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Work and sleep among transport operators: Disparities and implications for safety

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A B S T R A C T

The transportation and warehousing sector employs nearly 5 million individuals, many of whom are transport operators. Transport operators have experienced changes in work organization in recent decades; however, little is known about the impacts of these changes and how these impacts differ between operator types. Therefore, using two directly comparable transport operator datasets – one of all transport operator types by the National Sleep Foundation, and another of exclusively long-haul truck drivers called the Trucker Sleep Disorders Survey (TSLDS) – we sought for the first time to evaluate disparities between transport operators' work organization; sleep characteristics; sleep problems and sleep disorders; and safety outcomes. We also explored associations between work organization and sleep characteristics, problems, and disorders with safety outcomes.

Many significant differences were found across transport operator sectors. In particular, the TSLDS long-haul truck drivers largely fared worse when compared to other transport operators across a number of characteristics, including shift length, shift work, sleep latency, and the number of safety outcomes due to sleepiness. These cross-sectoral differences suggest the need for tailored interventions to address the unique configurations of demographic, work organization, sleep, and safety characteristics found in different transport operator sectors. However, across all transport operator sectors, latent sleep disorders appeared ubiquitous; thus, universal efforts to screen, diagnose, and treat sleep disorders should be a public health imperative. Differences were found transport operator in patterns of significant associations between work organization and sleep with safety outcomes, further suggesting the need for tailored interventions. However, sleep quality, sleep sufficiency, and whether one's workday schedule allowed adequate sleep were the most strongly associated with safety, suggesting that addressing these issues could benefit many transport operators. Further research, including a national study of transport operators, would help guide future interventions to enhance safety.

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1. Introduction

The transportation and warehousing sector, which includes transport operators, employs nearly 5 million individuals in the United States (Bureau of Labor Statistics, 2016d). By far the largest segment of transport operators are heavy and tractor-trailer drivers, who number 848,640 (Bureau of Labor Statistics, 2016e). Other transport operators include 71,930 airline pilots, copilots, and flight engineers; 35,860 locomotive engineers; 38,440 railroad conductors and yardmasters; 79,450 taxi drivers and chauffeurs; 230,200 school bus drivers; 66,070 transit and intercity bus drivers; and 51,080 light or delivery service truck drivers (Bureau of Labor Statistics, 2016a, 2016b, 2016c, 2016e). Given the high-stakes nature of work as a transport operator, specifically regarding the safety and well-being of others, safety is paramount in such occupations. However, transportation vehicle operators endure an unequal distribution of risks (Helmkamp et al., 2013), many of which are related to work organization and sleep, that influence safety outcomes.

As is the case with many other occupations, the work organization of transport operators has undergone tremendous changes over the past several decades. Beginning in the mid-1970s, many industries experienced profound changes in business practices (Belzer, 2000). These changes resulted in multiple changes to work organization, including more demanding work, declines in unionization, wage stagnation or decreases, and diminished job security (Landsbergis et al., 2014; Siqueira et al., 2014). Among the most impactful changes have occurred in shift work and work hours. Shift work, defined as any work shift outside the 7 a.m. to 6 p.m. period, or rotating shifts, has become increasingly common (Caruso, 2014; Geiger-Brown et al., 2012). Long working hours, generally defined as working more than 40 h per week, or an extended shift as more than 8 h per day, are also pervasive (Caruso et al., 2004). Among all industrialized nations, the U.S. has the longest working hours on a yearly basis, and the proportion of workers working long hours has increased substantially over the past three decades (Caruso et al., 2006; Johnson and Lipscomb, 2006).

Changes in work organization have detrimentally impacted sleep. This is especially true of transportation workers, who have the highest prevalence of short sleep duration of any occupation (2010). Poor sleep is associated with shift work, long work hours, and job stress, which subsequently result in an increase in performance errors (Caruso and Rosa, 2012; Jackson et al., 2013). Shift work and long work hours disrupt circadian rhythms and are associated with increased sleep problems and sleep disorders and reduced sleep duration and sleep quality (Antunes et al., 2010; Caruso, 2014; Geiger-Brown et al., 2012; Johnson and Lipscomb, 2006; Luckhaupt et al., 2010).

Sleep patterns, sleep problems and sleep disorders endemic to transportation workers lead to increased fatigue and sleepiness and are a major cause of accidents and injuries (Pack et al., 2006; Smolensky et al., 2011). These connections are particularly well established among transport operators, as operating a vehicle requires continuous attention, and poor performance can generate immediate consequences (Philip and Åkerstedt, 2006). Together, sleepiness, sleep deprivation, and driving at night have been implicated in an estimated 20% of traffic accidents (Philip, 2005). Federal regulatory bodies, including the Federal Aviation Administration, the Federal Transit Administration, and the Federal Railroad Administration (U.S. Federal Motor Carrier Safety Administration, 2015), enact policies to reduce fatigue and improve sleep, with a principal aim of mitigating accidents and injuries. Despite these efforts, the transportation and warehousing sector had an incidence rate of occupational injuries and illnesses of 225.2 per 10,000 full-time workers in 2014, which was the highest rate among all private industries (Bureau of Labor Statistics, 2015b). More specifically, the transportation and material moving occupations had the largest share of fatal injuries (28%) of any occupational group, while transportation incidents accounted for 40 percent of fatal workplace injuries in 2014 (Bureau of Labor Statistics, 2015a, 2015b).

1.1. The case of long-haul truck drivers

The largest segment of transport operators – long-haul truck drivers – exemplify many of the patterns of work, sleep, and safety which have unfolded across the transportation and warehousing sector. The trucking industry has undergone substantial changes over the past several decades, many of which have significant implications for the health and safety of drivers (Belzer, 2000). Many of these changes are associated with deregulation following the passage of the Motor Carrier Act of 1980 (Belzer, 2000), which resulted in myriad changes to the structure of the industry and ushered in an era of excessive competition among trucking companies (Belzer, 2000). Multiple elements of the work organization of long-haul trucking were transformed, leading to longer work hours, more frequent shift work, longer periods away from home, and a faster pace of work, all of which have increased job stress and job strain; further, these changes resulted in changes to pay structures which resulted in decreases in unionization, wage declines, along with loss of benefits and more hazardous working conditions (Apostolopoulos et al., 2014, 2016b, 2016c; Belzer, 2000; Lemke et al., 2015; Saltzman and Belzer, 2007).

The work organization of long-haul truck drivers directly affects safety (Belzer, 2009). Cumulatively, long-haul truck drivers' long work hours, fragmented and erratic work shifts, and frequently disrupted circadian rhythms degrade sleep duration and quality and can bring about sleep problems and sleep disorders (Apostolopoulos et al., 2014; Caruso, 2014; Ebrahimi et al., 2015; Geiger-Brown et al., 2012; Hege et al., 2015; Krueger et al., 2007a; Lemke et al., 2015; Philip, 2005). These sleep issues then induce fatigue and excessive sleepiness during working hours (Ingre et al., 2006; Moller et al., 2006; Otmani et al., 2005; Philip, 2005; Philip and Åkerstedt, 2006; Philip et al., 1999). Fatigue and sleepiness have consistently been shown to degrade the ability to safely operate a vehicle and perform other safety-critical job tasks (Ingre et al., 2006; Lemke et al., 2016; Moller et al., 2006; Otmani et al., 2005; Philip and Åkerstedt, 2006; Philip et al., 1999). Thus, sleep issues are associated with accidents and injuries among long-haul truck drivers (Chen et al., 2016; Hanowski et al., 2007; McCartt et al., 2000). Large truck crashes are catastrophic for other motorists and pedestrians and place the public at excessive risks for injury. For example, among large truck crashes in 2012, there were 2813

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