Nurse-driven interventional technology: a cost and benefit perspective

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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
A programme for the use of micro-inducers and venous ultrasound for peripherally inserted central catheters (PICCs) was examined. The programme aimed to reduce the number of patients sent to the Interventional Radiology (IR) department for the placement of PICCs. The programme provided guidance and education to the staff primarily involved in the placement of PICCs, in order to avoid referral to the IR department.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients requiring the placement of a PICC. Specific inclusion and exclusion criteria were not reported.

Setting
The setting was secondary care. The economic study was carried out at the Veteran's Administration Puget Sound Health Care System in Seattle and Tacoma (WA), USA.

Dates to which data relate
The effectiveness and resource use data were gathered from April 1999 to December 2000. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out on the same sample of patients as that used in the effectiveness study. It was likely to have been conducted prospectively.

Study sample
Power calculations to determine the sample size were not carried out. The method of sample selection was not reported, but it appears that all patients requiring PICC placement were considered. However, it was not stated whether there were some exclusions. There were 398 PICCs placed in the 9 months before the programme was implemented and 494 in the post-implementation period. The patient demographics and characteristics were not reported.
Study design
This was a cohort study, although it was unclear whether it was fully prospective. The study was carried out in a single centre. The study comprised two 9-month periods (pre- and post-intervention). No actual follow-up was performed, as each patient was followed until the PICC was placed. The outcome assessment was not blinded.

Analysis of effectiveness
It was not stated whether all of the patients included in the initial study sample were accounted for in the analysis of effectiveness. However, it was likely that there was no patient exclusion. The outcomes in the analysis were:

- the number of PICC placements sent to the IR department before and after the introduction of the programme (and after the introduction of venous ultrasound and micro-inducers);
- the percentage of physician orders for PICC placements;
- changes in the quality of care; and
- the incidence of mechanical phlebitis.

The baseline comparability between the pre- and post-intervention periods was not discussed.

Effectiveness results
The number of PICC placements sent to the IR department was 100 in the pre-intervention period. This dropped to 36 in the post-intervention period.

There was a decrease from 26% to around 15% after the introduction of micro-inducers and another 8% drop after the introduction of venous ultrasound. Therefore, the final percentage of patients sent to the IR department for PICC placement was around 7%.

There was a 29.5% increase in physician orders for PICC placements.

The author stated that the quality of care improved (as PICCs were placed sooner) and the incidence of mechanical phlebitis decreased dramatically (figures not reported).

Clinical conclusions
The introduction of a programme for the use of venous ultrasound and micro-inducers both reduced the number of patients who needed to go to the IR department for PICC placement and decreased morbidity related to catheter placement.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic study. In effect, a cost-consequences analysis was conducted.

Direct costs
Discounting was not relevant since the costs per patient were incurred during a short time. The unit costs and the quantities of resources used were not presented separately. The health services included in the economic evaluation were radiologist's time, radiology technicians' time, other personnel's time, non-reusable supplies, medications and depreciation of the equipment (fluoroscope). Also included were space usage for patients sent to the IR department, and insertion trays, gowns, sterile towels, micro-inducers, sterile probe covers and equipment depreciation for patients who were not sent to the IR unit. The costs were estimated using actual data coming from the centre where the study was conducted. The resource use data were estimated from actual data referring to the sample of patients who were included.
in the effectiveness study. The cost/resource boundary of the study was that of the hospital. No price year was reported, but it was likely that the prices had been estimated in 1999 and 2000 when the resource use data were gathered.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not performed.

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

Cost results
The cost per PICC placed was $978 for patients sent to the IR department and $155 for catheters not placed by IR staff.

As the number of patients sent to the IR department decreased by 64 units, then the total costs per PICC placement were $62,592 for the 64 patients sent to the IR unit and $9,952 for the 64 patients not sent to there. Therefore, the introduction of the programme led to a saving of $52,640 for the hospital.

The author stated that further cost-savings could have been realised by the observed reduction in cases of mechanical phlebitis.

Synthesis of costs and benefits
Not relevant.

Authors' conclusions
The introduction of a programme for the placement of peripherally inserted central catheters (PICC) was effective as nurses were able to place catheters. This reduced both the proportion of patients requiring transportation to the Interventional Radiology (IR) department and the hospital costs.

CRD COMMENTARY - Selection of comparators
The choice of the comparator (no programme) appears to have been appropriate, as it reflected the approach used to deal with patients requiring PICC placement before the implementation of the new intervention. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The basis of the analysis of effectiveness was a cohort study where the two groups were not studied concurrently. The main weakness of this design is that as time passes between the pre- and post-intervention periods, some bias or confounding factors may have an impact on the study results. Other factors, other than the implementation of the
programme, may also have had an effect on the study results. In fact, the author did not show the baseline comparability of the two groups and did not address the issue of the role played by other factors. This makes the impact of the programme unclear. Several other factors might also have limited the internal validity of the analysis. First, the lack of power calculations, needed to ensure the inclusion of an appropriate number of patients. Second, there were no details on the method of sample selection and the demographic and clinical characteristics of the patients included in the analysis. Third, the open assessment of the outcome and, finally, the use of data from a single centre. It was also unclear whether the study sample was representative of the study population.

**Validity of estimate of measure of benefit**
No summary benefit measure was used in the analysis. In effect, a cost-consequences analysis was conducted.

**Validity of estimate of costs**
The perspective adopted in the study was not explicitly reported, but it appears to have been that of the hospital where the study took place. A breakdown of the costs was provided, but the unit costs and the quantities of resources used were not presented separately. The price year was also not reported. This reduces the possibility to replicate the economic study and transfer the results of the analysis to other settings. No statistical test was performed and the data were treated deterministically. The cost estimates were specific to the study setting and sensitivity analyses were not conducted.

**Other issues**
The author did not compare the findings with those from other studies, nor address the issue of the generalisability of the study results to other settings. Therefore, the external validity of the analysis was low. Further, the data were gathered in a single centre that may not reflect treatment patterns in other settings. The study referred to the wide group of patients requiring PICC placement and this was reflected in the conclusions of the analysis. However, the analysis of a sub-group of patients (critically ill versus transportable patients) would have been helpful in identifying the areas where the intervention was more effective and led to the greatest cost-savings.

**Implications of the study**
The study results suggested that the implementation of a nurse-driven programme for PICC placement is effective and leads to cost-savings. However, this conclusion must be interpreted with caution due to the limitations of the analysis. The author suggested that future studies should assess potential improvements in the area of infusion therapy.

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