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Assessing the Australian occupational driver behavior questionnaire in U.S. taxi drivers: Different country, different occupation and different worker population

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Abstract

Background: Promoting safe driver behaviors is an important aspect of road safety. To better understand road safety behaviors, there is a role for practical instruments that can validly measure typical road safety behaviors among occupational drivers. The Occupational Driver Behavior Questionnaire (ODBQ) was developed to assess road safety behaviors among home health nurses in Australia.

Methods: We administered a cross-sectional survey to a sample of taxi drivers in two U.S. metropolitan areas. The survey included Newnam's ODBQ-12 and a study-specific 15-item version (ODBQ-15) assessing 4 different road safety behaviors with 3 more items added and motor-vehicle crashes in the past year. Logistic regression analyses examined the association of the road safety behaviors with motor vehicle crashes. A series of confirmatory factor analysis (CFA) models assessed the construct validity of the ODBQ-12 and ODBQ15.

Results: We pooled survey data from 497 Houston drivers and 500 Los Angeles drivers to assess study aims. CFA models examining the 12-item and the 15-item ODBQ versions had good model fit (Comparative Fit Index > 0.95, Tucker Lewis Index ≥ 0.95, root mean square error of approximation < 0.06, standardized root mean square residual ≤ 0.05). The ODBQ's road safety

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behaviors were significantly associated ($p < 0.001$) with crashes while working (ORs 0.51–0.75) and not working (ORs 0.57– 0.84).

Conclusions: The ODBQ-12 and ODBQ-15 were both significantly associated with motor vehicle crashes among taxicab drivers in two large U.S. metropolitan areas. Researchers studying occupational drivers who transport passengers may want to consider using the ODBQ-15. The 3 additional items are meaningful to this workforce and are priority areas for international road safety efforts.

Keywords

ODBQ; Road safety; Questionnaire; Occupational; Motor vehicle crashes

1. Introduction

The United Nations passed a resolution in 2020 establishing a second *Decade (2021–2030) of Action for Road Safety* (United Nations, 2020), where road injury remains a leading cause of death for low and middle-income countries (World Health Organization, 2020) and the United States (CDC, 2021). Road injuries are estimated to cost the world economy almost $2 trillion dollars from 2015 to 2030 (Chen, Kuhn, Prettner, & Bloom, 2019). In the United States, transportation-related injuries are the leading cause of work-related death (Bureau of Labor Statistics, 2021a), with roadway incidents (e.g., collisions, running off the road) accounting for the vast majority of these fatalities (Bureau of Labor Statistics, 2021b). The annual economic burden to U.S. employers for work-related motor-vehicle crashes in 2015 was estimated at $25 billion (Network of Employers for Traffic Safety, 2016). Road safety continues to be a priority area among U.S. federal entities (e.g., Administration, 2021; Administration, 2021; National Institute for Occupational Safety and Health, 2021; Safety & Administration, 2012), the Academies (2016), non-governmental organizations (e.g., Council, 2021), academic institutions (e.g., National Institute for Occupational Safety and Health, 2021), and employers (Network of Employers for Traffic Safety, 2021).

A key component of road safety research is improving driving behaviors. The roles of speeding (Bowie & Walz, 1994; Elvik, 2005; Speed, 2018; Joksch, 1993), distracted driving (Atchley, Tran, & Salehinejad, 2017; Caird, Johnston, Willness, Asbridge, & Steel, 2014), and fatigue (Robb, Sultana, Ameratunga, & Jackson, 2008) in motor-vehicle crash risks are well established. There is a wide range of measurement methods and tools with varying levels of sophistication and cost to assess these risk factors. Epidemiologic research in high-income countries focused on preventing crashes among occupational drivers routinely employs recent technological advances to directly measure risk factors for unsafe driving behaviors or crash outcomes (Bell, Taylor, Chen, Kirk, & Leatherman, 2017; Campbell, 2012; Chen, Fang, Guo, & Hanowski, 2016), with direct measurement considered the gold standard (Spielholz, Silverstein, Morgan, Checkoway, & Kaufman, 2001). However, research examining road safety behaviors among taxi and for-hire drivers continues to rely on self-report measures of drivers' perspectives of their driving behavior. Studies conducted across several continents assessing road safety behaviors span lower, middle, and high-income countries: Australia (Dalziel & Soames Job, 1997), Cameroon (Oyono et al., 2021), China (Meng et al., 2016; Routley, Ozanne-Smith, Qin, & Wu, 2009; Wang, Li, & et al., 2019, Wang, Zhang, & et al., 2019; Wu & Loo, 2016), Ethiopia (Asefa, Ingale, Shumey, & Yang, 2015; Hassen, Godesso, Abebe, & Girma, 2011), Iran (Dadipoor, Ranaei, Ghaffari, Rakhshanderou, & Safari-Moradabadi, 2020; Habibi, Haghi, & Maracy, 2014; Omidi, Mousavi, Moradi, & Taheri, 2021; Razmara, Aghamolaei, Madani, Hosseini, & Zare, 2018a; Razmara, Aghamolaei, Madani, Hosseini, & Zare, 2018b; Vehadi et al., 2018), Singapore (Lim & Chia, 2015), Tanzania (Nguyen et al., 2018), Uganda (Muni et al., 2019, 2020), United States (Hill, Baird, Torres, Obrochta, & Jain, 2021), and Vietnam (Hill et al., 2013). All but two of these studies were conducted in the past decade, while other, more sophisticated technologies to measure road safety behaviors have been available. There is a clear demand for cost-effective and practical road safety assessment measures in occupational safety and health research focused on taxi drivers, an occupation comparatively under-represented in road safety research.

Valid, reliable, and pragmatic measures are key for improving road safety research efforts when sophisticated technological tools are not feasible, not possible, or too far removed from understanding the drivers' behaviors. The ground transportation industry subsector that includes taxi and other for-hire drivers is a workforce with fewer road safety regulations, most frequently nontraditional employment arrangements (e.g., gig workers), and comprised of small fleets or operator-owned and managed (e.g., independent taxi drivers) with a very limited budget for road safety technology and generally no, if any, personnel dedicated to fleet safety. Road safety research involving interviewing occupational drivers about their driving behaviors continues to be conducted internationally in countries crossing all income levels because of their low cost and relative ease to administer among taxi (and other gig) drivers. There is a need for validated measurement instruments that can be used by companies or operators with very limited resources to support the veracity of research that is used to inform policy.

The Occupational Driver Behavior Questionnaire (ODBQ) is distinguished from the Driver Behavior Questionnaire as it recognizes the role of the occupational setting in road safety behaviors (Newnam & VonSchuckmann, 2012). The ODBQ is comprised of 12 questions asking about the frequency of drivers' road safety behaviors spanning traffic laws, speeding, fatigue, and distracted driving. It was intended to provide drivers and their management with proactive opportunities for improvements in road safety by using a survey tool designed for the occupational driving context. The ODBQ was developed and validated in an Australian community-based nursing organization and is a practical survey instrument for use in the field (Newnam, Greenslade, Newton, & Watson, 2011). The purpose of this analysis was to examine the psychometrics of the Occupational Driver Behavior Questionnaire among a population of U.S. taxi drivers in Houston and Los Angeles. This workforce differs socio-demographically, drives for longer hours, and works different shifts than the original population for which it was designed.

The occupational driving context is unique because of the added job demands and stress to the basic function of driving. Driving is leading the functioning of a vehicle while optimizing available cognitive resources to safely arrive at a location while navigating traffic, road signs/lights, and road and weather conditions during a dynamic process from departure to destination. For taxi drivers, job demands vary by both the number and duration of trips, providing customer service during the trip, and collecting payment at the end of the trip. Stress in the occupational context would include meeting these demands under too many or too little fares, the potential for passenger violence, fares late at night or early in the morning and/or after a long shift, and while tired. Adding items relevant to passenger safety captures unique elements of this domain of occupational driving jobs. Furthermore, items specific to drivers who exclusively drive passengers for a living are meaningful to company management and industry regulators who are faced with making decisions to strengthen existing policies or implement new ones in the midst of seemingly unrestricted Transportation Network Companies, which provide app-based ride sourcing services. In response to the current regulatory environment, three new items related to passenger safety while driving were added to the original scale. A secondary purpose of this analysis was to compare the performance of two versions of the ODBQ scale – the validated 12-item scale (ODBQ-12) and a 15-item version with additional items conceptually important for professional drivers who transport passengers (ODBQ-15).

2. Methods

2.1. Participants and procedures

Drivers licensed to drive a taxi for their city for 12 months or more were invited to participate in a cross-sectional study. Flyers describing the study were posted in break areas at airports and in regulatory offices. Additionally, ground transportation regulators in each city sent an email describing the study to licensed taxi drivers. Trained surveyors in sampling and administering the survey instrument conducted interviews of eligible taxi drivers at both international airports in Houston and a downtown location in Houston and the international airport in Los Angeles. Taxis were systematically approached within randomly selected parking lot lanes. Taxi drivers were informed the survey should take approximately 30 min and they would be provided with a $40 gift card. The drivers were told the study purpose was to ask about their work environment, experiences driving with passengers in the past year, and time spent driving. After agreeing to participate, taxi drivers meeting the inclusion criteria (licensed by the city for at least 12 months) and providing verbal assent after receiving and discussing the consent form were administered a 30-min survey. Drivers were remunerated the $40 gift card for their time. The National Institute for Occupational Safety and Health Institutional Review Board reviewed and approved the study protocol, data collection instruments, and consent process. The Office of Management and Budget reviewed and approved the project in accordance with the Paperwork Reduction Act.

2.2. Instrument

The ODBQ was administered as part of a larger survey developed to evaluate workplace violence and motor- vehicle crashes among taxi drivers, whose causes of work-related death are due almost exclusively to violence and crashes (BLS, 2018b). The 30-min overall survey included questions about the following topic areas: business-related aspects to driving a taxi, psychosocial work environment, passenger violence, motor-vehicle crashes, road safety behaviors (ODBQ), safety measures, and sociodemographics. Socio-demographic variables included: sex, age, race/ethnicity, nativity, educational attainment, and marital status. Participants provided exact age in years and designated sex as “Male” or “Female.” When collecting data on race, surveyors showed respondents a card listing options for “White,” “Black or African American,” “Asian,” “American Indian or Alaska Native,” “Native Hawaiian or Pacific Islander,” “Refused,” and “Other”; drivers were asked to identify one or more as applicable. Participants responding “Other” were asked to specify. On the other side of the card were options to describe ethnicity with definitions for determining “Hispanic, Latino, or Spanish origin.” Drivers responding “Yes” or “No” to the question”Were you born in the US” determined nativity. Educational attainment outlined the highest level of formal education completed as “Grade school,” “Secondary school,” “Some high school,” “High school diploma,” “Technical/trade school,” “Associate’s degree,” “Undergraduate degree,” “Graduate degree, Master level,” and “Graduate degree, Doctoral level.” The responses “Married,” “Not married, but in a long-term relationship,” “Separated,” “Divorced,” “Widowed,” and”Single” designated the driver’s marital status.

Occupational Driver Behavior Questionnaire.—The ODBQ-12 assesses four subscales: speeding, rule violations, inattention, and driving while tired (Newnam & VonSchuckmann, 2012; Newnam et al., 2011). Table 1 provides a list of the specific items according to their subscales. Three items were added to create the ODBQ-15 because they were conceptually meaningful, as described previously, to taxi driver safe driving behavior. The additional items were generated by subject matter experts knowledgeable of the road safety concerns (see Table 1). One item was added to the speeding subscale (speeding with a passenger), one to the rule violations subscale (wearing a seatbelt), and one to the inattention subscale (using a handheld mobile device while driving). All items were prefaced with”How often do you” and anchored by a 5-point Likert scale where 1 signifies “Rarely or never” and 5 signifies “Very often or all the time.” Modifications to original item wording were minimal and done for clarity and relevance to the taxi driver population.

Two variables served as outcomes: (1) the frequency of motor-vehicle crashes in the past 12 months not related to driving a taxicab, and (2) the frequency of motor-vehicle crashes occurring while driving a taxi in the past 12 months; each was asked as an open-ended question and later coded as 1 (crash) and 0 (no crash).

2.3. Statistical analyses

Data collected from both cities, Houston and Los Angeles, were pooled together after it was determined there were no meaningful differences in demographic averages or inter-item correlation statistics between cities likely to affect the ODBQ psychometric properties. Descriptive statistics were calculated using SPSS, version 24 (IBM Corp, 2016).

We developed a strategic approach to selecting the ODBQ versions and scale forms for analyses. We calculated Cronbach’s alpha to assess the ODBQ scale reliability (Cronbach, 1951). Cronbach’s alpha values greater than 0.7 were considered acceptable for a minimum reliability threshold (Frost et al., 2007). We then performed Confirmatory factor analysis (CFA) using maximum likelihood estimation with robust standard errors using M-PLUS version 8 (Muthén & Muthén, 2017) to assess construct validity. We chose a confirmatory, instead of exploratory, approach because of existing empirical and theoretical knowledge about the ODBQ (Newnam & VonSchuckmann, 2012; Newnam et al., 2011). Notably, the

ODBQ was developed to assess road safety behaviors across four subscales. In addition, existing research supports a 4-factor solution among drivers who drove at least once per week for occupational purposes (Newnam et al., 2011).

Given the existing information on home health care workers whose work-related driving was secondary to the primary job tasks of healthcare support, and the opportunity to test the ODBQ scale in a sample of taxi drivers whose primary job task is to drive passengers, we chose to examine the factor structure through a systematic process. We started with assessing a model fit for a 4-factor solution to compare findings with the original Australian sample. Testing the first-order model implies there is no meaningful conceptual difference between the subscales, which we do not believe, but we wanted to have data available to companies or road safety researchers and practitioners who embraced and moved forward with applying the ODBQ as a first-order model in practice. Finally, we assessed a second-order 4-factor model to provide a combination of practicality for users to obtain a single score but retain the ability to assess differences in the subscales after behavior-specific policies or targeted trainings are implemented.

We compared fit between models using Satorra Bentler's scaled chi-square difference test (Satorra & Bentler, 2001). The collective performance of the following indicators were used to assess model fit: overall Chi-square (non-significant value = good fit), comparative fit index (CFI, >0.90 = adequate fit and >0.95 = good fit), Tucker-Lewis index (TLI, >0.90 = adequate fit and >0.95 = good fit), root mean square error of approximation (RMSEA, 0.05–0.08 = adequate fit, <0.05 = good fit), and standardized root mean square residual (SRMR, 0.05–0.08 = adequate fit and <0.05 = good fit) (Bryne, 2012). CFAs were performed separately for the 12item and 15-item ODBQ versions. We also examined the magnitudes of factor loadings and modification indices. Model adjustments based on modification indices were considered only if they indicated points of strain and were substantively meaningful.

Univariable and multivariable logistic regression models assessed the association of both versions of the ODBQ to each outcome. Odds ratios and 95% confidence intervals were calculated. The Wald chi-square (χ^2) test statistic assessed model fit (Buse, 1982). All logistic regression models were conducted using SAS v9.4 (SAS Institute, Cary, NC).

3. Findings and results

3.1. Descriptive statistics

The average driver age was 43.9 years and the drivers were predominantly males (92%) (Table 2). More drivers were either Black (35%) or White (32%), with 12% identifying as Hispanic and 12% Asian. Just over half (53%) reported being born outside of the United States. Half of the study sample completed some college, and at least one-third attained a high school diploma. The majority (57%) of participating drivers were married or in a long-term relationship.

Item means ranged from 3.41–4.82 with no major floor or ceiling effects except for RV4, DF2, and DF3, which had ceilings of 86.7%, 68.2% and 77.3%, respectfully (Table 3). In addition, all items had complete data. There were two ODBQ items correlated at 0.85 or greater (Table 3). For speeding, 'how often do you exceed the speed limit on a highway or freeway' (SP2) and 'how often do you exceed the speed limit when traveling to do pickups' (SP3) were correlated at 0.87. This was a deciding point for dropping one of the items or keeping both. These two items were reevaluated and considered equally valuable components of the speeding with a passenger subscale.

3.2. Examining ODBQ scale performance: Confirmatory factor analyses

The CFA results indicated the 4-factor models appeared to best fit the data (CFI ≥ 0.91, TLI ≥ 0.89, RMSEA ≤ 0.08, SRMR ≤ 0.08. (Table 4). The single factor models for both the 12- and 15-item ODBQ scales had poor fit (Table 4). The second-order single-factor models demonstrated satisfactory fit. More specifically, the CFI and TLI values were in the adequate range and the RMSEA and SRMR values were just outside the acceptable range (Table 4).

When examining local fit, the factor loadings were >0.50 and statistically significant for the first-order 4-factor ODBQ-12 model. The underlying factor ODBQ-12 model had factor loadings >0.50 with the exception of item 1 from Inattention (IN1 factor loading = 0.41) and items 2 and 3 from the fatigued driving construct (DF2, 0.43; DF3, 0.35). The second-order single-factor ODBQ-12 had factor loadings >0.50 with the exception of the fatigued driving construct (factor loading = 0.47).

When examining local fit for the ODBQ-15 models, the first-order 4-factor model had factor loadings >0.50 with the exception of the added item for Rule Violation: 'how often do you wear your seatbelt while driving' (factor loading = 0.02). There were five items with factor loadings <0.50 for the model examining one underlying factor: RV4 (0.03), IN1 (0.38), DF1 (0.47), DF2 (0.41), and DF3 (0.33). The second-order ODBQ-15 model had factor loadings >050 with the exception of RV4 (0.02) and the construct for fatigued driving (0.43).

Modification indices for the two 4-factor models indicated correlated residuals for items SP3 ('how often do you exceed the speed limit when traveling to do pickups') and SP2 ('how often do you exceed the speed limit on a highway or freeway'), and RV1 ('how often do you not signal to change lanes when no other traffic is around') and RV2 ('how often do you perform a U-turn in a non-designated zone'). Examining new models that included correlated residuals between items SP2&SP3 and RV1&RV2 indicated models with good fit indices for both the ODBQ-15 and the ODBQ-12 (CFI > 0.95, TLI ≥ 0.95, RMSEA ≤ 0.06, SRMR ≤ 0.05).

3.3. Examining ODBQ association with motor vehicle crashes: Logistic regression analyses

Scoring higher on the ODBQ-15 and the ODBQ-12 was significantly associated with not experiencing a motor- vehicle crash in the past 12 months *while* driving a taxi (Table 5). Each subscale was inversely associated with the outcome and odds ratios ranged from 0.55 to 0.75($p < 0.001$). Both full ODBQ scales were inversely associated with the outcome (ODBQ-12 OR = 0.52, 95% CI 0.41– 0.66; ODBQ-15 OR = 0.51, 95% CI 0.40–0.66) ($p < 0.001$). When including all subscales in a single model to reflect a second-order 4-factor model, only Inattention (aORs = 0.73–0.75; $p = 0.02$) and Driving Fatigued (aORs-0.67–

0.68; $p < 0.01$) remained associated with the outcome for both the ODBQ-12 and ODBQ-15 (Table 5).

For the second outcome, experiencing a motor-vehicle crash in the past 12 months *outside* of driving a taxi, both the ODBQ-15 and the ODBQ-12 were significantly associated with the outcome. Each subscale was inversely associated with the outcome. The odds ratios for each version of the scale were very similar for three of the subscales: Speeding, ORs = 0.67–0.69 ($p < 0.001$), Rule Violation, ORs = 0.58–0.66 ($p < 0.001$), and Driving Fatigued, ORs = 0.82, $p = 0.05$. The OR for Inattention was 0.84 ($p = 0.05$) for the ODBQ-12 and 0.78 ($p = 0.01$) for the ODBQ-15. Both full ODBQ scales were inversely associated with the outcome and similar in magnitude: ORs = 0.57–0.60 ($p < 0.001$). When including all subscales in a single model, only Rule Violation (aORs = 0.72–0.74; $p < 0.05$) remained associated with the outcome for either ODBQ scale version. The point estimates for Speeding were <1; ORs = 0.79–0.83. The point estimates for Inattention approximated 1; ORs = 0.99–1.01. The point estimates for Driving Fatigued were >1; ORs = 1.09.

4. Discussion

The focus of our analysis was to examine the validity of the original ODBQ in a new population of linguistically, racially, and ethnically diverse occupational drivers and test the validity of an expanded version (ODBQ-15) with three added items meaningful to occupational drivers transporting passengers. Our findings indicated both versions of the Occupational Driver Behavior Questionnaire demonstrated good validity in a driving population that exclusively drives for a living. More specifically, confirmatory factor analysis testing revealed good construct validity for first-order 4-factor models, suggesting the ODBQ captures four distinct subscales: speeding, inattention, rule violation, and driving while fatigued. In addition, logistic regression models indicated good convergent validity for both versions of the ODBQ subscales. To our knowledge this is the first validation of the ODBQ outside of the original scale development work (Newnam et al., 2011; Newnam & Von Schuckmann, 2012), the first time in the United States among occupational drivers, and the first time in a field of research where cross-sectional study designs using surveys are the predominant road safety epidemiologic research tools and approaches.

Previous research examining the validity and reliability found best model fit for the 4-factor model of the ODBQ-12 with CFA testing revealing loading on the following constructs – speeding, rule violation, inattention, and fatigued driving -- and good model fit (Newnam et al., 2011). The original scale's development was conducted in Australia among occupational drivers who drove regularly over a week as part of their community nursing tasks. Our findings are consistent with that of Newnam et al. as our study indicated the ODBQ is made up of four subscales rather than one general scale.

Our study expands on this original work by examining the ODBQ in a new population, U.S. taxi drivers. The scale was originally conceptualized with the unique demands, timing, and work environment that add context to occupational drivers. Furthermore, taxi drivers ferry passengers around as their only work task on demand and can work long hours at times not supported by their body's circadian rhythm. To manage the stress and job demands, driving performance may be inadvertently protected at the expense of road safety behaviors known to be particularly crucial when transporting passengers (such as speeding, seatbelt use, and distracted driving). To this end, an item representing each of these road safety behaviors meaningful to the taxi industry was added to the ODBQ. Therefore, an additional objective for our study was to test a 15-item version of the ODBQ that included three questions about speeding (speeding with a passenger), rule violation (seatbelt use), and inattention (using a handheld device while driving). Our results indicated no major differences in fit between versions. Even though the 12-item version may be preferred because it has fewer items, we feel both versions are acceptable. Importantly, the 15-item version includes additional items that are conceptually important and indicate specific responses. For instance, every city requires some form of restricted cell phone use while driving a taxi. Every city requires its taxi drivers to fasten their seatbelt at all times. Taxi drivers' response to frequency of using a handheld device while driving or neglect to use their seatbelt should be 'never.' Any level of frequency of performing these behaviors is an opportunity to reinforce road safety behaviors by reminding taxi drivers of the importance of wearing their seatbelt and minimizing behaviors that lead to distracted driving and trying to understand and address the barriers to safe behaviors.

The convergent validity of both the 15-item and the 12-item versions of the scale was promising. Specifically, the overall scales were significantly associated with motor-vehicle crashes within and outside the work environment. The higher the score for road safety behavior subscales, the lower the odds ratio for experiencing a crash. This is a novel finding as previous evaluations of the ODBQ's validity did not examine convergent validity. Observing an association between both versions of the scale with relevant injury outcomes is a valuable contribution to the road safety literature, especially regarding the use of screening tools. Interestingly, when all subscales were included in multivariable models, only Inattention and Driving While Fatigued were associated with motor-vehicle crashes occurring while driving a taxi, whereas only Rule Violation was significantly associated with motor-vehicle crashes occurring while not driving a taxi. These findings suggest all of the subscales are important; however, Inattention and Driving While Fatigued may play more of a role in occupational crash outcomes and Rule Violation may play more of a role in non-occupational crash outcomes. It is worth mentioning Rule Violation and Speeding are correlated (Pearson's r ranging 0.74–0.76) and Speeding may play more of a role in non-occupational crash outcomes that is not observable. Overall, more work is necessary to examine the convergent validity of subscales with the same outcomes using objective measures or a study design that incorporates longitudinal data to gain a better understanding of the predictive validity.

The study has several strengths and limitations. A limitation is the cross-sectional study design provided concurrent validity, rather than the predictive validity obtained from a longitudinal study design, which limits the inferences that can be made about ODBQ scale performance in predicting motor-vehicle crashes and injuries. However, the robust population size and the rigor of the validity testing provided much needed insight into how well a valid scale was performing in a different worker population that spends more time driving. An important consideration for future applications of this tool is the training of management in its use for educational purposes rather than in a punitive context. For this study, all participants were informed their responses were confidential and none of the companies represented would be provided with any of the data. Drivers provided verbal assent and were given a copy of the consent form. In an environment where companies administer the ODBQ in house, if management has a history of punitive responses to unsafe road behaviors drivers would be less likely to respond to the questionnaire. Additional study strengths include the socio-demographic diversity of the population that increases the generalizability of the findings and the industry examined as novel contributions in the use and advancement of the ODBQ as a valid measurement tool for road safety among those who exclusively drive for a living.

Our findings contribute to the occupational road safety literature by identifying and further validating a practical and inexpensive measurement tool for road safety. We adapted the tool for use in a population of full-time drivers who transport passengers as their main job task. The constructs encompassed in the full scale are relevant to every aspect of driving a taxi – fatigue, distracted driving (inattention), obeying traffic laws (rule violation), and speeding. This versatile tool could be used by management to schedule driver refresher training or in research when expensive direct road safety measures are not feasible. The current findings support the use of either version of the ODBQ as a promising contribution to occupational road safety.

Biography

Cammie Chaumont Menendez, PhD, is an epidemiologist focused on conducting research examining the effectiveness of interventions and strategies designed to prevent or mitigate injuries in the workplace. Her interests are using Total Worker Health approaches to prevent injuries while promoting health and safety factors occurring both inside and outside the workplace, equity in implementing demonstrated occupational safety measures, and the health and safety of gig workers. She received her PhD from the NIOSH Education and Research Center in Injury Prevention at the University of Texas Health Sciences Center School of Public Health in Houston.

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Table 1

Occupational Driver Behavior Questionnaire subscales, items and corresponding descriptions.

Subscales	Items	Descriptions
Speeding [+]	SP1	How often do you exceed the speed limit on a residential road?
	SP2	How often do you exceed the speed limit on a highway or freeway?
	SP3	How often do you exceed the speed limit when traveling to do pickups[§]?
Rule Violation	RV1	How often do you not signal to change lanes when no other traffic is around?[¶]
	RV2	How often do you perform a U-turn in a non-designated zone?
	RV3	How often do you not come to a complete standstill at a stop sign?[¶]
Inattention	IN1	How often do you drive while thinking about how to get to your destination?
	IN2	How often do you drive while thinking about your next pickup [Ŧ] or work task?
	IN3	How often do you drive while thinking about your work-related problems/issues?
Driving While Fatigued	DF1	How often do you drive while tired?
	DF2	How often do you have difficulty driving because of tiredness or fatigue?
	DF3	How often do you find yourself nodding off while driving?
Additional Items [**]	SP4	How often do you exceed the speed limit when travelling with a passenger?
	RV4	How often do you wear your seat belt while driving?
	IN4	How often do you use a handheld cell phone while driving?

Note.

[*] Items are Likert-based with 5 options, ranged from 1 to 5, 1 being “Rarely/Never” through 5 being “Very often/all the time.” All items except for RV4 were reversecoded. (Newnam et al., 2011).

[+] Every item on Speeding began with ‘How often do you deliberately’ in the original 12-item ODBQ. For the current study we dropped ‘deliberately’ from each question for both versions of the ODBQ.

[§] Modified from ‘travelling to clients or the office’.

[¶] Removed ‘fail’ to not using a signal to change lanes and coming to a complete standstill for RV1 and RV3.

[Ŧ] Replaced ‘next patient’ with ‘next pickup’.

[**] Items SP4, RV4, and IN4 were not a part of the 12-item ODBQ (Newnam et al., 2011).

Table 2

Descriptive statistics for Houston and Los Angeles Taxi Cab Drivers for Years.

Individual factors	Mean ± SD or %
# of crashes for the past 12 months (n = 971)	
At least 1 crash (n = 148)	15%
Age (n = 971)	43.9 ± 10.1
Sex (n = 961)	
Male (n = 897)	92%
Race and Ethnicity (n = 835)	
Black or African American, non-Hispanic (n = 290)	35%
White, non-Hispanic (n = 266)	32%
Hispanic (n = 101)	12%
Asian, non-Hispanic (n = 100)	12%
American Indian/Alaska Native/Native Hawaiian/Pacific Islander, non-Hispanic (n = 30)	4%
Refused to answer question (n = 29)	4%
Nativity (n = 973)	
Born outside the U.S. (n = 514)	53%
Educational attainment (n = 970)	
Below High School (n = 128)	13%
High School (n = 333)	34%
Some College (n = 491)	50%
Graduate degree (n = 18)	2%
Relationship status (n = 971)	
Married or Long-term relationship (n = 559)	57%
Single (n = 273)	28%
Separated, Divorced, or Widowed (n = 129)	13%
Refused to answer question (n = 10)	1%

Table 3

Correlation matrix and descriptive statistics for ODBQ items.*

	Speeding				Rule violation					Inattention			Driving while fatigued		
	SP1	**SP2**	**SP3**	**SP4**	**RV1**	**RV2**	**RV3**	**RV4**	**RV5**	**IN1**	**IN2**	**IN3**	**DF1**	**DF2**	**DF3**
SP1	1														
SP2	**0.75**	1													
SP3	**0.74**	**0.87**	1												
SP4	**0.77**	**0.69**	**0.72**	1											
RV1	**0.68**	**0.62**	**0.63**	**0.68**	1										
RV2	**0.68**	**0.58**	**0.57**	**0.63**	**0.73**	1									
RV3	**0.67**	**0.57**	**0.57**	**0.61**	**0.67**	**0.77**	1								
RV4	0.03	0.06	**0.07**	0.06	0.04	0.04	0.00	1							
IN1	**0.20**	**0.29**	**0.30**	**0.18**	**0.21**	**0.18**	**0.19**	−0.03	1						
IN2	**0.33**	**0.44**	**0.46**	**0.33**	**0.34**	**0.31**	**0.29**	0.05	**0.72**	1					
IN3	**0.40**	**0.42**	**0.44**	**0.37**	**0.38**	**0.35**	**0.36**	0.05	**0.52**	**0.68**	1				
IN4	**0.45**	**0.46**	**0.46**	**0.44**	**0.42**	**0.45**	**0.47**	−0.01	**0.38**	**0.48**	**0.48**	1			
DF1	**0.32**	**0.41**	**0.43**	**0.31**	**0.37**	**0.38**	**0.33**	0.04	**0.38**	**0.46**	**0.52**	**0.30**	1		
DF2	**0.34**	**0.37**	**0.38**	**0.32**	**0.36**	**0.38**	**0.34**	−0.01	**0.32**	**0.40**	**0.45**	**0.34**	**0.68**	1	
DF3	**0.31**	**0.37**	**0.38**	**0.30**	**0.33**	**0.38**	**0.31**	0.05	**0.28**	**0.35**	**0.42**	**0.33**	**0.65**	**0.77**	1
Mean	3.69	3.46	3.52	3.89	3.90	4.05	3.99	4.82	3.41	3.59	3.86	3.89	4.08	4.48	4.63
SD	1.27	1.24	1.21	1.12	1.16	1.12	1.22	0.54	1.16	1.12	1.06	1.25	1.00	0.87	0.75
%Floor	9.4	9.6	8.0	4.7	5.6	4.7	6.9	0.6	7.8	6.1	3.9	6.6	2.7	1.2	0.4
%Ceiling	33.8	24.1	25.7	36.9	39.7	45.6	47.1	86.7	20.2	24.6	33.8	45.0	42.3	68.2	77.3
%Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Correlations are bivariate Pearson correlations. All correlations in bold were at least statistically significant at the < 0.05 observed significance level.

* Los Angeles N = 500, Houston N = 496. 19 cases removed in Houston dataset due to missingness; both datasets were combined. Final analytic sample n = 977.

Table 4

Model fit results, Confirmatory Factor Analysis (n = 977).

12-item model						
Models/Measures	χ^2	***df***	**CFI**	**TLI**	**RMSEA**	**SRMR**
1. First-order 4-factor	335.33	48	0.94	0.92	0.08	0.06
2. First-order 4-factor (MIA)	192.53	46	0.97	0.96	0.06	0.04
3. One underlying factor	1864.14	54	0.62	0.54	0.19	0.13
4. Second-order single-factor	395.16	50	0.93	0.90	0.08	0.08
15-item model						
Models/Measures	χ^2	***df***	**CFI**	**TLI**	**RMSEA**	**SRMR**
1. First-order 4-factor	631.14	84	0.91	0.89	0.08	0.07
2. First-order 4-factor (MIA)	351.99	82	0.96	0.95	0.06	0.05
3. One underlying factor	2256.61	90	0.66	0.60	0.16	0.12
4. Second-order single-factor	707.78	86	0.90	0.88	0.09	0.09

Note. χ^2, Chi-square; df, degrees of freedom; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; CFI, comparative fit index, TLI, Tucker-Lewis index.

12-item model. Models 1 and 4 were compared using the Satorra-Bentler (1994) scaled chi-square difference test, yielding statistically significant results [$\Delta \chi^2 = 56.88$, Δ df = 2, $p < 0.001$], suggesting that Model 1 fits the data better than 4.

15-item model. Models 1 and 4 were compared using the Satorra-Bentler (1994) scaled chi-square difference test, yielding statistically significant results [$\Delta \chi^2 = 80.85$, Δ df = 2, $p < 0.001$], suggesting that Model 1 fits the data better than 4.

MIA = modification indices applied. Both models with MIA had the highest two correlated residuals added, which were the same for both models, SP3 with SP2 and RV2 with RV1.

Every χ^2 p-value is < 0.001.

Table 5

Logistic Regression Models for Convergent Validity Testing.

Experiencing a Motor Vehicle Crash While Driving a Taxi <12 months

	ODBQ-15			ODBQ-12		
Model	**O.R.**	**95% CI**	**Sig.**	**O.R.**	**95% CI**	**Sig.**
Speeding	0.75	0.63, 0.88	<0.001	0.75	0.64, 0.89	<0.001
Inattention	0.59	0.48, 0.73	<0.001	0.61	0.50, 0.74	<0.001
Rule Violation	0.68	0.54, 0.85	<0.001	0.74	0.62, 0.87	<0.001
Driving Fatigued	0.55	0.45, 0.68	<0.001	0.55	0.45, 0.68	<0.001
Full Scale^	0.51	0.40, 0.66	<0.001	0.52	0.41, 0.66	<0.001
Speeding*	1.02	0.77, 1.36	0.89	1.03	0.79, 1.34	0.83
Inattention*	0.73	0.57, 0.95	0.02	0.75	0.59, 0.95	0.02
Rule Violation*	0.93	0.64, 1.34	0.68	0.90	0.69, 1.18	0.45
Driving Fatigued*	0.67	0.52, 0.87	<0.001	0.68	0.52, 0.88	<0.01

Experiencing a Motor Vehicle Crash Outside of Driving a Taxi <12 months

	ODBQ-15			ODBQ-12		
Model	**O.R.**	**95% CI**	**Sig.**	**O.R.**	**95% CI**	**Sig.**
Speeding	0.67	0.57, 0.78	<0.001	0.69	0.59, 0.80	<0.001
Inattention	0.78	0.65, 0.94	0.01	0.84	0.70, 1.00	0.05
Rule Violation	0.58	0.48, 0.71	<0.001	0.66	0.56, 0.77	<0.001
Driving Fatigued	0.82	0.66, 1.00	0.05	0.82	0.66, 1.00	0.05
Full Scale^	0.57	0.45, 0.72	<0.001	0.60	0.48, 0.74	<0.001
Speeding*	0.79	0.61, 1.02	0.07	0.83	0.66, 1.05	0.12
Inattention*	0.99	0.78, 1.25	0.92	1.01	0.81, 1.25	0.96
Rule Violation*	0.72	0.52, 0.99	0.04	0.74	0.58, 0.94	0.01
Driving Fatigued*	1.09	0.83, 1.42	0.53	1.09	0.83, 1.42	0.55

^Overall survey score in one regression model.

*Subscales were combined into one regression model.