Continuous positive airway pressure reduces risk of motor vehicle crash among drivers with obstructive sleep apnea: systematic review and meta-analysis

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CRD summary
This review of observational studies concluded that continuous positive airway pressure reduced accident risk in drivers with obstructive sleep apnoea. Weaknesses in the evidence base suggest that the authors' conclusions should be interpreted with some caution.

Authors' objectives
To assess the impact of continuous positive airway pressure (CPAP) on risk of motor vehicle accidents in drivers with obstructive sleep apnoea.

Searching
PubMed, EMBASE, PsycINFO, CINAHL, TRIS and the Cochrane Library were searched to May 2009. Search strategies were reported to be available on request. Reference lists of included studies and recent narrative reviews, and contents of new issues of selected journals and selected 'grey literature' sources, were also screened. The review was limited to articles published in full in English.

Study selection
Before-and-after, case control and cohort studies that reported on accidents that involved people with obstructive sleep apnoea treated with continuous positive airway pressure (CPAP) were eligible for the review. Studies had to include at least 10 participants, aged 18 years or older, and include sufficient data to allow calculation of an effect size.

Participants in included studies were mostly male and had moderate to severe sleep apnoea; their mean apnoea-hypopnoea index ranged from under 20 to 54 per hour; their mean body mass index ranged from 29.2 to 35.5kg/m² (where reported). The average age of participants ranged from 46 to 56.6 years. Most participants were private drivers. Distances driven ranged from 18,000 to 30,000km/year (where reported). The studies provided different types of crash data. Accident rates were based on self-report in most studies.

The authors did not state how many reviewers selected studies for the review.

Assessment of study quality
The authors stated that study quality was assessed using separate scales for controlled studies and before-after studies. No further details were reported in the paper, but the authors stated that details were available on request.

Data extraction
Data were extracted by two independent reviewers to calculate rate ratios (RR) and 95% confidence intervals (CI) for accidents. Data for injury were extracted for one study.

Methods of synthesis
Studies were pooled by meta-analysis using a random-effects model if significant heterogeneity was present. Heterogeneity was assessed using the Q-statistic and $I^2$.

Sensitivity analyses included the use of fixed-effect and random-effects cumulative meta-analyses, and re-analyses of data with and without subgroups of participants.

Publication bias was assessed using a 'trim and fill' method.

Results of the review
Nine studies with 1,976 participants (range 36 to 893) were included in the review. Study quality was reported to be low. All studies used a retrospective before-after design with observation periods ranging from six months to five years.
before study entry, with similar periods after enrollment. Three studies included a control group of drivers without sleep apnoea.

Across all studies, risk of accident was significantly reduced after treatment with continuous positive airway pressure (CPAP) compared with the period before treatment (pooled RR 0.28, 95% CI 0.22 to 0.35). Substantial heterogeneity was present in the meta-analysis ($I^2=87.2\%$). Sensitivity analysis indicated that the findings were robust. Risk of injury was significantly reduced in the study reporting this outcome (RR 0.2, 95% CI 0.1 to 0.39).

Results from the three studies that compared crash data of CPAP-treated obstructive sleep apnoea patients with normal controls were inconsistent. One study reported an increased crash risk in CPAP-treated patients and the other two studies found no increased crash risk.

**Authors’ conclusions**
Observational studies indicated that continuous positive airway pressure (CPAP) reduced accident risk in drivers with obstructive sleep apnoea.

**CRD commentary**
The review question and inclusion criteria were generally clear, although the criteria for study design were only stated in the abstract. The authors searched a range of sources including grey literature. The review was limited to English language studies, so relevant studies published in other languages could have been overlooked. Publication bias was assessed, but the results were not reported. Other than data extraction, the number of reviewers involved in various stages of the review was not reported, which meant that the risk of reviewer errors or bias affecting the review was uncertain.

Study quality was assessed, although details of criteria and results were not reported in the paper. Relevant details of included studies were reported. Studies were pooled by meta-analysis and heterogeneity was assessed.

It was clear that the included studies were at high risk of bias. Small sample sizes, short observation periods and non-concurrent collection of data made it difficult to be sure that differences in accident risk were caused by CPAP treatment. The authors acknowledged these limitations, but based their conclusions on the large and statistically significant reductions seen in almost all the studies. The weaknesses of the evidence base suggest that the authors’ conclusions should be interpreted with some caution.

**Implications of the review for practice and research**
The authors did not state any implications for practice or research.

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