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Obstructive sleep apnoea and crash risk: Case study results within the development of the European road safety Decision Support System

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Problem

Within fatigue management, sleep research and sleep medicine, driver fatigue is widely recognised as a leading contributing factor to crashes. In particular drivers with obstructive sleep apnoea (OSA) are considered to be at increased risk of crashing. However, within road safety policy making driver fatigue can be overlooked. One reason for this may be a lack of understanding from road policy makers as to the importance of this risk in comparison to other risks e.g. speeding, drink driving.

Evidence based policy making is becoming increasingly prominent. Road safety policies are informed by accurate scientific information relating to crash risks and the cost-effectiveness of appropriate countermeasures. However, despite good intentions it can be difficult for policy makers to access and understand the scientific literature.

Method

The Safety Causation, Benefits and Efficiency (SafetyCube; www.safetycube-project.eu) research project is funded by the European Commission under the Horizon 2020 research framework programme. SafetyCube is developing an innovative road safety Decision Support System that will enable policy-makers and stakeholders to select and implement the most appropriate strategies to reduce road crashes. The project applies a standardised methodology for synthesising scientific knowledge into an accessible and easy to understand format for road safety stakeholders.

A comprehensive taxonomy of risk factors has been developed considering the driver, vehicle and road infrastructure. The scientific literature relating to each specific risk factor has been by systematically searching, screening and coding studies. OSA is one driver related risk factor which has been investigated as follows:

Literature search: A Title, Abstract, Keywords search in the database Scopus was conducted in May 2016 for journal papers published in English after the year 1995. Search terms combined queries relating to 1. driver fatigue/ sleepiness, 2. Obstructive sleep apnoea, 3. Road safety, 4. Crashes/injuries, 5. Risk, severity or frequency. Due to the large number of search results, the search was subsequently limited to papers originating in the following

countries: Europe, Israel, North America, Australia, New Zealand and Japan and publication period: 1 Jan 2006- 3 May 2016.
Screening: title and abstract screening of the 997 search hits identified all papers relating to crash risk and OSA. Duplicates were removed (5 removed). Titles were initially screened to remove those not addressing risk of fatigue in relation to road safety (832 removed). Papers were separated by topic relating to sleep disorders (51 papers), not enough sleep/driving when tired (96 papers) and other fatigue related (12 papers). The 51 sleep disorders papers were screened in detail.
Coding studies: each study was considered using an in house coding template. The coding template included information on: core elements of the study (study design, road users, potential sources of biases etc.), flexible elements (e.g. additional information that characterizes the study design), exposures, outcomes and reported results (measure of effects, p-values, confidence intervals, etc.). Every effect considered within a study was independently coded e.g. if OSA was categorised by different AHI magnitudes then the impact of each AHI grouping on crash risk was coded.

Results

997 studies were initially identified. The titles and abstracts of the remaining studies were screened identifying those specifically related to fatigue and crash risk. Studies related to sleep disorders were separated (n = 51), 23 of which focused on OSA. 21 full texts were obtained. Of the 21 OSA studies, 2 were meta-analyses. Any studies included in the meta-analysis were not independently coded (3). 8 of the remaining studies were not codable because they did not meet the minimum data requirements e.g. did not include a control group or consider crash risk. Studies were prioritised as follows: meta-analysis, those published more recently than the meta-analysis, accident report studies, driving simulator studies, publication date. Those studies considering truck drivers or car drivers were prioritised above other transport modes. In total 6 studies were coded.

Overall, OSA was consistently found to increase crash risk. The most recent meta-analysis demonstrated that drivers with OSA (regardless of AHI category ≥5, 10 or 20) are at a significantly increased risk of being involved in a crash compared to individuals without OSA (Garbarino et al 2015). The second meta-analysis and an independent study also reported a significant increased crash risk (Tregear et al 2009; Basoglu et al 2014). Similarly, truck drivers with OSA were found to be over 3 times more likely to be involved in a crash than drivers without OSA (Meuleners et al., 2015). While all the studies reported OSA to crash risk, one study also investigated near-misses and found no significant result (Catarino et al 2014). Finally, a driving simulator study identified that the driving performance of OSA participants deteriorates faster over time than controls, however, overall driving performance (lane position variability) did not significantly vary between OSA and control group participants (May et al., 2016).

Discussion

There is consistent evidence that untreated OSA increases crash risk, compared to drivers without OSA. This result is reported from a range of methodologically sound studies, including two meta-analyses. Using a standardised approach to coding scientific literature it has been possible to synthesise findings about the risk of OSA into a usable and understandable format for policy makers. Accessibility of this information is important because, while the risk of OSA is well recognised within the fatigue management and sleep

medicine community, it is arguably less so among road safety practitioners. It is vital for the custodians of road safety budgets to have a broad understanding of all associated crash risks in order to decide how to most appropriately allocate funds. Some countries do consider OSA within road safety policy e.g. by having OSA related licencing requirements, however, many do not and the exact policy details vary. This inconsistency suggests discrepancies between policy makers understanding of the risk of OSA to road safety. The next step within SafetyCube is to consider the countermeasures to mitigate identified risks (e.g. fitness to drive screening, public awareness campaigns). The same standardised literature searching and coding approach will be taken to synthesise knowledge about countermeasures.

Summary

The SafetyCube project addresses a critical gap in the knowledge for implementing evidence based policy making. OSA is one factor within the scientific literature which is known to increase crash risk, however, road safety would be improved if this knowledge were more accessible and widely understood by policy makers. A Decision Support System is being developed which will include concise, reliable and easily accessible information about a wide range of road safety risks (including OSA) and the countermeasures which can be applied to address them.

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