Development and implementation of a rapid, accurate, and cost-effective protocol for national stroke prevention screening
Lavenson G S, Pantera R L, Garza R M, Neff T, Rothwell S D, Cisneros J

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 stroke prevention screening (SPS) protocol was assessed. This SPS protocol was developed to detect all three of the immediate causes of stroke: carotid artery disease, atrial fibrillation (AF) and hypertension (HT). The SPS protocol employed the quick carotid scan (QCS) to detect possible stroke-potential carotid artery disease, a lead II/electrocardiogram rhythm strip to recognise AF, and a right arm blood pressure measurement to determine HT. The QCS uses rapid imaging of the carotid arteries in the neck with a colour-flow, pulsed Doppler ultrasound probe. Patients with a possible greater than 50% stenosis were referred for a full-colour duplex carotid artery ultrasound examination.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients older than 50 years. No other inclusion or exclusion criteria were reported.

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

Dates to which data relate
The effectiveness and resource use data were collated between November 1997 and February 2004. The costs were derived from two studies published in 1994 and 1997. A price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study. Diagnostic accuracy was derived from prior studies and the authors' extrapolations.

Link between effectiveness and cost data
The effectiveness data and the resource use data were derived from the same patients. The costs were extrapolated for future projections using the 40 million Medicare recipients.

Study sample
Power calculations were not reported. The sample comprised patients, aged over 50 years, who were screened for the
three immediate causes of stroke in the central valley of California between November 1997 and February 2004. No inclusion or exclusion criteria, except for age, were reported. A total of 2,559 patients were screened. The authors did not state whether any people refused to participate or were excluded from the initial sample.

**Study design**
This was a diagnostic yield study that was carried out in multiple sites in the same area (the central valley of California). All of the patients included in the initial study sample were screened using the SPS protocol.

**Analysis of effectiveness**
The outcome measures used were the prevalence of carotid occlusive disease (COD), AF and HT. The authors did not report any summary statistics for the study participants.

**Effectiveness results**
In the study sample, there were 191 individuals (7.5%) with COD, 130 (5.1%) with AF and 750 (29.3%) with HT.

**Clinical conclusions**
The authors did not report any clinical conclusions based on this study.

**Outcomes assessed in the review**
The clinical outcomes assessed were the sensitivity and specificity of QCS, and the efficacy of carotid endarterectomy.

**Study designs and other criteria for inclusion in the review**
Study designs and other criteria for inclusion in the review were not reported. In a prior diagnostic accuracy study, the authors evaluated the sensitivity and specificity of QCS based on 500 consecutive new carotid ultrasound patients (Lavenson et al. 1998, see ‘Other Publications of Related Interest’ below for bibliographic details). The authors used the results from the Asymptomatic Carotid Arteriosclerotic study to assess the efficacy of carotid endarterectomy (Executive Committee for the Asymptomatic Carotid Arteriosclerotic Study 1995, see ‘Other Publications of Related Interest’ below for bibliographic details).

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
Two published studies provided evidence.

**Methods of combining primary studies**
The results were not combined.
Investigation of differences between primary studies
Potential differences between the primary studies were not discussed in the analysis.

Results of the review
The authors found a 93% sensitivity and 87% specificity of QCS in a previous study. The vascular laboratory of New York University found a sensitivity of 97%.

From the Asymptomatic Carotid Arteriosclerotic study, the authors estimated that carotid endarterectomy on 10 patients prevented 1 stroke.

Methods used to derive estimates of effectiveness
The authors made an assumption to derive the effectiveness.

Estimates of effectiveness and key assumptions
The authors reported that approximately two thirds of patients with a possible greater than 50% carotid stenosis on screening needed carotid endarterectomy.

Measure of benefits used in the economic analysis
The measure of benefits used was the number of stroke prevented. Using the above estimated parameters, the authors presented some extrapolations to derive the number of screened seniors needed to prevent one stroke. The extrapolations were based on a total number of 6,073 screened patients residing in the central valley of California, at Madigan Army Medical Center, at New York University and by the American Vascular Association at 68 leading institutions.

Direct costs
The costing was carried out from the perspective of a medical care system. The direct medical costs included the costs of QCS, ultrasound and second examination, the cost of carotid endarterectomy, and the cost of managed stroke. The quantities and the unit costs were reported separately for the QCS test and ultrasound examination. The resource use data were derived from the effectiveness study. The direct medical cost of having a stroke was derived from a published study. The source of the unit costs for the screening protocol was unclear, but the unit costs appear to have been taken from the authors’ setting. The costs were not discounted. Cost-savings were extrapolated for future projections using the 40 million Medicare recipients. A price year was not reported.

Statistical analysis of costs
The authors did not report any statistical analyses of the costs.

Indirect Costs
The indirect costs were not reported.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was reported.
Estimated benefits used in the economic analysis
Two hundred seniors needed to be screened to prevent 1 stroke.

Screening 6,073 seniors could prevent 30 strokes.

The projection of screening to 40 million Medicare recipients could be anticipated to prevent 200,000 of the 750,000 strokes occurring annually.

Cost results
The cost of screening 6,073 seniors was $2,465,790. The averted costs due to screening (cost of managed stroke) were $4,410,000. Therefore, the net cost-saving was $1,944,210.

For the projection of screening to 40 million Medicare recipients, the net cost-saving was $12,961,400,000.

Synthesis of costs and benefits
The cost-saving was $64,807 per stroke prevented.

Authors' conclusions
The stroke prevention screening (SPS) protocol developed was rapid, accurate and cost-effective. It provided a means of effectively screening seniors for the three silent, immediate causes of strokes so they could be treated before stroke occurred.

CRD COMMENTARY - Selection of comparators
The choice of no screening as the comparator was clear. The authors justified their choice of a full carotid artery ultrasound as the comparator for QSC: "ultrasound is the surest means of discovering carotid artery disease". However, it was unclear whether all potential screening alternatives for COD, AF and HT were assessed in the study. You should judge whether this comparator is relevant in your setting.

Validity of estimate of measure of effectiveness
The analysis was based on a diagnostic yield study, which was appropriate for addressing the study question of the sensitivity of the screening strategies. However, the study design did not allow a full assessment of diagnostic accuracy (the number of false positives and true negatives were not reported). Details of the study sample, such as demographics, were not given to set the context for the reader and, therefore, did not enable an assessment of generalisability to other settings.

Published studies were also used to obtain the input parameters. However, the authors only provided brief details of the methods used for the review, so the validity of the data cannot be assessed. For example, the criteria used to ensure the validity of the primary studies and the methods used to extract the data were not stated.

Where evidence of effectiveness was lacking, the data were derived from assumptions. Uncertainty around all outcomes was not evaluated using a sensitivity analysis. These facts introduce strong uncertainty into the effectiveness results obtained. The main analysis focused on the comparison of the screening protocol versus no screening, with the comparison of QCS versus carotid endarterectomy incorporated implicitly into this analysis (full details of this comparison were not reported).

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefits. The reader is referred to comments in the 'Validity of estimate of measure of effectiveness' field (above).
Validity of estimate of costs
It appears that all the categories of costs relevant to the medical care system perspective were included. The analysis did not focus on the immediate direct costs of screening the patients. The main focus was the cost-savings due to stroke prevented and these were included in the analysis. However, the costs associated with false positives and false negatives were not included in the analysis. This may have led to the costs of the SPS protocol being underestimated. It was unclear whether overhead costs were incorporated in the unit cost estimates, as the cost components were not reported. The costing could have been reported more thoroughly by breaking down the cost and resource use elements so that the reader could assess the key cost-drivers. The unit costs for the screening protocol were derived from the authors’ setting, while the costs of having a stroke were derived from a published study. No statistical or sensitivity analysis of the costs was carried out, and this strongly limits the interpretation of the results. The failure to report the price year also limits any future reflation exercises. Discounting was not relevant and, appropriately, was not carried out.

Other issues
The authors did not compare their results with the findings from other studies. In addition, the issue of generalisability to other settings was not addressed. The conclusions reported were an accurate reflection of the scope of the analysis and the results presented. However, the results of the study focused on screening for carotid artery disease, although the authors drew conclusions on the accuracy of the SPS protocol to detect AF and HT. The performance of a lead II/electrocardiogram rhythm strip to recognise AF and a right arm blood pressure measurement to determine HT was not assessed. Therefore, the overall performance or accuracy of the SPS protocol was not assessed. The authors reported no other limitations to their study.

Implications of the study
There were no specific recommendations for future research. The authors suggested that there is an imperative need to decrease stroke by means of the SPS protocol.

Source of funding
None stated.

Bibliographic details

PubMedID
15619477

DOI
10.1016/j.amjsurg.2004.08.055

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH