Immediate benefits realized following implementation of physician order entry at an academic medical center
Mekhjian H S, Kumar R R, Kuehn L, Bentley T D, Teater P

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 impact of implementing an electronic system for ordering drugs, radiology and laboratory investigations (physician order entry, POE), either with or without an electronic medication administration record (eMAR), was studied. The system considered was the Invision 24 with a graphical user interface (Siemens Medical Solutions Health Services Corporation).

Type of intervention
Treatment and management.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised all patients in the participating hospital departments during the study period.

Setting
The setting was tertiary care (specifically, inpatient nursing units in an academic health system). The economic study was carried out in Columbus (OH), USA.

Dates to which data relate
The effectiveness data were collected between November 1999 and January 2001. The dates to which the resource use data related were unclear. No price year was given.

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

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that which provided the clinical effectiveness data.

Study sample
No sample size or power calculations were reported. The authors did not report the overall sample size and, although the number of medication events or orders was reported for each outcome measured before and after POE implementation, the total number of patients included could not be determined. The characteristics of these patients were not given.
Study design
The study was a cohort study that was conducted in two centres, the Ohio State University Hospitals (OSUH) and the James Cancer Hospital. The patients were followed up for 10 to 12 months across all services in the respective hospitals. As the data were taken from a computerised medical records system, loss to follow-up was not an issue.

Analysis of effectiveness
The primary health outcomes used were:
- medication turnaround times,
- radiology procedure completion times,
- laboratory result reporting times,
- medical transcription errors,
- countersignature of verbal orders, and
- the length of hospital stay.

As the baseline characteristics of the patients were not measured, no adjustments were made.

Effectiveness results
Statistical significant reductions were reported following the implementation of POE for:
- medication turnaround times, 64%, (p<0.001);
- radiology procedure completion times, 43%, (p<0.05); and
- laboratory result reporting times, 25%, (p=0.001).

POE combined with eMAR eliminated all physician and nursing transcription errors.

There were statistically significant improvements in order countersignature by physicians in the OSUH and James Cancer Hospital. Improvements of 43.1% in the OSUH and 26.2% in James Cancer Hospital were obtained, (p<0.001).

The average length of stay in the OSUH fell from 3.91 to 3.71 days following the introduction of POE, (p=0.002).

The average length of stay in James Cancer Hospital fell from 3.68 to 3.61 days, but the difference was not statistically significant, (p=0.356).

Clinical conclusions
The authors concluded that POE and eMAR provided a framework for improvements in patient safety and in the timeliness of care. They did not draw any clear conclusions on the impact of POE on the length of hospital stay. However, the data did not provide clear evidence of an impact on the average length of hospital stay.

Measure of benefits used in the economic analysis
As the introduction of POE did not appear to have a clear impact on the length of stay, a cost-consequences analysis was, in effect, performed.

Direct costs
The hospital costs were included in the analysis. The total inpatient costs were taken from the hospital central information system. No details of how these total costs had been calculated were reported. No price year was reported and the date of the resource use data was unclear. The total costs were adjusted to reflect the severity of the case-mix, using the acuity index assigned by the Health Care Financing Administration to each diagnosis-related group. No discounting was undertaken.

**Statistical analysis of costs**
The statistical significance of the difference between costs before and after the introduction of POE was tested using a t-test.

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

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was performed.

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

**Cost results**
In the OSUH, the severity-adjusted total cost per admission was $5,697 prior to the introduction of POE and $5,661 afterwards, (p=0.687). In James Cancer Hospital, the severity-adjusted total costs were $6,427 before the implementation of POE and $6,518 afterwards, (p=0.502).

**Synthesis of costs and benefits**
The benefits and costs were not combined.

**Authors’ conclusions**
The implementation of physician order entry (POE) and electronic medication administration record (eMAR) have enhanced patient care by improving turnaround time, reducing transcription errors, and improving verbal order countersignature by physicians, without adversely affecting the length of stay or total cost.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparator was clear. It represented the situation before the implementation of the intervention (i.e. prior practice in the authors' setting). You should consider how this relates to your own setting.

**Validity of estimate of measure of effectiveness**
The clinical effectiveness data were taken from a cohort study with a historical control. This is an acceptable study design for the study question, as it allows the identification of a very large number of patients, thus enhancing the generalisability of the study results. However, the study was subject to a number of inherent biases. The authors did not report in detail the overall sample size of the study and did not assess whether their patient sample was representative of the study population. However, the sample comprised patients admitted over a significant period of time, and thus is
likely to have been representative of the study population. No patient characteristics were reported. Therefore, it is not possible to assess whether there were any differences between the two groups which might have impacted on the study results. Appropriate statistical tests were used to examine the differences between the two groups.

Validity of estimate of measure of benefit
The clinical effectiveness data and the economic data were not combined. Therefore, this study is classified as a cost-consequences analysis.

Validity of estimate of costs
The economic perspective of the study was not explicitly stated, but a hospital view appears to have been adopted. All the costs directly linked to individual patient care appear to have been included, although the lack of detail means it is not possible to confirm this. It appears that the cost of the electronic system has not been included in the study. The inclusion of this cost would be likely to considerably increase the costs for patients after the implementation of POE. The fact that only severity-adjusted total costs were reported limits the generalisability of the study. The lack of a price year also compromises the generalisability of the study and prevents any future reflation exercises. No statistical analysis of resource use or unit costs was undertaken, although the difference between the total costs was tested using an appropriate statistical test. Discounting was unnecessary since all costs were incurred during a short time (less than 2 years) and, appropriately, was not performed.

Other issues
The authors did not compare their findings with those from other studies. However, it is likely that this was because of the reported lack of cost-effectiveness evidence in this area. They also did not directly consider how their results may be generalised to other settings. The authors do not appear to have been selective in their presentation of the results, although more detail on the cost data would have aided assessment of the study.

Implications of the study
The authors did not make any direct recommendations for further research or changes to practice, although they noted that their study supports the Institute of Medicine recommendations on the use of POE.

Source of funding
Supported by the Ohio State University Health System.

Bibliographic details

PubMedID
12223505

Indexing Status
Subject indexing assigned by NLM

MeSH
Academic Medical Centers; Clinical Pharmacy Information Systems; Decision Support Systems, Clinical; Hospital Costs; Humans; Length of Stay; Medical Records Systems, Computerized; Medication Errors /prevention & control; Medication Systems, Hospital; Patient Care; Time and Motion Studies; User-Computer Interface

AccessionNumber