Preplacement nerve testing for carpal tunnel syndrome: is it cost effective
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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
The use of preplacement nerve testing for carpal tunnel syndrome (CTS) was evaluated, as part of a recruitment policy in companies. An electrophysiological screening test for CTS was performed, with normal and abnormal results provided to the company.

Type of intervention
Screening.

Economic study type
Cost-benefit analysis.

Study population
The study population comprised workers hired by a company that performed median nerve testing as part of its POPP medical examination.

Setting
The setting was the workplace. The economic study took place in a company manufacturing automobile parts, located in the Midwestern USA.

Dates to which data relate
The effectiveness data were gathered from January 1996 to May 2003. It seems that the resource consumption data have been collected for the same period. The price year was 2003.

Source of effectiveness data
The effectiveness data were derived from a single study and authors’ assumptions.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that used in the effectiveness study.

Study sample
No study sample was determined in the planning phase of the study. In addition, no retrospective power calculations were reported. The study sample comprised all new workers hired during the study period. The company hired 2,154 new workers, of which four were excluded from the analyses because their duration of employment was not determined. Therefore, the cohort included 2,150 workers (56% male). The mean age at time of hire was 30.3 (+/- 10.8) years. The POPP nerve test results were abnormal for 327 workers (61% male) and normal for 1,823 workers (55% male). The mean age at time of hire was 35.9 (+/- 12.2) years for workers with abnormal POPP nerve test results.
and 28.6 (+/- 10.2) years for those with normal POPP nerve test results.

**Study design**
This was a retrospective cohort study that was carried out in a single company. The workers were followed from the moment they were hired until they left the company, or until follow-up ended in May 2003. The mean duration of follow-up among the participants was 2.1 years. No blinding of the outcome assessment was reported.

**Analysis of effectiveness**
The analysis used participants for whom there were complete data. The primary outcome of interest was the number of workers' compensation (WC) claims related to CTS. A multivariate logistic model was used to investigate the relationship between some variables and abnormal POPP nerve test results. Workers with an abnormal POPP nerve test were significantly older, (p<0.001), and more obese, (29.6 +/- 7.1 kg/m2 versus 27.5 +/- 6.2 kg/m2; p<0.003), than workers with normal POPP nerve tests. Males were more likely to have an abnormal nerve test than females, but this difference was of borderline significance. In a multivariate logistic model predicting abnormal POPP nerve tests, age and body mass index but not gender remained significant covariates (the results were not shown).

**Effectiveness results**
There were a total of 35 WC claims related to CTS in the entire cohort. Of these, 22 were among workers with normal POPP nerve tests and 13 among workers with abnormal POPP nerve tests, (p<0.001).

The proportion of WC claims for CTS was significantly greater among workers with abnormal POPP nerve tests (chi-squared 13.3; p<0.001).

The overall rate of WC CTS cases in the cohort was 7.80 per 1,000 person-years (PYs). The rate of WC CTS claims was greater among workers with abnormal POPP nerve tests (19.36 cases per 1,000 PYs) than those with normal POPP nerve tests (5.76 cases per 1,000 PYs).

**Clinical conclusions**
The authors did not report any clear clinical conclusion.

**Measure of benefits used in the economic analysis**
The measure of benefit used was the monetary value of the WC CTS claims that would have been avoided by not hiring workers with abnormal POPP nerve test results. The estimation of the WC CTS claims avoided was based on two assumptions. First, the rate of WC CTS claims among replacement workers would have been the same as observed among workers with normal POPP nerve tests. Second, the replacement workers would have accumulated the same number of PYs of follow-up as did the workers with abnormal POPP nerve test results.

**Direct costs**
The quantities and the unit costs were reported separately. For each WC case of CTS, the medical costs and wage replacement costs were included. The costs of screening and hiring workers were also considered in the analyses. The company provided a model for estimating the costs of hiring a new employee. The cost categories considered were processing and screening job applicants, interviewing and testing job applicants, new hire processing and orientation, and POPP medical screening (including the physical examination, drug test and nerve test costs). The initial job training costs were also considered. These reflected wages, fringe, and training costs incurred during the first 4 days of employment.

The costs associated with a WC case of CTS were retrieved from company insurance records and a multivariate regression model. POPP medical screening costs were based on actual costs. Discounting was not applied, although it might have been appropriate. All of the costs were adjusted to May 2003 prices, according to the Consumer Price Index.
Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs from reduced productivity related to “light duty” during recovery were included in the analysis. The number of light-duty days for each WC case of CTS was obtained from the Occupational Safety and Health Administration log. The company estimated the cost of a light-duty day. Discounting was not applied. The price year was 2003.

Currency
US dollars ($).

Sensitivity analysis
The analysis was performed for four scenarios that included or excluded the costs of initial job training, and also considered or did not consider the incorporation of a drug test and the drug test failure rate. Univariate sensitivity analyses, based on published data, were performed. The parameters varied were the overall rate of WC CTS in the entire cohort, the rate ratio of WC CTS among workers with abnormal and normal nerve test results, the costs of cases of WC CTS, and the costs associated with hiring workers.

Estimated benefits used in the economic analysis
A total of 9.13 WC CTS claims would have been avoided if the company had not hired the otherwise-qualified workers who had failed the POPP nerve test. The total potential saving related to avoided WC CTS claims would have been $178,985.

Cost results
The costs in scenario A (including both drug test and job training costs) were $536,338.

The costs in scenario B (including drug test and excluding job training costs) were $253,981.

The costs in scenario C (excluding drug test and including job training costs) were $494,209.

The costs in scenario D (excluding both drug test and job training costs) were $229,413.

Synthesis of costs and benefits
The net loss to the company of not hiring otherwise-qualified workers who had failed the POPP nerve test ranged from $357,353 in scenario A to $50,428 in scenario D. These results were shown to be robust in the sensitivity analyses.

Authors’ conclusions
Not hiring otherwise-qualified workers with abnormal post-offer preplacement (POPP) nerve test results, in order to reduce the costs of work-related carpal tunnel syndrome (CTS), is not a cost-effective strategy for employers.
Validity of estimate of measure of effectiveness
The analysis used a retrospective cohort study to estimate the number of WC claims related to CTS. The study sample seems to have been representative of the study population, as all new workers hired during the study period were included in the analysis. It could be debated whether the number of WC claims could be considered a measure of health effectiveness. The main weakness of the analysis was that the raw nerve test results were not accessible, so the internal validity of the data could not be judged. Moreover, the impact of using alternative cut-offs for defining normal and abnormal results could not be assessed. The lack of reported blinding of the outcome assessment presented a further potential limitation to the reliability of the findings. The authors performed appropriate statistical analyses to test if differences between the two groups were statistically significant.

Validity of estimate of measure of benefit
The estimation of the WC CTS claims avoided was based on two reasonable assumptions. The method used to calculate the monetary value of the avoidable WC CTS claims seems to have been appropriate.

Validity of estimate of costs
The quantities and the unit costs were reported separately, which will aid the generalisability of the authors' results. All the costs relevant to the perspective adopted in the analysis were included. The price year was reported and the inflation methods used were appropriate. However, the cost estimations do not appear to be generalisable to other settings or countries, as they were based on the company's database. Discounting was not applied, although it might have been appropriate given the time horizon of the study.

Other issues
Although a sensitivity analysis was performed, the effectiveness and cost estimations would appear to be specific to the study setting. Nevertheless, the authors stated that in most companies the cost-benefit ratio would be less favourable than in their analysis. The authors compared their effectiveness and cost results with those of other studies, but not their cost-benefit results because, to their knowledge, no similar studies had been published. The authors reported several limitations of their study (see 'Validity of estimate of measure of effectiveness' field). The authors reported another limitation in that they did not assess the possible cost-benefit of using POPP nerve tests in other circumstances, for example, to determine job placement.

Implications of the study
The authors argued that instead of spending resources on a POPP nerve test, and discriminating against large number of workers with abnormal nerve test results, companies should invest resources in alternative strategies to reduce costs related to WC CTS, such as the reduction of ergonomic job hazards.

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