Cost-effectiveness of a nurse-led telemonitoring intervention based on peak expiratory flow measurements in asthmatics: results of a randomised controlled trial

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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.

CRD summary
This study examined the cost-effectiveness of a nurse-led telemonitoring programme in comparison with the usual care in asthmatic adults and children. The telemonitoring programme was of limited cost-effectiveness when using a generic quality-of-life instrument as a measure of the benefit of the intervention on the patients' health. Only a decrease in the price of the asthma monitor would improve the cost-effectiveness of this strategy. The study was well conducted and well reported. The authors’ conclusions are robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of a nurse-led telemonitoring programme for the management of asthma in comparison with usual care, in a population of both adults and children with mild to moderate asthma.

Interventions
The intervention consisted of an asthma monitor at home, and a hospital-based nurse practitioner as the main caregiver. The monitor was a portable hand-held device with a similar modem. The patients read their spirometry test results on the monitor screen and transferred the monitor data to the nurse's computer by connecting the modem to the household phone line. Lung function tests were performed daily and more often if required. Drug dosages were modified according to the function test results. The usual care consisted of regular outpatient care of three to six monthly medical check-ups with their lung specialist or paediatrician.

Location/setting
Netherlands/community and outpatient.

Methods
Analytical approach:
This economic evaluation was carried out alongside a clinical trial. The time horizon of the analysis was one year. The authors stated that the perspectives of society and the health care system were adopted.

Effectiveness data:
The clinical data came from a single-centre, prospective, randomised controlled trial (RCT), with randomisation taking place at patient level after stratification by age (children aged 7 to 18 years, versus adults aged 18 years and older). In the adult sample, there were 27 patients in the control group and 26 patients in the intervention group. In the child sample, there were 27 patients in the control group and 29 patients in the intervention group. The length of follow-up was 12 months and measurements were carried out at baseline, and 4, 8, and 12 months. A total of five patients (three adults and two children) were lost to follow-up in the intervention group while two patients (one adult and one child) were lost in the control group. Adjustment for baseline differences was performed. The quality of life associated with the two strategies was the primary effectiveness measure.

Monetary benefit and utility valuations:
The utility estimates were valued by means of two multi-attribute instruments which were the EuroQol at five Dimensions (EQ-5D) based on the time trade-off method and the Short Form at six Dimensions (SF-6D) based on the
standard gamble instrument.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure.

Cost data:
The costs categories were the implementation of the intervention, health care costs, patient and family costs, and productivity losses. Overhead costs were included and a breakdown of cost items for each category was given. The unit costs and resource quantities were presented separately. The resource use data were derived from the clinical trial by means of a four-week prospective cost diary. The volume of resources associated with hospital services was based on the hospital billing system of the University Hospital, Maastricht. The unit costs were derived from the Dutch manual for cost research wherever available. The calculation of indirect costs was based on the friction cost methodology. Intervention costs were calculated using a micro-costing approach. All costs were in Euros (EUR) and the price year was 2002.

Analysis of uncertainty:
A non-parametric bootstrapping simulation was carried out in order to address the uncertainty in the cost-utility ratios. Cost-effectiveness acceptability curves were generated for two commonly used thresholds in the Netherlands, which were EUR 40,000 and EUR 80,000 per QALY. Two deterministic sensitivity analyses were also carried out. In the first, the costs of the asthma monitor were set to zero in the intervention group and in the second, the costs of school absenteeism were included using data from the Ministry of Education, Culture, and Science.

Results
No significant differences were found between the groups with respect to quality-of-life evaluations for both instruments. However, after adjustment for baseline differences, the QALYs gained with the intervention were 0.03 in the adult sample and 0.01 in the child sample when using the EQ-5D.

In the adult sample, the total costs were EUR 2,973 in the intervention group and EUR 1,948 in the control group. In the child sample, the total costs were EUR 1,206 in the intervention group and EUR 597 in the control group. These differences were mainly attributable to the fixed cost of the intervention (monitor).

In the adult sample, when using the EQ-5D, the incremental cost per QALY gained with telemonitoring over usual care was EUR 15,366 from the perspective of the health care system and EUR 31,035 from the perspective of society. When using the SF-6D, the telemonitoring intervention was dominated (i.e. less effective and more expensive) regardless of the perspective. At a ceiling ratio of EUR 40,000 per QALY, there was a 59% probability of the intervention being cost-effective from the societal perspective.

In the child sample, when using the EQ-5D, the incremental cost per QALY gained with telemonitoring over usual care was EUR 58,726 from the perspective of the health care system and EUR 59,071 from the perspective of society. At a ceiling ratio of EUR 40,000 per QALY, there was a 22% probability of the intervention being cost-effective from the societal perspective.

The deterministic sensitivity analysis indicated that excluding the cost of the monitor improved the cost-effectiveness of the telemonitoring strategy (EUR 17,427 per QALY for adults and EUR 15,438 for children using the societal perspective), whilst including the cost of school absenteeism only slightly improved the cost-effectiveness of telemonitoring.

Authors' conclusions
The authors concluded that the nurse-led telemonitoring programme was of limited cost-effectiveness when using a generic quality-of-life instrument as a measure of benefit of the impact of the intervention on patients' health. Only a decrease in the price of the asthma monitor would improve the cost-effectiveness of such a strategy.

CRD commentary
Interventions:
The selection of the comparators appears to have been appropriate in that the new approach was compared with the usual care in the authors’ setting. The two interventions were clearly described.

**Effectiveness/benefits:**
The use of a RCT to derive the clinical evidence represents a valid approach given the strengths of such a design. The inclusion and exclusion criteria were reported. The reasons for the exclusion of some patients, and the refusal rates were reported. Study groups were comparable in terms of baseline characteristics, except for the utility estimates. Thus, adjustments for baseline differences in utility scores were made when comparing the results of the two groups. The methodological approach used to deal with missing data was described. The details on loss to follow-up were reported. The use of an intention-to-treat principle makes the clinical results more robust. Overall, the derivation of the clinical data was based on a valid methodology and was transparently reported. QALYs are a validated benefit measure, which permit cross-disease comparisons. The study focused only on changes in quality of life, which was appropriate as the disease has no impact on survival. Problems with the implementation of the two utility scales were reported and discussed.

**Costs:**
The categories of costs were consistent with the perspectives. A breakdown of cost items was provided. Extensive information on the resource use, unit costs, the price year, and the sources of data was provided, which enhances the transparency of the economic analysis. Statistical analyses were performed on the economic data and the impact of varying key cost estimates was investigated in the sensitivity analysis.

**Analysis and results:**
The synthesis of costs and benefits was appropriately conducted. The issue of uncertainty was satisfactorily addressed by means of a bootstrapping approach. The study findings were clearly reported. The authors acknowledged that the generalisability of the study might be limited by the fact that it was carried out in a single outpatient centre, which may not be representative of other medical settings. Also, the authors compared their findings with those of other studies, showing different conclusions. They stated that the intervention might be more cost-effective in a population with more severe asthma.

**Concluding remarks:**
On the whole, the study was well conducted using a valid methodology, which was satisfactorily reported. The authors’ conclusions are valid and robust.

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