was reported to describe average cost-effectiveness of the two alternatives. Average CE-ratios, for RPCC and no RPCC respectively for mortality (or survival) and morbidity were used to measure effectiveness were:

- cough preparation overdose: $414 and $664; $415 and $671,
- for acetaminophen overdose: $479 and $819; $482 and $836,
- tricyclic antidepressant overdose: $509 and $863; $526 and $899,
- cleaning substance exposure: $493 and $774; $497 and $790.

Even though the RPCC was found to be a dominant strategy (i.e. had both lower costs and greater effectiveness) the authors calculated the incremental cost-effectiveness ratios. The sensitivity analysis performed revealed that RPCC is always more cost effective than the no RPCC alternative across reasonable ranges of average inpatient and emergency department costs. The results for the cost-minimisation analysis were similar to those derived from the cost-effectiveness analysis. No discount rate was used as costs were incurred at one point in time only. No price date was given.

**Authors’ conclusions**
The RPCC is more cost effective in the treatment of poison exposures than poison exposure treatment in the absence of this service. For the 4 poison exposure types studied, the results of the decision analysis were similar both between outcomes considered, and across the different exposures. The cost effectiveness ratio is about half of that with access to the RPCC rather than without. As the successful treatment of poison exposures in the RPCC increase so do the cost savings to society.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparator used. Access to Regional Poison Control Centres (RPCC) is declining with 59% of US population having access to this type of service in 1991 as against 50% in 1994. The alternative strategy is treatment directly through the hospital emergency department.
Validity of estimate of measure of benefit
A major problem of the study is the lack of empirical data relating to morbidity/mortality and treatment adverse effects as well as efficacy issues associated with the poison exposure treatment. The modelling approach, with parameter estimates derived from literature and a panel of experts, was used to address this problem. The obvious uncertainty related to this type of evidence was dealt with in the sensitivity analysis. It was assumed that the effectiveness of RPCC provided service was at least as good as the alternative (no RPCC).

Validity of estimate of costs
Resource quantities and costs were stated separately. The details of quantity/cost estimations given were satisfactory, but the comparability in terms of cost items included (e.g. travel, over heads) was not discussed. The authors state that a societal perspective was taken but patients’ costs have not been included within the calculations.

Other issues
The authors’ conclusions appear to be justified given that the assumptions and ranges used in the sensitivity analysis were valid. Since one of the alternatives (RPCC) had both lower costs and greater effectiveness (i.e. was a dominant strategy), the incremental cost-effectiveness ratios reported by the authors appear superfluous. There is no reason to assume that the study findings are generalisable as RPCC practices may vary considerably from one setting to the next, as may poison exposure treatment opportunities outside an RPCC.

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