Multicomponent targeted intervention to prevent delirium in hospitalized older patients: what is the economic value
Rizzo J A, Bogardus S T, Leo-Summers L, Williams C S, Acampora D, Inouye S K

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 investigated the implementation of the Hospital Elder Life Program, a multicomponent targeted intervention (MTI) to prevent delirium in hospitalised older patients. The MTI was based on 6 risk factors for delirium: cognitive impairment, sleep deprivation, immobility, visual impairment, hearing impairment and dehydration.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised hospitalised elderly patients. Further details are provided in the earlier clinical trial of effectiveness (Inouye et al. see 'Other Publications of Related Interest' for bibliographic details). The inclusion criteria were consecutive admissions of patients to three units on the general medicine service at Yale-New Haven Teaching Hospital (Connecticut). The patients had to be at least 70 years old, with no evidence of delirium at admission and at intermediate or high risk of the condition at baseline (criteria were specified). The exclusion criteria included coma or terminal illness, those with a hospital stay of 48 hours or less, an inability to participate in interviews, or prior enrolment in the study.

Setting
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence and resource use were gathered during a 3-year period from 25 March 1995 to 18 March 1998. The reference year for the prices was 1995.

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

Link between effectiveness and cost data
The costing was based on actual expenditure during the study period, and was conducted on the same sample of patients as that used in the effectiveness study.

Study sample
No power calculations were reported for the determination of the sample size. However, this information might be contained within the earlier clinical trial (Inoue et al. see 'Other Publications of Related Interest' for bibliographic details). The study participants comprised matched pairs of intervention and control patients who were enrolled in the clinical trial. Out of 2,434 patients initially screened, 1,265 were excluded (based on the exclusion criteria). In addition, 250 (10%) refused to participate and a further 67 were unable to be matched. Thus, a total of 852 patients started the trial (426 matched pairs in the intervention and control groups). The patients had a mean age of just less than 80 years (standard deviation 6.16), 39% were male, 13% were non-white, and 28% were categorised as high risk in relation to the incidence of delirium.

**Study design**
Randomisation was not possible as the prospective matching of all intervention patients with controls from two usual care floors (in the hospital) was hindered by the unavailability of beds in the intended separate study units. Therefore, as the patients were assigned to floors according to bed availability, the authors described this as a pseudo-randomised trial. The patients were matched on age, gender and baseline delirium risk. This study was conducted in a single centre over a 3-year period. Trained research staff, blinded to the nature of the study and patient group assignment, performed the assessments. The duration of follow-up was until hospital discharge.

**Analysis of effectiveness**
The primary health outcome for the clinical trial was the incidence of delirium that developed during hospitalisation. This was assessed using Confusion Assessment Method (CAM) criteria. The authors reported complete data collection for all patients. Despite the lack of randomisation, the groups were reported to be similar at baseline. There were no systematic differences in terms of the patients assigned to (or staff composition within) each group. Diagnoses, illness severity, co-morbidity scores and the process of care were reported as similar across intervention and control floors. At analysis, patient demographics and discharge status (death, nursing home, home or independent living) were similar.

**Effectiveness results**
Overall, the incidence of delirium was significantly lower for patients in the MTI group (10%) than those in the UC group (15%), (5% significance level).

The incidence rate was 7% for those in the intermediate-risk group receiving the MTI, compared with 12% in the UC group, (p<0.05).

In high-risk patients, the incidence rate was 19% in the MTI group and 24% in the UC group, (p not significant).

**Clinical conclusions**
The authors concluded that the MTI was an effective method of reducing the incidence of risk of delirium in hospitalised elderly people, in particular those with an intermediate risk for the condition (the incidence reduction was statistically significant).

**Modelling**
A multivariate analysis was performed to isolate the specific impact of the MTI on hospital costs and length of stay. The multiple regression models controlled for MTI status and also for matching variables (e.g. race, gender and baseline delirium risk), race, co-morbidity and health indicators, and year of treatment.

**Measure of benefits used in the economic analysis**
The authors did not use a summary measure of benefit in the economic analysis. Therefore, a cost-consequences analysis was performed.
Direct costs
The direct costs of the intervention, relating to personnel and equipment employed, were calculated for the study period. These were used to derive an average daily intervention cost that was applied to each patient, and thus varied according to the length of hospital stay. Personnel costs (excluding time spent in research-based activities) were derived from a detailed time study and hospital salary scales. Equipment costs (such as office overhead expenses and specific intervention items) were derived from actual expenditure during the study period. Health care utilisation costs (e.g. nursing, pharmacy, diagnostic procedures) were taken from UB-82 forms that represented charges to Medicare submitted by Yale-New Haven Hospital. Cost-to-charge ratio data (provided by the hospital) were used to convert charges to estimated costs. The reference year for the prices was 1995.

Statistical analysis of costs
In the analysis of delirium outcomes, descriptive costs were given as mean values plus the standard error (SE). Differences were explored using a standard t-test. In the multivariate analysis, the costs were analysed using t- and f-statistics (at the 1, 5 and 10% significance levels).

Indirect Costs
In line with the perspective chosen, the indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was carried out to explore the robustness of the results arising from variations in the hospital and MTI costs (4-fold variation).

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

Cost results
The total cost of the MTI intervention over the 3-year period study was $257,385.

In the intermediate-risk group, non intervention costs (i.e. those pertaining to health care utilisation) were significantly lower following the MTI ($6,124, SE=337) than for those receiving UC ($7,565, SE=545), (5% significance level).

The total cost-savings were $831 in the intermediate-risk group receiving the MTI strategy, compared with UC.

There was no statistically significant difference in the non intervention costs in the high-risk group (MTI $7,414 versus UC $6,618).

When the intervention costs were included, cost reductions remained in the intermediate-risk group (-$99; p not significant) and cost increases were noted in the high-risk group ($1,308; p<0.05).

In multivariate analysis (controlling for age, gender, baseline risk and so on), the total non intervention costs were reduced significantly (5% level) for the intermediate-risk group but not for the high-risk group. These reductions were seen largely in daily costs (e.g. nursing costs, diagnostic procedures and others such as intensive care, rehabilitation and physical therapy), but not length of stay.

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

The results of the sensitivity analysis showed that a 4-fold variation in hospital and MTI costs changed the magnitude of the estimated effect of the MTI. However, these results were consistent with the direction presented in the 'Authors' Conclusions' (below).

**Authors' conclusions**
The multicomponent targeted intervention (MTI) is cost-effective for patients at intermediate risk for delirium. The MTI was not effective in preventing delirium amongst high-risk patients and exhibited higher overall costs, thus the MTI strategy was not cost-effective in this patient group.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of the comparator (UC) was clear, although detail was lacking on the content of UC. Further details might be contained within the parent clinical study (Inoue et al., see 'Other Publications of Related Interest' for bibliographic details). You should decide if this represents a widely used technology in your own setting.

**Validity of estimate of measure of effectiveness**
Failure to carry out true randomisation and the possibility of contamination between study participants in this trial represent significant threats to the internal validity. The authors stated that the demographic profile of patients was similar between the groups at baseline, although the extent of any differences present at analysis was unclear. However, some appropriate exploration was undertaken by multivariate methods, to help isolate the specific impact of the MTI. Further strengths of the study lie in full data collection for all patients. The authors acknowledged that the generalisability of the effectiveness findings might be restricted by this single-site study, although the age of the included participants was likely to reflect those admitted to hospital with risk of delirium. They also acknowledged that the lack of a statistically significant impact of MTI on delirium prevention in the high-risk sample might have reflected the inadequate power of the study.

**Validity of estimate of measure of benefit**
As no summary measure of benefit was used in the economic analysis, the reader is referred to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

**Validity of estimate of costs**
It appears that appropriate costs relating to the hospital perspective have been included in the analysis. The authors acknowledged that other costs (specifically those incurred over a longer term and relating to a societal perspective) would be worthy of attention in this area. It was not possible to separate the costs from the quantities with this multicomponent intervention, thus limiting reproducibility in other settings. Sparse detail on the recording of personnel and equipment resource use and the source of costs relating to the MTI meant that it was not possible to determine the reliability of the methods. The absence of a sensitivity analysis on this aspect of resource use may limit the interpretation of the findings. The use of UB-82 forms (representing health care use/charges to Medicare) was appropriate to this single-site study and hospital costs were later adequately explored in sensitivity analysis. Cost-to-charge ratio data provided from the authors' setting were used to convert Medicare charges to estimated costs. Although there are limitations relating to the generalisability (to other settings) of costs derived in this way, the use of a cost-to-charge mechanism is methodologically superior to the reporting of charges only. The reporting of the price reference year will aid any future reflation exercises.

**Other issues**
The authors compared their findings with those from other multicomponent intervention studies, but none related to the prevention of delirium. The authors appropriately acknowledged the limited generalisability of their findings from this single-site study, along with further limitations arising from the analysis over a relatively short timeframe.
Implications of the study
The authors suggested that future delirium trials are needed to continue work with intermediate-risk groups, in a variety of settings and over a longer timeframe, to establish the significance of a wider range of costs and outcomes. They also recommended further investigation into the impact of individual components and the direct economic impacts of delirium.

Source of funding
Supported in part by the National Institute on Aging (grant RO1AG12551) and by in-kind support from the Claude D. Pepper Older Americans Independence Center (grant P60AG10469).

Bibliographic details

PubMedID
11458138

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Connecticut; Cost-Benefit Analysis; Delirium /economics /prevention & control; Female; Geriatric Assessment; Health Care Costs; Health Services for the Aged /economics; Hospital Costs; Humans; Length of Stay; Male; Models, Econometric; Multivariate Analysis; Outcome Assessment (Health Care) /economics; Patient Care Planning /economics; Prospective Studies; Regression Analysis

AccessionNumber
22002008046

Date bibliographic record published
30/09/2005

Date abstract record published
30/09/2005