Understanding Individual, Organizational and Work Environment Factors Associated with Fatigue-Related Road Safety Behaviors among Taxicab Drivers in a Large Metropolitan City in the Southwest U.S.

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Problem: Violence-related events (such as robberies) and roadway incidents are the leading causes of injury among taxicab drivers. Fatigue is an under-recognized job hazard prevalent in this workforce that is associated with both injury outcomes. Safety training for taxicab drivers varies widely across cities as it is conducted in accordance with municipal ordinances or company policies that augment municipal requirements. Increased competition for fares with the advent of transportation network companies (e.g., Uber, Lyft) have extended workdays and hours needed to earn an income. Our objective for this analysis was to describe the association of individual, organizational, and work environment factors with fatigue among taxicab drivers.

Methods: We developed a survey for licensed taxicab drivers that asked about employment characteristics, work schedule, job demands, passenger violence, taxi crashes, safety measures, safety climate, road safety behaviors, knowledge of safety practices, and socio-demographic characteristics. We trained surveyors to administer the survey using systematic sampling among taxicab drivers waiting for fares at two international airports and a downtown location in a large metropolitan city in the Southwest U.S. To be eligible to participate in the survey, drivers were required to be licensed in the city for at least 12 months. The surveys took approximately 30 minutes to complete and participants were compensated for their time. The study was approved by the National Institute for Occupational Safety and Health Institutional Review Board and all participating drivers provided informed consent.

Statistical analyses presented here were conducted in 2017; data were collected in 2015. Three fatigue-related road safety behaviors from the validated Occupational Driver Behavior Questionnaire were examined as separate outcomes for the current analysis: (1) often driving while tired, (2) often having difficulty driving because of tiredness or fatigue, and (3) often finding yourself nodding off while driving. Variables hypothesized to be associated with the reporting of fatigue-related behaviors were first analyzed using bivariable logistic regression models to determine significance at $p \leq 0.25$. A correlation matrix of the variables associated with any of the behaviors resulted in elimination of variables to prevent collinearity, thus guiding selection of variables into the model-building process. A backwards-stepwise elimination process provided the final logistic models describing each fatigue-related behavior as a separate model with cut points for variable inclusion set at $p \leq 0.05$.

Results: Responses for 496 participants were analyzed for each of the three behavior outcome measures. Seventeen variables were associated with “often driving while tired” in bivariable regression analyses. In the final model (Model 1), eight variables were statistically significantly associated with “often driving while tired”: increasing number of years driving for the current company [OR_{adj}=1.08; 95%CI 1.03–1.13], leasing versus owning the taxicab [OR_{adj}=2.58; 95%CI 1.43–4.66], experiencing any passenger-related violence in the past 12 months [OR_{adj}=2.85; 95%CI 1.67–4.86], increasing number of hours driving taxicab in a typical workweek [OR_{adj}=0.69; 95%CI 0.48–0.98], not feeling free to report safety problems to company management [OR_{adj}=4.54; 95%CI 1.95–10.58], identifying as Asian [OR_{adj}=3.74; 95%CI 1.93–7.23], increasing education [OR_{adj}=0.56; 95%CI

0.41–0.75] and being involved in a motor-vehicle crash while driving taxicab in past 12 months [OR_{adj}=2.12; 95%CI 1.00–4.48] [See table].

Eighteen variables were associated with "often having difficulty driving because of tiredness or fatigue" in bivariable regression analyses. In the final model (Model 2), seven variables were statistically significantly associated with "often having difficulty driving because of tiredness or fatigue": increasing number of years driving for the current company [OR_{adj}= 1.08; 95%CI 1.02–1.13], experiencing any passenger-related violence in the past 12 months [OR_{adj}=2.63; 95%CI 1.41–4.90], not feeling free to report safety problems to company management [OR_{adj}=5.07; 95%CI 2.18-11.81], identifying as Asian [OR_{adj}=2.89; 95%CI 1.38–6.05], increasing education [OR_{adj}=0.59; 95%CI 0.42–0.83], reporting belonging to a religion [OR_{adj}=2.00; 95%CI 1.07–3.76] and being involved in a motor-vehicle crash while driving taxicab in past 12 months [OR_{adj}=2.64; 95%CI 1.19–5.86].

Sixteen variables were associated with "often nodding off while driving" in bivariable analyses. In the final model (Model 3), four variables were statistically significantly associated with "often nodding off while driving": increasing number of years driving for the current company [OR_{adj}=1.10; 95%CI 1.05–1.16], not feeling free to report safety problems to company management [OR_{adj}=3.37; 95%CI 1.26–8.98], identifying as Asian [OR_{adj}=4.50; 95%CI 2.16–9.38], and increasing education [OR_{adj}=0.59; 95%CI 0.41–0.86].

Discussion: There were several modifiable factors associated with all of the fatigue-related road safety behaviors examined in these analyses. The odds of reporting fatigue-related road safety behaviors was consistently greater with increasing years working for their current company [OR_{adj} 1.08–1.10], and not feeling free to report safety problems to the company [OR_{adj} 3.37–5.07]. Increasing level of educational achievement was associated with lower odds of reporting fatigue-related road safety behaviors [OR_{adj} 0.49–0.56]. Identifying as Asian was associated with increased odds for all of the fatigue-related road safety behaviors [OR_{adj} 2.89–4.50].

The lack of statistical association of number of hours reported driving during the day and night in a typical workweek was surprising. Increasing hours of night time driving was associated with "often nodding off while driving" until the refined variable for race/ethnicity was entered into the model. While all drivers should have access to fatigue management training, these findings allow us to target specific populations of drivers in an industry with limited resources for safety.

Summary: This analysis provides important insight for designing interventions and targeting research translation efforts for a worker population who drives for a living that has been the focus of very few research studies. At an organizational level, companies should consider implementing policies that promote the safety and wellness of drivers in addition to efforts to promote an overall culture of safety. The significance of education for every fatigue-related road safety behavior speaks to the importance of fatigue management training for this workforce. Finally, safety training can have the most impact when implemented among *all* taxicab drivers, regardless of socio-demographic group.

Table. Final variables describing three fatigue-related road safety behaviors among taxicab drivers in Southwest U.S.			
Independent variables	**Model 1**	**Model 2**	**Model 3**
Increasing number of years driving	OR_{adj}=1.08; 95%CI 1.03-1.13	OR_{adj}=1.08; 95%CI 1.02-1.13	OR_{adj}=1.10; 95%CI 1.05-1.16
Not feeling free to report safety problems to company management	OR_{adj}=4.54; 95%CI 1.95-10.58	OR_{adj}=5.07; 95%CI 2.18-11.81	OR_{adj}=3.37; 95%CI 1.26-8.98
Identifying as Asian	OR_{adj}=3.74; 95%CI 1.93-7.23	OR_{adj}=2.89; 95%CI 1.38-6.05	OR_{adj}=4.50; 95%CI 2.16-9.38
Increasing education	OR_{adj}=0.56; 95%CI 0.41-0.75	OR_{adj}=0.59; 95%CI 0.42-0.83	OR_{adj}=0.59; 95%CI 0.41-0.86
Involved in a motor-vehicle crash while driving taxi <12 months	OR_{adj}=2.12; 95%CI 1.00-4.48	OR_{adj}=2.64; 95%CI 1.19-5.86	-
Experiencing any passenger-related violence <12 months	OR_{adj}=2.85; 95%CI 1.67-4.86	OR_{adj}=2.63; 95%CI 1.41-4.90	-
Leasing versus owning	OR_{adj}=2.58; 95%CI 1.43-4.66	-	-
Increasing number of hours driving taxicab in a typical workweek	OR_{adj}=0.69; 95%CI 0.48-0.98	-	-