Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial

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 study considered a clinical pathway to treat pneumonia in nursing home patients. The clinical pathway was delivered by nursing staff and consisted of mobile chest radiographs, hypodermoclysis (if required) and levofloxacin (500 mg orally for 10 days). Patients were transferred to hospital if their pulse rose above 100 beats per minute, their respiratory rate increased above 30 per minute, their systolic blood pressure fell below 90 mmHg, or their oxygen saturation was lower than 92%.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised nursing home patients aged 65 years or older with pneumonia, with a pulse of 100 beats per minute or less, a respiratory rate of 30 per minute or less, a systolic blood pressure of at least 90 mmHg, oxygen saturation of at least 92%, and the ability to eat and drink. Patients who were not expected to live more than 30 days from the date of enrolment (as judged by their attending physician and nurse) were excluded from the study, as were those with a history of anaphylactic or serious allergic reaction to fluoroquinolones. Patients with advance directives precluding transfer to hospital were also excluded.

Setting
The study was set in institutional care (nursing homes). The economic study was carried out in Canada.

Dates to which data relate
The clinical effectiveness and resource use data related to the period between 2001 and 2005. The price year was 2005.

Link between effectiveness and cost data
The resource use data were collected from the same patient sample that provided the clinical effectiveness data. It was unclear whether the costing was conducted prospectively or retrospectively.

Study sample
The study paired nursing homes on the basis of the number of occupied beds. One of the pair was randomly allocated to the clinical pathway group and the other provided usual care. Sample size calculations that took account of the clustered nature of the trial were performed in the planning phase of the study. Overall, 36 nursing homes were identified as eligible for the study and 22 were randomised to one of the treatment regimens. To be eligible for the study, the nursing...
homes had to have at least 100 residents and have no stated policies for pneumonia treatment. Two nursing homes withdrew from the study after randomisation but before any patients had been included. A total of 680 patients were included in the study, of whom 327 were in nursing homes allocated to the clinical pathway and 353 were in nursing homes providing usual care.

**Study design**

The study was a cluster, randomised controlled trial. An independent statistician performed the randomisation using random-number tables. Blinding to the treatment group was not feasible in this study. The patients were followed up for 4 weeks. Data on 661 (97%) patients, 314 in the clinical pathway group and 347 in the usual care group, were obtained. Fourteen patients withdrew from the study (9 in the clinical pathway group and 5 in the usual care group), three were transferred from their nursing home (2 in the clinical pathway group and 1 in the usual care group), and two in the clinical pathway group were excluded because of adverse reactions.

**Analysis of effectiveness**

The primary health outcomes used were:

- the hospital admission rates,
- the number of days spent in hospital,
- the number of visits to the emergency department without admission,
- the mortality rates,
- time to normalisation of vital signs,
- the rate of falls,
- adverse reaction,
- the pneumonia severity index,
- the change in quality of life (measured using the Minimum Data Set Health Status Index), and
- functional status (measured using a modified Barthel Index).

The analysis was conducted on an intention to treat basis. The two patient groups appear to have been comparable in terms of their age, gender, co-morbidities and severity of illness.

**Effectiveness results**

The hospitalisation rate was 8% with a mean of 0.79 days per patient in the clinical pathway group, compared with 20% with a mean of 1.74 days per patient in the usual care group. The difference was 12% (95% confidence interval, CI: 5 to 18; p=0.001) for the hospitalisation rate and 0.94 days (95% CI: 0.34 to 1.55; p=0.004) for the mean days in hospital per patient.

The mortality rate was 3.1% in the clinical pathway group versus 6.0% in the usual care group, (p=0.23).

The fall rate was 10.9% in the clinical pathway group versus 9.5% in the usual care group, (p=0.60).

The change in quality of life was -0.032 in the clinical pathway group versus -0.037 in the usual care group, (p=0.055).

The change in functional status was -0.105 in the clinical pathway group versus -0.175 in the usual care group, (p=0.23).

Normalisation of vital signs took a mean of 2.55 days in the clinical pathway group and 2.66 days in the usual care group.
group, (p=0.79).

There were no significant differences in residents who experienced adverse events.

**Clinical conclusions**
The authors concluded that treating nursing home patients with pneumonia by means of a nurse-led clinical pathway resulted in comparable clinical outcomes, while reducing hospital admissions, compared with usual care administered by the patient’s physician.

**Measure of benefits used in the economic analysis**
No summary measure of health benefits was used in the economic analysis. In effect, a cost-consequences analysis was undertaken.

**Direct costs**
The direct costs of the health care payer were identified. The different categories of costs investigated were assessment, additional diagnosis and treatment resources (including oxygen, hydration and chest radiograph) and hospitalisation. This last category of costs included intensive care unit length of stay, non-intensive care unit length of stay, emergency department visit, physician fees, diagnostic imaging and ambulance transport. The resource use data were collected from the same patient sample that provided the clinical effectiveness data, but it was unclear whether these were collected alongside the clinical data (primary data) or were obtained from hospital records (secondary data). Professional fees were taken from a standard professional schedule. The unit costs for hospitalisation and patient transport were taken from the accounting system of a large hospital. The source of the unit cost for the additional nursing time received by those in the clinical pathway group was not reported. A breakdown of resource use and unit costs was included in the paper. The price year was 2005. The authors calculated the total cost of implementing the clinical pathway throughout Canada and across the USA.

**Statistical analysis of costs**
The total costs were reported as mean values with 95% CIs.

**Indirect Costs**
No productivity costs were included in this study.

**Currency**
Canadian costs (Canadian dollars, CAD) were presented in US dollars ($). The conversion rate was $1 = CAD 1.20.

**Sensitivity analysis**
No analyses to investigate uncertainty in the data were performed.

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

**Cost results**
The mean total cost per patient was $1,183 in the clinical pathway group compared with $2,199 in the usual care group. Therefore, the clinical pathway resulted in a cost-saving of $1,016 (95% CI: 207 to 1,824).
Synthesis of costs and benefits
Not relevant since, in effect, a cost-consequences analysis was performed.

Authors' conclusions
"A clinical pathway for treating residents of nursing homes with pneumonia and other lower respiratory tract infections results in similar clinical outcomes to usual care, reduces hospitalisations, and results in an overall reduction of health care costs."

CRD COMMENTARY - Selection of comparators
In this study, the treatment of pneumonia by a nurse-led clinical pathway was compared with treatment by the patient's physician. The latter (treatment by the patient's physician) represented usual care in the authors' setting. You should consider how this compares with usual care in your own setting prior to applying the results of this study.

Validity of estimate of measure of effectiveness
The clinical effectiveness data were taken from a clustered, randomised controlled trial, which was appropriate for the study question. The study sample was restricted to nursing homes that had at least 100 beds and the authors acknowledged that this might limit the generalisability of the study findings. Sample size calculations that took account of the clustered nature of the trial were undertaken in the planning phase of the study, and the sample was of sufficient size. The method of randomisation, study length, and loss to follow-up were reported, and these suggest that the internal validity of the study is likely to be good. It was not practical to blind either the patients or the health care staff to the treatment group allocation. Statistical analysis of the trial data was appropriate and took account of the clustering in the trial.

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

Validity of estimate of costs
The economic perspective of the study was that of the third-party health care payer and all appropriate costs appear to have been included. A breakdown of resource use and costs was provided for both treatment groups. This enhances the generalisability of the study findings. However, although the degree of uncertainty around the total cost data was described using confidence intervals, no statistical or sensitivity analyses were undertaken. Charges were used to proxy price which, given the third-party payer perspective, was appropriate. A clear price year was reported, which will permit future reflation exercises. Discounting was not performed but was not necessary given the short follow-up period.

Other issues
The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis. They compared some clinical results (mortality rates) with those from other studies. The study was set in Canada and the authors discussed how their study might be applied to the USA and how the economic implications might differ. The authors acknowledged that restricting the nursing homes included in the study to those with at least 100 beds might have reduced the generalisability of their findings.

Implications of the study
The authors did not make any recommendations for further research or changes to current practice.

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