Economic impact of an infection control education program in a specialized preschool setting

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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
This study considered the impact of an intensive infection control programme in specialised preschool day care for children with Down syndrome, and a less intensive infection control regimen in non specialised preschool day care.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population in the primary analysis comprised children with Down syndrome in specialised preschool day care. The population in the secondary analysis comprised all children in non specialised preschool day care.

Setting
The setting was an institution. The paper did not report the exact geographical setting of the study. However, it was clear that it was undertaken in the USA.

Dates to which data relate
The effectiveness data for the primary analysis were taken from a paper published in 1996. The majority of the resource use data were taken from papers published between 1971 and 2000. All prices were converted to 1999 figures.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of completed studies, and estimates of effectiveness based on opinion.

Modelling
A Markov state transition model was used to estimate the incidence of infections and the associated costs. Each cycle of the model lasted one month and the model was run for 12 cycles.

Outcomes assessed in the review
The model parameters included the probability of developing sinusitis, otitis media, a gastrointestinal illness, a common cold, pharyngitis, bronchitis, croup, bronchiolitis and pneumonia. The model also incorporated parameters that related to the number of physician visits, courses of antibiotics and days absent from day care.
**Study designs and other criteria for inclusion in the review**
The majority of the inputs parameters were derived from a prospective study (Krilov et al. 1996, see 'Other Publications of Related Interest' below for bibliographic details). This study included 33 children in the baseline year and 38 during the intervention year. The two groups were shown to be comparable in terms of demographic and clinical parameters. In addition, the authors undertook a search for articles that included "infectious diseases", "infection control" and "economics" as keywords. The search was limited to articles in English and excluded review articles, letters and editorials.

**Sources searched to identify primary studies**
MEDLINE and EMBASE were searched for primary studies.

**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**
Twelve primary studies were used to identify the model parameters.

**Methods of combining primary studies**
Where published papers provided different estimates for one of the model parameters, the figure that would bias the results against the intervention was chosen.

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

**Results of the review**
The study estimated that the intensive intervention reduced the median monthly rate per child of developing an infection from 0.70 to 0.53.

The monthly rate of respiratory infections was estimated to fall from 0.67 to 0.42 per child.

The distribution of respiratory infections was considered to be 86% common cold, 3% pharyngitis, 3% bronchitis, 2% croup, 3% bronchiolitis and 3% pneumonia.

Changes in the rate of gastrointestinal diseases, otitis media and sinusitis were not statistically significant.

The number of physician visits per child per month was considered to be reduced from 0.5 to 0.33.

The number of courses of antibiotics was reduced from 0.33 to 0.28 per child per month.

The number of days absent from day care was also considered to have fallen from 0.75 to 0.4 per child per month.

**Methods used to derive estimates of effectiveness**
The authors made a number of assumptions relating to resource usage and childcare arrangements for children with Down syndrome in specialised preschool day care in the event of an infection. A literature review and a clinical expert.
panel were used to alter the extent and effectiveness of the intervention, the rates of illness and resource use in the event of illness, in order to undertake the secondary analysis.

Estimates of effectiveness and key assumptions
It was assumed that all children with pharyngitis would have a rapid strep test, 20% would have a beta-strep culture, and 80% of children with pneumonia would have a chest X-ray. When a child had croup it was assumed that they would all be prescribed dexamethasone acetate (0.6 mg/kg). It was assumed that if a child were too ill to attend day care they would be looked after by a parent. The authors assumed other information about resource use. However, the table within the paper did not give sufficient detail on the source of each data item to list all items arising from assumptions.

In order to undertake the secondary analysis that reflected all children in non-specialised preschool day care, the professional cleaning service was excluded from the intervention and the cleaning and disinfection of toys was reduced by 25%. In addition, baseline illness rates were reduced by 10%, the effectiveness of the intervention was reduced by 25%, and resource use in the event of an illness was reduced by 50%.

In assessing the additional cost associated with the intensive intervention compared with existing practice, the authors assumed that the sole cost associated with infection control measures was cleaning products and that 25% of the quantities used in the intensive intervention would be used.

Measure of benefits used in the economic analysis
No summary measure of benefits was produced. In effect, the authors carried out a cost-consequences analysis.

Direct costs
In assessing the consequences of the intervention, the study included health care-related costs incurred by the health care provider or purchaser as a result of illness of the children. A clinical panel was used to estimate medical use for the primary analysis. This included hospitalisation, emergency room visits, physician visits, laboratory tests and professional services. These data were adjusted based on the authors’ assumptions for the secondary analysis. Cost data for all medical care use were taken from the Medicaid reimbursement schedules. Medication costs were taken from the Drug Topics Red Book, and 20% was deducted from wholesale prices to obtain an estimate of the actual cost. The price year was 1999. The costs were not discounted, which was appropriate as the total time period of the study was two years. Data for the secondary analysis were obtained from the same sources, but quantities were altered on the basis of authors’ assumptions.

In the primary analysis, the costs of the intensive intervention to the day care provider were included in the study. Resource use data were obtained from the sponsor of the primary study that provided the majority of the effectiveness evidence. Resource items included personnel to conduct initial assessments, training and compliance monitoring, a contract cleaning service, cleaning and disinfection products, and educational materials. The cost of personnel was calculated using a combination of actual and national wage rates, and the actual price paid for contract cleaning was used. Retail prices minus 30% were used to identify the cost of cleaning and disinfection products. The source of the data for the cost of the educational materials was not reported. The costs of the baseline or control year were assumed to consist solely of 25% of the cleaning and disinfection products used in the intensive intervention. The costs were inflated to 1999 prices using the all items component, or the medical care services component of the Consumer Price Index. The costs were not discounted, which was appropriate as the total time period of the study was two years. Data for the secondary analysis were obtained from the same sources, but the quantities were altered on the basis of the authors’ assumptions.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
Productivity losses for parents were quantified using the number of days a child was absent as a result of illness. Lost parental working time was estimated using two methods, the opportunity cost method and the replacement cost method. A clinical expert panel determined the amount of productivity lost in the primary analysis. This was adjusted on the basis of authors' assumptions for the secondary analysis. The cost of the loss of productivity was calculated using a national average wage rate. The price year was 1999. The costs were not discounted but, again, this was appropriate as the total time period of the study was two years.

Currency
US dollars ($).

Sensitivity analysis
A sensitivity analysis was undertaken to consider the certainty and improve the generalisability of the results. The paper did not give a rationale for the parameters used in the sensitivity analysis. The nature of the sensitivity analysis in the primary analysis was not reported. However, a one-way analysis appears to have been performed. The paper stated that a threshold analysis was performed in the secondary analysis. An analysis from the perspective of the child's household was also undertaken.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
In the primary analysis, the total cost of illness per child was $1,235 in the baseline year versus $615 in the intervention year.

In the secondary analysis, the total cost of illness per child was $962 in the baseline year versus $614 in the intervention year.

The cost of infection control practices was $18.84 per child in the baseline year versus $1,990.18 per child for the intensive intervention.

The cost of infection control practices was $18.84 per child in the baseline year versus $81.24 per child for the less intensive intervention.

Synthesis of costs and benefits
The primary analysis showed a net cost of the intensive intervention of $1,351 per child per year. The secondary analysis showed a net saving of the less intensive intervention of $286 per child per year.

An incremental analysis was not undertaken.

The sensitivity analysis showed that the primary analysis was relatively insensitive to changes in the following:

the baseline infection rates,
the distribution of care between the parent and babysitter,
the inclusion of over-the-counter medication,
the highest possible number of infections per month,
the distribution of respiratory illnesses, and
the method of costing lost productivity.

All sensitivity analyses indicated that the intervention was cost-saving.

**Authors’ conclusions**
The less intensive intervention in non specialised day care was cost-saving. The intervention has the potential to eradicate 70% of the costs associated with higher infection rates among children in day care.

**CRD COMMENTARY - Selection of comparators**
The authors used the year prior to the introduction of the intervention as the comparator. This was appropriate as it provided an assessment of the intervention in comparison with current practice. You should consider how the infection control practices in the baseline year compare with current practice in your own setting prior to applying the results of this study.

**Validity of estimate of measure of effectiveness**
The authors obtained the majority of the effectiveness data from a single primary study. Additional data were taken from a systematic review of the literature and a clinical panel. The methods of the literature review appear to have been rigorous, and the paper reported the databases searched and the keywords used in the search strategy. Where the results of the published studies provided differing estimates for a given value, the one that was most biased against the intervention was used. This is likely to have resulted in an underestimate of the true effectiveness of the intervention. The paper did not make it clear how the clinical panel was formed and, in terms of their methods, reporting was limited to the fact that they considered relevant literature. The paper also stated that the authors made a number of assumptions. However, there was no clear distinction between the estimates obtained from the clinical panel and those made by the authors. The authors’ assumptions were not reliably backed up by evidence from the literature. However, many of the estimates were investigated in the sensitivity analysis.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefits. Thus, the analysis was one of cost-consequences.

**Validity of estimate of costs**
The authors reported that the study was undertaken from a societal perspective and they made a comprehensive assessment of appropriate costs. However, over-the-counter medications were only included in the sensitivity analyses and not in the two principal analyses. The paper suffers from a lack of clarity around the quantities of resources used and their unit costs, and this hinders its generalisability. On a more positive note, the clear price year and the broad sensitivity analysis, which covered the quantity and cost of resources, aid the generalisability of the results of the study. Where retail prices were used to determine the cost of resources, a percentage deduction was made to obtain an estimate of actual cost.

**Other issues**
In undertaking the secondary analysis, the authors clearly addressed the issue of generalising the results of the primary analysis to other settings. They noted that their study appeared to be the first to assess the economic implications of infection control interventions in preschool day care. However, they compared aspects of their results with those from other studies and found no substantial discrepancies. The authors reported several limitations for this study. First, the potential societal savings may have been underestimated, because costs associated with secondary infections in parents, siblings, or day care centre personnel (DCC) were not considered. Second, the study by Krilov et al. was not aimed at determining which parts of the intervention programme were responsible for the reduction in rates of illness. Third, medical records in the study by Krilov et al. were not reviewed to validate the parents’ responses on the questionnaires about their children’s illnesses.
Implications of the study
The authors suggested "multidimensional ICEPs (infection control education programmes) could have substantial clinical and economic benefits to both families and society; however, these benefits can be fully realized only through effective educational programs that communicate these benefits to parents, DCC personnel, and policy makers”.

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Other publications of related interest

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