Tenth International Conference on Managing Fatigue: Abstract for Review

Evaluation of Research on Commercial Motor Vehicle Drivers with Moderate-to-Severe Obstructive Sleep Apnea: A Literature Review to Inform Industry Regulations

Erin Mabry, Virginia Tech Transportation Institute, emabry@vtti.vt.edu
Gene Bergoffen, MaineWay Services, bergoffen@roadrunner.com

Problem

Obstructive sleep apnea (OSA) is the most common sleep disorder and is characterized by repetitive bouts of upper airway occlusion or collapse during sleep, resulting in restless and unrestorative sleep (White et al. 2006) which is a concern for workers with safety sensitive positions. The primary risk factors for OSA are male gender, older age, and obesity, all of which are highly prevalent among the commercial motor vehicle driver population. However, prevalence of OSA, along with several other research questions that would guide federal regulations for commercial motor vehicle (CMV) drivers, has been difficult to elucidate. To help inform pending federal mandates regarding OSA evaluation, we summarized the extant literature and data concerning OSA prevalence, screening, testing, treatment, compliance, safety and efficacy of treatment, and cost/benefit information among and for the CMV industry. These data will support and inform the rulemaking process for OSA regulations for the CMV industry and identify gaps in the current knowledge-base to prioritize future research and data collection.

Methods

Information to answer or inform the above questions was sought from database searches, including PubMed MEDLINE, the Transportation Research Information Service, occupational health literature (e.g. Journal of Occupational and Environmental Medicine, Occupational Health and Safety, Safety and Health at Work, Environmental and Occupational Health, Journal of Transport and Health), sleep literature (e.g. Sleep, Journal of Clinical Sleep Medicine, Sleep Medicine), traffic safety research literature (e.g., Accident Analysis & Prevention, Journal of Transportation Safety) and publically available literature and documents related to the Advance Notice of Proposed Rulemaking.

Results and Discussion

Although models and existing data are available to estimate the prevalence of OSA among CMV drivers, it has yet to be examined using diagnostic data from the industry and current epidemiological industry data from the CMV driver population. When considering the safety risks of undiagnosed or untreated OSA for informing OSA rulemaking for CMV operations, findings from this literature review also highlight the importance of considering OSA-related EDS and fatigue, independent of apnea-hypopnea (AHI) level. OSA screening tools and practices which have demonstrated utility in other safety-sensitive industries, including rail and aviation, may provide guidance for proposed mandates for the CMV industry (Federal Aviation Administration 2016; Colquhoun 2016). Regarding the efficacy of OSA treatment in terms of

safety outcomes, the literature for CMV drivers is scarce. One study evaluated the effect of an employer mandated OSA program on CMV driver crash risk and although the findings are robust, similar evaluations with additional carriers, company and independent drivers, and OSA providers must be conducted to support these findings (Burks et al., 2016). Findings from the literature review indicate that factors beyond reduction in AHI should be considered when evaluating efficacy of OSA treatment. Resolution of oxygen desaturation, EDS, sleep latency, and subjective assessments of sleep quality and quality of life are all factors that may influence efficacy of treatment, independent of AHI severity. Although some studies suggested the need for treatment to reduce crash risk among drivers with mild OSA, others indicated that PAP treatment for mild OSA was largely ineffective and may even have negative effects on health outcomes and sleep hygiene. Additional research is warranted to identify an AHI severity threshold and accompanying symptomology that indicates a need for effective treatment that produces positive health outcomes. It is inconclusive what level of severity of OSA predicts an increase in crash risk, though some literature suggests that OSA symptomology, rather than AHI severity, may be a stronger influence on crash risk, and others indicate subjective symptomology is not predictive of crash risk. Additional research among the CMV driver population is warranted to examine the influence of AHI severity and symptomology, particularly among drivers with mild OSA, on driving performance and crash risk. Although existing models to estimate the potential costs and benefits of OSA screening, testing and treatment for CMV drivers largely favors long-term cost savings and benefits (Hoffman et al., 2010; Frost & Sullivan, 2016), the costs imposed on drivers should be considered when drafting regulatory mandates. Significant out-of-pocket costs imposed on drivers, lack of carrier financial assistance, and inadequate or lacking medical insurance benefits, and repeated sleep test referrals are barriers to CMV driver acceptance of OSA programs and regulations (Mabry et al., 2012; Boris et al., 2016)

Summary

Findings from this extensive literature review identified gaps in the literature which will prioritize future research and data collection to address these information gaps and increase the knowledge base regarding OSA in transportation operations and the impact on CMV safety. Existing diagnostic data from the industry and current epidemiological industry data from the CMV driver population would help determine the prevalence of OSA among CMV drivers. When considering the safety risks of undiagnosed or untreated OSA for informing rulemaking for CMV operations, it is important to consider symptomology, independent of OSA severity. Regarding the efficacy of OSA treatment in terms of safety outcomes, the literature for CMV drivers is scarce; evaluations with additional carriers, company and independent drivers, and OSA providers must be conducted to support these findings. Findings from the literature review indicate that factors beyond reduction in AHI, such as symptomology and subjective outcomes, should be considered when evaluating efficacy of OSA treatment, independent of AHI severity. Additional research is warranted to identify an AHI severity threshold and accompanying symptomology that indicates a need for effective treatment that produces positive health outcomes. Inconclusive and conflicting evidence warrants additional research to examine the influence of AHI severity and symptomology, particularly among CMV drivers with mild OSA, on driving performance and crash risk. Significant costs associated with OSA testing and treatment are imposed on drivers and should be considered when drafting regulatory mandates to improve CMV driver acceptance of OSA programs and regulations.

References

Boris, C. R., & Brewster, R. M. (2016). *Commercial driver perspectives on obstructive sleep apnea*. [White Paper]. Retrieved November 1, 2016, from http://atri-online.org/2016/04/14/atri-launches-commercial-driver-survey-on-sleep-apnea-issues/

Burks, S.V., Anderson, J.E., Bombyk, M., Haider, R., Ganzhorn, D., Jiao, X., Lewis, C., Lexvold, A., Liu, H., Ning, J., Toll A., Hickman, J. S., Mabry, E., Berger, M., Malhotra, A., Czeisler, C. A., & Kales, S. N. (2016). Nonadherence with employer-mandated sleep apnea treatment and increased risk of serious truck crashes. *Sleep, 39*(5), 967-975.

Colquhoun, C. P. & Casolin, A. (2016). Impact of rail medical standard on obstructive sleep apnoea prevalence. *Occupational Medicine, 66*(1). Retrieved from http://occmed.oxfordjournals.org/content/early/2015/08/13/occmed.kqv101.full

Federal Aviation Administration. (2016). *Guide for Aviation Medical Examiners*. Retrieved from: https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/dec_cons/disease_prot/osa/

Frost, & Sullivan. (2016). *Hidden health crisis costing America billions: Underdiagnosing and undertreating obstructive sleep apnea draining healthcare system* [PDF document]. Retrieved from: http://www.aasmnet.org/articles.aspx?id=6426

Hoffman, B., Wingenbach, D. D., Kagey, A. N., Schaneman, J. L. & Kasper, D. (2010). The long-term health plan and disability cost benefit of obstructive sleep apnea treatment in a commercial motor vehicle driver population. *Journal of Occupational and Environmental Medicine, 52*(5), 473-477.

Mabry, J. E., Baker, S., Hickman, J., Hanowski, R. (2012). *Case study on the impact of treating sleep apnea in commercial motor vehicle drivers: Sleep apnea programs from two leading U.S. carriers and focus group findings.* (Report No. 12-UI-017). Blacksburg, VA: National Surface Transportation Safety Center for Excellence.