Repeated Cross-Sectional Assessment of Commercial Truck Driver Health

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Objective: To assess relationships and trends over time in individual conditions and multiple conditions among a large sample of independent, nonoverlapping truck drivers using a repeated cross-sectional study design. **Methods:** Commercial driver medical examinations were conducted on 95,567 commercial drivers between January 1, 2005, and October 31, 2012. Specific medical conditions that have been identified by the Federal Motor Carrier Safety Administration's Medical Review Board as possibly increasing crash risk were examined. Prevalence and trends over time were analyzed. **Results:** A total of 8 of the 13 conditions significantly increased from 2005 to 2012. Prevalence of multiple concomitant conditions also increased, with prevalence odds ratios as high as 7.39 (95% confidence interval, 3.92 to 13.98) for four or more conditions in 2012 as compared with 2005. **Conclusions:** Individual and multiple conditions thought to be associated with increased crash risk significantly increased between 2005 and 2012.

Commercial motor vehicle (CMV) drivers are one of the largest employment categories in the United States, with an estimated 5.7 million CMV drivers in 2012.[1] Trucking is also the most common job in 29 of the 50 states.[2] Truck driver crashes are a disproportionate and leading cause of workplace fatalities, with 3602 total deaths in 2012 because of large truck crashes, with most of the fatalities (67%) being occupants of passenger vehicles.[3]

Many CMV drivers reportedly have poor health status that is commonly attributed to lifestyle and occupational factors (eg, improper diet, inadequate physical activity, poor sleep hygiene, shiftwork),[4–7] as well as comorbid conditions including diabetes mellitus, hypertension, and cardiovascular disease[8–12] although few data are available to understand the relative importance of these factors. In addition to poor health status, CMV drivers also have poor access to and utilization of the traditional health care system.[13–16]

Multiple comorbid medical conditions and/or use of specific medications are believed to increase the risk for crashes among CMV drivers.[17] The belief that combinations of risk factors increase crash risk was a primary inspiration for the federal Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation to revise the process for certifying medical fitness to drive.[18] Subsequently, there have been many changes proposed for individual medical conditions, but there has been just one published guideline for qualifying CMV drivers with multiple medical conditions (Table 1).[19,20]

Interstate CMV drivers must successfully complete a commercial driver medical examination (CDME) to maintain a commercial driver's license at least every 2 years. Medical examiner certification guidelines vary on the basis of specific health conditions (eg, high blood pressure), and many drivers are not medically certified for the full 2-year maximum length. Drivers are evaluated for the presence of numerous potential health conditions by the health care provider completing the examination. Although some of these conditions are based on self-reported past diagnoses, some of these conditions are objectively measured or calculated, including weight, blood pressure, and body mass index (BMI).

This article aims to quantify the change in prevalence of these multiple medical conditions between 2005 and 2012 among a large repeated cross-sectional study of independent, nonoverlapping CMV drivers. The secondary aim is to calculate prevalence odds ratios (PORs) by year for these conditions after adjusting for changes in population confounding factors (eg, age).

METHODS

This study was approved by the University of Utah Institutional Review Board (#35889). Methods have been previously described in detail and an abbreviated description of the methods is presented here.[21] Data were obtained from RoadReady, Inc (RR), a private company that provides a web-based platform for recording CMDE findings. The RR database includes CDMEs performed by dozens of examiners on CMV drivers licensed in all 48 of the contiguous states. The database contains CMV drivers who are both employed by private carriers and independent owner/operator drivers. Although the exact number is not known, it is estimated that the majority of the drivers (>80%) are classified as over-the-road or long-haul drivers, and thus considered at high risk for obesity and poor health.[22,23]

Examination data are entered directly into the RR system by the clinics through a computerized program to ensure high data quality and capture. Data from RR spanning January 1, 2005, to October 31, 2012, were analyzed. Data elements are those of the Federal Motor Carrier Safety Administration (FMCSA) Commercial Driver fitness determination form 649-F (6045) and include demographics (age and sex), medical history (eg, neurological problems, medications, sleep disorders, and diabetes mellitus), measured height, weight (for BMI) and blood pressure, heart rate, urinalysis, and other medical examinations (eg, vision, cardiovascular, and hearing whisper screening test). If drivers had multiple consecutive CDMEs in the RR database, only the first CDME was analyzed, and any subsequent examinations were excluded. These examinations are performed on those drivers who are renewing commercial driver licenses as well as new commercial drivers.

Therefore, when stratified by year of examination, calculations will result in a measure of disease prevalence.

A total of 95,567 CDMEs encompassing all CDMEs performed from January 1, 2005, to October 31, 2012, were extracted from the RR database.

Comorbid Medical Conditions

The FMCSA has provided multiple sources of guidance for examiners to utilize when evaluating a CDME including medical expert panel recommendations, medical review board recommendations, conference reports, and evidence summaries.[17,19,24] There are few conditions that are absolutely disqualifying (eg, uncontrolled epileptic seizures), although there is guidance on hundreds of conditions (eg, being seizure-free and off-seizure medications for a period if previously diagnosed with epilepsy).

To address concerns regarding combinations of multiple risk factors, the FMCSA's Medical Review Board developed a multiple conditions matrix, shown on the left side of Table 1, to provide guidance.[19] For the analyses in this article, each of the 13 conditions is given equal value and the total numbers of conditions were summed for a per-driver score for each CDME from 2005 to 2012. Most, but not all, of the conditions are directly applicable to the RR data, and a detailed description of the Medical Review Board recommendations and the RR data used to fulfill that recommendation are provided in Table 1.

Statistical Analyses

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC). The data set analyzed included all complete CDMEs from individual, nonoverlapping CMV drivers who were in the RR System. Data were stratified by calendar year that the examination was performed. Mean and standard deviations or frequency and percentage are presented for the 13 conditions and sum of conditions by examination year. Logistic regression was used to quantify the magnitude and direction of association between calendar year and condition. Crude and adjusted PORs were calculated. Prevalence odds ratios and 95% confidence interval (95% CI) were adjusted for age, sex, and BMI in a multivariate logistic regression with the first year (2005) being the reference year.

RESULTS

There were 95,567 drivers' examinations included in these analyses, with a minimum of 7618 (8.0% of total) examinations in 2011 and a maximum of 18,559 (19.4% of total) in 2007. Mean age of the annually stratified population decreased between 2005 and 2012, from 47.0 to 44.1 years. Mean BMI steadily increased from 30.6 kg/m^2 in 2005 to 32.6 kg/m^2 in 2012, associated with a decline in both normal weight (18.5 to 24.9 kg/m^2; 19.5% to 11.2%) and overweight (25.0 to 29.9 kg/m^2; 32.6% to 29.3%) drivers and a meaningful increase in obese (30 to 34.9 kg/m^2; 25.0% to 28.2%) and morbidly obese ($\geq$35.0 kg/m^2; 22.2% to 31.2%) drivers between 2005 and 2012 (Fig. 1).

Table 2 provides demographic data and the frequency of each of the 13 conditions, stratified by year. There were meaningful increases over time for (1) opioid or benzodiazepine use, (2) BMI more than 35 kg/m^2, (3) sleep apnea, (4) hypertension, (5) diabetes mellitus, (6) cardiovascular disease, and (7) psychiatric disorders. Vision problem was the only condition where the prevalence meaningfully decreased.

Drivers were increasingly more likely to have most conditions over the 7-year period, with stronger PORs in later years (Table 3). These results remained after adjustment for age, sex, and BMI. The largest PORs and 95% CIs were observed for sleep disorders (POR = 7.66; 95% CI, 6.25 to 9.39) and opioid and/or benzodiazepine use (POR = 4.73; 95% CI, 3.58 to 6.24). Psychiatric disorders, hypertension, cardiovascular disorders, and diabetes mellitus—all had statistically significant PORs greater than 2.0. In addition, many of these increases reached statistical significance relatively quickly as compared with the 2005 year, for example both hypertension and opioid and/or benzodiazepine use being statistically higher POR in 2006 and continuing to have statistically
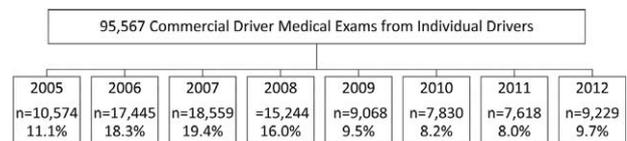

FIGURE 1. Breakdown by year of commercial driver medical examination data.

TABLE 1. Multiple Conditions Matrix and Data Used From the CDME Form for EACH CONDITION

FMCSA's Medical Review Board Multiple Conditions[19,20]	Comparable Data Used in This Report From the Road Ready Database of CDMEs
1. Body mass index >35 kg/m^2	Body mass index >35 kg/m^2
2. Diabetes mellitus requiring medication	Diabetes mellitus controlled by medication
3. Cardiovascular disease or dysrhythmias	Heart disease, heart surgery, or heart abnormalities
4. Hypertension	Elevated blood pressure >140/90 mm Hg, or hypertension medication, or self-reported history of hypertension
5. Requirement for a visual exemption	Corrected vision in both eyes worse than 20/40 or horizontal field of vision <70° in either eye
6. Obstructive sleep apnea	Sleep problems
7. Renal disease	Kidney disease
8. Pulmonary disease with pulmonary function test abnormality	Lung and chest abnormalities
9. Epilepsy seizure free for >10 yrs	Seizures/epilepsy
10. Musculoskeletal disease requiring medical, surgical, or prosthetic treatment	Spine or other musculoskeletal disorder
11. Stroke	Stroke or paralysis
12. Major psychiatric illness (as defined pending formal review by the MRB)	Nervous or psychiatric disorders
13. Opioid or benzodiazepine use	Opioid or benzodiazepine medication, including generic and trade names, in the record

CDME, commercial driver medical examination; FMCSA, Federal Motor Carrier Safety Administration; MRB, Medical Review Board.

TABLE 2. Demographic Data From Commercial Driver Medical Examination by Year*

	Mean (SD) or n (%)								
	2005 (n = 10,574)	2006 (n = 17,445)	2007 (n = 18,559)	2008 (n = 15,244)	2009 (n = 9068)	2010 (n = 7830)	2011 (n = 7618)	2012 (n = 9229)	Total (n = 95,567)
Age, yrs	47.0 (10.4)	46.3 (10.5)	46.1 (10.5)	46.3 (10.5)	46.7 (9.9)	45.9 (10.0)	45.0 (10.0)	44.1 (10.3)	46.0 (10.4)
BMI, kg/m²	30.6 (6.9)	30.9 (7.0)	31.4 (7.2)	31.7 (7.3)	32.3 (7.2)	32.5 (7.5)	32.4 (7.2)	32.6 (7.2)	31.7 (7.2)
Female	461 (4.4)	861 (4.9)	860 (4.6)	659 (4.3)	276 (3.0)	288 (3.7)	294 (3.9)	354 (3.8)	4052 (4.2)
Condition†									
Medication†	65 (0.6)	144 (0.8)	189 (1.0)	218 (1.4)	129 (1.4)	145 (1.9)	164 (2.2)	250 (2.7)	1304 (1.4)
Vision	249 (2.4)	1099 (6.3)	444 (2.4)	70 (0.5)	104 (1.2)	62 (0.8)	40 (0.5)	52 (0.6)	2120 (2.2)
BMI >35.0 kg/m²	2348 (22.2)	4011 (23.0)	4755 (25.6)	4136 (27.1)	2623 (28.9)	2358 (30.1)	2311 (30.3)	2868 (31.1)	25410 (26.6)
Sleep apnea	117 (1.1)	176 (1.0)	227 (1.2)	202 (1.3)	161 (1.8)	220 (2.8)	364 (4.8)	734 (8.0)	2201 (2.3)
Hypertension	1811 (17.1)	3115 (17.9)	3730 (20.1)	3636 (23.9)	2550 (28.1)	2491 (31.8)	2451 (32.2)	3030 (32.8)	22814 (23.9)
Diabetes mellitus	466 (4.4)	784 (4.5)	983 (5.3)	871 (5.7)	648 (7.2)	563 (7.2)	541 (7.1)	826 (9.0)	5682 (5.9)
Cardiovascular	263 (2.5)	439 (2.5)	541 (2.9)	495 (3.3)	349 (3.9)	346 (4.4)	380 (5.0)	417 (4.5)	3230 (3.4)
Kidney disease	19 (0.2)	21 (0.1)	28 (0.1)	39 (0.3)	26 (0.3)	21 (0.3)	22 (0.3)	30 (0.3)	206 (0.2)
Lung disorders	226 (2.1)	332 (1.9)	395 (2.1)	360 (2.4)	199 (2.2)	200 (2.6)	182 (2.4)	218 (2.4)	2112 (2.2)
Musculoskeletal	9 (0.1)	8 (0.1)	17 (0.1)	6 (0.0)	2 (0.0)	3 (0.0)	3 (0.0)	5 (0.1)	53 (0.1)
Psychiatric	133 (1.3)	232 (1.3)	307 (1.7)	257 (1.7)	156 (1.7)	217 (2.8)	183 (2.4)	241 (2.6)	1726 (1.8)
Seizure	3 (0.0)	9 (0.1)	11 (0.1)	7 (0.1)	7 (0.1)	4 (0.1)	0 (0.0)	2 (0.0)	43 (<0.1)
Stroke	9 (0.1)	18 (0.1)	19 (0.1)	26 (0.2)	15 (0.2)	10 (0.1)	14 (0.2)	12 (0.1)	123 (0.1)

*Medical conditions are based on the CDME form's medical history section.[19]
†Opioid or benzodiazepine use.
BMI, body mass index; SD, standard deviation.

significantly higher prevalence through 2012 when compared with the prevalence in 2005. By contrast, vision problems were significantly higher in 2006 and then significantly decreased from 2008 to 2012, as compared with 2005.

The trend over time in prevalence of conditions in the multiple conditions matrix (Table 1) was highly significant ($P < 0.0001$) and is shown in Table 4. Table 5 illustrates the PORs for the count of conditions over time, with high PORs for later years with drivers having three or more, four or more, and five or more conditions reaching statistical significance in years 2007, 2009, and 2010, respectively. These PORs indicate an increasingly unhealthy population with a constellation of conditions becoming more frequent as compared with 2005. These trends are not driven by a single condition. Figure 2 demonstrates the significant increase in counts of conditions per year, as compared with 2005.

DISCUSSION

This large, repeated cross-sectional study over 7 years of more than 95,000 CMV drivers found significant increases in prevalence of eight individual medical conditions. This study also found large increases in the percentage of drivers recommended for disqualification on the basis of the presence of multiple medical conditions; in 2005, only 0.5% were recommended for disqualification, but this increased to 2.2% in 2012. The registry of certified medical examiners, which went into effect in 2014, did not play a role in the increase of conditions seen in these analyses. Individual conditions, but particularly drivers having multiple medical conditions, are thought to contribute to increase the risk of crash.[18] To date, this study seems to be the first evaluation of changes in prevalence of medical conditions over time among this population.

The multiple conditions matrix (Table 1) was developed by the FMCSA Medical Review Board as a guideline for driver certification on the basis of CDME findings that increase the risk of being involved in a crash. This study is the first-reported evaluation of the change of these conditions, both individually and as a composite, over time. The significant increase in drivers recommended for not being medially certified because they have four or more conditions, with a POR of 7.39 from 2005 to 2012, indicates that there is a meaningful increase in the prevalence of multiple concomitant medical conditions that may increase the risk of crashes. If this matrix correctly classifies crash risk, it may be a usable tool to be implemented across the industry. Nevertheless, the potentially causal interactions between these conditions and subsequent crashes have not been prospectively evaluated.

The entire study sample ($n = 95,567$) had a mean BMI of 31.7 kg/m², which is significantly higher than the general population of 28.7 kg/m² as reported in 2010.[25] The proportion of CMV drivers who had a BMI of more than 35 kg/m² rose from 22.2% to 31.1% between 2005 and 2012, which is meaningfully higher than the 2012 male general population older than 20 years with a BMI of more than 35 kg/m² prevalence of 11.9%.[26] The same article reports that a change in prevalence of adult obesity (BMI >30 kg/m²) rose from 34.3% in 2005 to 2006 to 34.9% in 2011 to 2012, a much slower rate than was seen in this population (data not shown). When compared with prior published subjective self-reports of obesity from CMV drivers, the findings in this study are higher than previously reported obesity prevalence.[27,28] Two studies of truck drivers, one conducted in 2002 and the other between 2010 and 2012, reported the prevalence of drivers being overweight or obese.[10,12] Evaluating these two studies together, there are similar trends of increasing BMI between the two time points, with 22.8% and 37% of the drivers were overweight (BMI between 25 and 30 kg/m²), whereas 45% and 68.9% were classified as obese (BMI >30 kg/m²), respectively, for the two studies.[10,12] Another large study reported over 50% obesity among more than 19,000 drivers.[29] The most

TABLE 3. Prevalence Odds Ratio (95% Confidence Intervals) for Associations Between Individual Conditions From Commercial Driver Medical Examinations and Year of Examinations After Adjustment for Age, Sex, and BMI

Condition	2005 (n = 10,574) POR (95% CI)	2006 (n = 17,445) POR (95% CI)	2007 (n = 18,559) POR (95% CI)	2008 (n = 15,244) POR (95% CI)	2009 (n = 9068) POR (95% CI)	2010 (n = 7830) POR (95% CI)	2011 (n = 7618) POR (95% CI)	2012 (n = 9229) POR (95% CI)	Trend P Value
Medication*	1.00 (reference)	1.35* (1.00–1.81)	1.67* (1.26–2.21)	2.35* (1.78–3.11)	2.35* (1.74–3.80)	3.08* (2.29–4.13)	3.61* (2.70–4.82)	4.59* (3.49–6.05)	<0.0001
Vision	1.00 (reference)	2.81* (2.44–3.23)	1.03 (0.88–1.21)	0.20 (0.15–0.25)	0.49 (0.39–0.62)	0.34 (0.26–0.45)	0.23 (0.16–0.32)	0.25 (0.18–0.33)	<0.0001
BMI >35.0 kg/m²†	1.00 (reference)	1.03 (0.98–1.10)	1.19 (1.13–1.26)	1.30* (1.22–1.37)	1.44* (1.35–1.53)	1.50* (1.40–1.60)	1.50* (1.40–1.60)	1.54* (1.44–1.64)	<0.0001
Sleep apnea	1.00 (reference)	0.89 (0.70–1.13)	1.00 (0.80–1.26)	1.02 (0.80–1.28)	1.30* (1.01–1.66)	2.09 (1.66–2.64)	4.15* (3.34–5.16)	7.66* (6.25–9.39)	<0.0001
Hypertension	1.00 (reference)	1.09* (1.02–1.17)	1.26* (1.18–1.35)	1.56* (1.46–1.67)	1.89* (1.76–2.04)	2.42* (2.25–2.61)	2.66* (2.47–2.87)	2.90* (2.69–3.11)	<0.0001
Diabetes mellitus	1.00 (reference)	1.06 (0.94–1.19)	1.24* (1.11–1.40)	1.30* (1.15–1.46)	1.62* (1.42–1.83)	1.69* (1.49–1.93)	1.80* (1.58–2.05)	2.48* (2.20–2.80)	<0.0001
Cardiovascular	1.00 (reference)	1.06 (0.91–1.24)	1.26 (1.08–1.47)	1.38 (1.18–1.61)	1.65 (1.40–1.95)	2.02 (1.71–2.39)	2.48 (2.11–2.92)	2.36* (2.01–2.77)	<0.0001
Kidney disease	1.00 (reference)	0.69 (0.37–1.28)	0.86 (0.48–1.55)	1.45 (0.84–2.52)	1.61 (0.89–2.91)	1.54 (0.83–2.87)	1.71 (0.92–3.17)	1.98* (1.11–3.52)	0.0014
Lung disorders	1.00 (reference)	0.88 (0.74–1.04)	0.98 (0.83–1.16)	1.09 (0.92–1.29)	1.02 (0.84–1.24)	1.18 (0.97–1.43)	1.11 (0.91–1.35)	1.10 (0.91–1.33)	0.0265
Musculoskeletal	1.00 (reference)	0.56 (0.22–1.45)	1.14 (0.51–2.56)	0.49 (0.17–1.37)	0.28 (0.06–1.28)	0.50 (0.13–1.84)	0.54 (0.15–1.99)	0.77 (0.26–2.31)	0.3006
Psychiatric	1.00 (reference)	1.05 (0.85–1.31)	1.31* (1.07–1.61)	1.33* (1.08–1.64)	1.35* (1.07–1.71)	2.20* (1.77–2.74)	1.93* (1.54–2.42)	2.12* (1.71–2.63)	<0.0001
Seizure	1.00 (reference)	1.88 (0.51–6.97)	2.26 (0.63–8.12)	1.79 (0.46–6.91)	3.18 (0.82–12.34)	2.17 (0.48–9.71)	N/A	1.00 (0.17–5.99)	0.7524
Stroke	1.00 (reference)	1.28 (0.57–2.84)	1.30 (0.59–2.88)	2.12 (0.99–4.54)	2.11 (0.92–4.83)	1.72 (0.70–4.24)	2.68* (1.16–6.22)	2.03 (0.85–4.83)	0.1647

*p < 0.05.
*Opioid and/or benzodiazepine use.
†Not adjusted for BMI.
BMI, body mass index; CI, confidence interval; POR, prevalence odds ratio.

comparable and recent study published in 2015 reports a similar prevalence of BMI ($\geq$35 kg/m²) of 31.3% among men and 23.3% among women among 1265 long-haul drivers collected in 2010.[28] These similarities among individual cross-sectional studies suggest that trends seen in these analyses may not be artifacts but represent worsening health measures among CMV drivers. It should be noted that this study found considerable proportions of drivers above the different BMI screening thresholds that range from 30.0 to 35.0 kg/m² for sleep apnea, an issue associated with an increased crash risk.[19,24]

Although this study has highlighted the change of prevalence of health factors over time, the reasons for these changes are not known. It is possible that for certain conditions, such as diagnosis of sleep problems (including obstructive sleep apnea), increased research and attention has improved surveillance and detection. Yet, the changes in the CDME form to include screening for obstructive sleep apnea date to 2002, and thus precede this study's time frame. There have not been meaningful changes in the diagnosis criteria for these 13 conditions during this study time frame, suggesting that these trends cannot be explained by changes in definitions or regulations. It is possible that changes including increased attention to the health of drivers, adoption of more stringent examination criteria by examiners, and the publication of Joint Task Force Guidelines for obstructive sleep apnea[30] improved detection and reporting of some of these medical conditions. In addition, there has been an increase in screening for some conditions (eg, sleep apnea screening by Schneider National). This may partially explain the increased prevalence of some of these conditions; nevertheless, it is unlikely to be responsible for the entire increase observed in these data. A residual cohort effect is also possible. Another possible reason for the differences seen over time is the economic change, which may have influenced the driving population, with CMV driving jobs being perceived as less desirable yet the next choice for those who lost non-CMV driving jobs. There are some data that suggest that the recession resulted in overall lost jobs where drivers with poor records and poor health were laid off and drivers were not replaced.[31] Many of these conditions, such as measured high blood pressure, cholesterol, and BMI, are less subject to reporting bias. The increasing trends over time in prevalence of these more objective conditions suggest that these relationships may not be artifacts of reporting bias.

It is likely that there is differential, nonrandom underreporting and underdiagnosis of many of these factors because drivers are aware that the more factors they report, the less likely they are to be medically certified. The underreporting and underdiagnosis is more likely to occur in unhealthy drivers. There have been no studies evaluating the magnitude of this underreporting. Although this relationship is not likely to change over time, with the increasing number of conditions noted, it is possible that true change of conditions over time are stronger than those demonstrated by these analyses. The movement for a national drug/alcohol testing clearinghouse may impact the prevalence of some conditions, including opioid and benzodiazepine use, during medical examinations in the future.

Strengths of this study include the large sample size and nationwide representation. Demographic measures, including age, sex, and BMI, are comparable to other published reports of CMV drivers.[1,10,29,32–37] This study affords an objective approach by utilizing CDME data, including health conditions confirmed by a medical examiner and measured hypertension and calculated BMI. This accuracy allows for stronger conclusions than self-reported prevalence. This study does have limitations, which bound conclusions. The population size decreased significantly during the economic recession of 2007 to 2009 and did not completely recover by 2012. The losses in truck driving population during that time removed some of the drivers from the studied population. Most conditions were self-reported unless discovered by the examiner and

TABLE 4. Number of Relative Disqualifying Conditions From Commercial Driver Medical Examination Stratified by Year

Number of Conditions	2005 (n = 10,574)	2006 (n = 17,445)	2007 (n = 18,559)	2008 (n = 15,244)	2009 (n = 9068)	2010 (n = 7830)	2011 (n = 7618)	2012 (n = 9229)
0	6,392 (60.5%)	9,918 (56.9%)	10,365 (55.9%)	8,103 (53.2%)	4,389 (48.4%)	3,515 (44.9%)	3,429 (45.0%)	3,975 (43.1%)
1	2,989 (28.3%)	5,266 (30.2%)	5,527 (29.8%)	4,679 (30.7%)	2,917 (32.2%)	2,588 (33.1%)	2,406 (31.6%)	2,873 (31.1%)
2	911 (8.6%)	1,757 (10.1%)	2,030 (10.9%)	1,865 (12.2%)	1,323 (14.6%)	1,236 (15.8%)	1,250 (16.4%)	1,568 (17.0%)
3	231 (2.2%)	424 (2.4%)	529 (2.9%)	502 (3.3%)	364 (4.0%)	401 (5.1%)	408 (5.4%)	607 (6.6%)
4*	43 (0.4%)	66 (0.4%)	92 (0.5%)	83 (0.5%)	68 (0.8%)	75 (1.0%)	105 (1.4%)	179 (1.9%)
5	8 (0.1%)	14 (0.1%)	13 (0.1%)	11 (0.1%)	7 (0.1%)	12 (0.2%)	19 (0.3%)	24 (0.3%)
6	0 (0.0%)	0 (0.0%)	3 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.0%)	1 (0.0%)	3 (0.0%)
7	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

*Those with four or more conditions recommended for disqualification until resolution of one or more conditions.[19]

TABLE 5. Prevalence Odds Ratios and 95% Confidence Intervals for Multiple Medical Conditions by Year After Adjusting for Age, Sex, and BMI

Number of Conditions[a]	2005 (n = 10,574) POR (95% CI)	2006 (n = 17,445) POR (95% CI)	2007 (n = 18,559) POR (95% CI)	2008 (n = 15,244) POR (95% CI)	2009 (n = 9068) POR (95% CI)	2010 (n = 7830) POR (95% CI)	2011 (n = 7618) POR (95% CI)	2012 (n = 9229) POR (95% CI)
≥1	1.00 (reference)	1.22* (1.14–1.30)	1.16* (1.09–1.23)	1.25* (1.18–1.34)	1.42* (1.33–1.53)	1.78* (1.65–1.92)	1.86* (1.72–2.00)	2.09* (1.95–2.25)
≥2	1.00 (reference)	1.28* (1.14–1.44)	1.33* (1.19–1.49)	1.53* (1.36–1.71)	1.81* (1.60–2.05)	2.50* (2.20–2.85)	2.93* (2.58–3.34)	3.43* (3.04–3.88)
≥3	1.00 (reference)	1.15 (0.90–1.48)	1.46* (1.14–1.85)	1.59* (1.24–2.03)	1.91* (1.46–2.49)	2.80* (2.15–3.65)	3.16* (2.42–4.13)	4.69* (3.65–6.02)
≥4[b]	1.00 (reference)	1.27 (0.64–2.51)	1.86 (0.98–3.55)	1.43 (0.72–2.83)	2.45* (1.23–4.90)	3.89* (1.98–7.66)	5.69* (2.93–11.04)	7.39* (3.91–13.96)
≥5	1.00 (reference)	2.41 (0.32–17.93)	3.68 (0.53–25.80)	2.02 (0.24–16.78)	5.17 (0.66–40.28)	8.53* (1.17–62.26)	10.46* (1.41–77.54)	9.06* (1.22–67.52)

*P < 0.05.
[a] As compared with having zero of the multiple medical conditions.
[b] Those with four or more conditions are recommended for disqualification.[19]
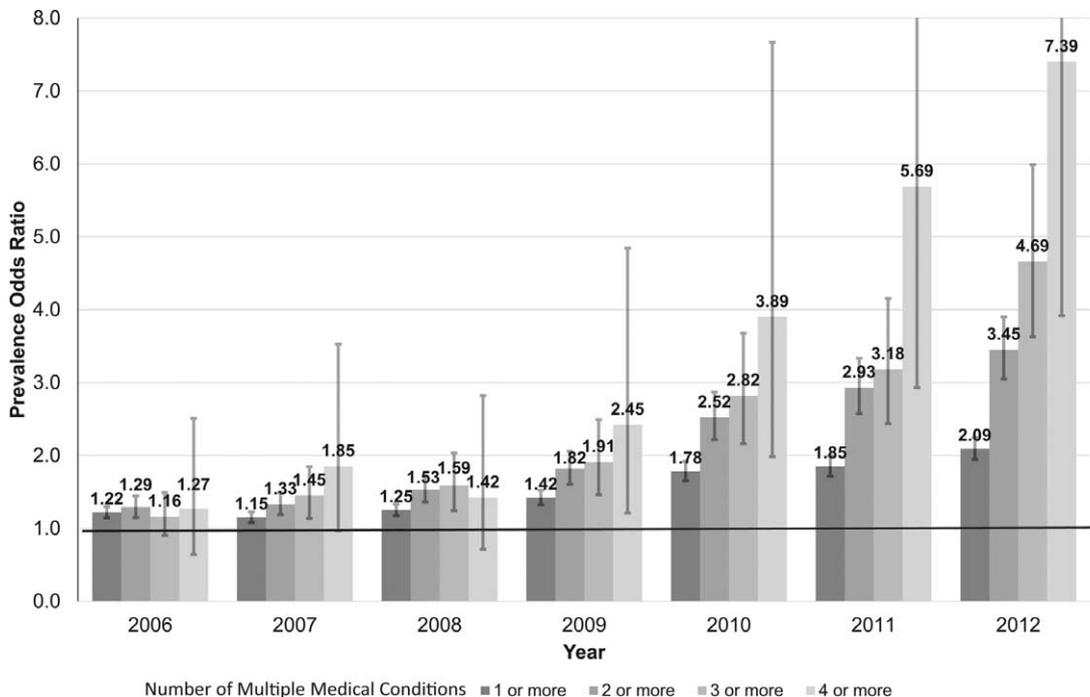CI, confidence interval; POR, prevalence odds ratio.

FIGURE 2. Prevalence odds ratios and 95% confidence interval for the number of multiple conditions per year compared with 2005, adjusted for age, sex, and body mass index.

included on the form. The repeated cross-sectional nature of these data is likely the largest limitation, and therefore this study cannot demonstrate temporality. The changes over time for these conditions do not demonstrate causal relationships on the basis of these analyses alone. In addition, the possibility of a self-selection bias exists; however, the similarity between these data and other published results suggests that selection bias(es) seem to be minor.[1,10,29,32–37]

Further study on changes over time of prevalence of health conditions is needed. There is a particular need for publications assessing the relationship(s) of individual, but especially multiple conditions on risks of crash.

CONCLUSIONS

Among 95,567 truck drivers, there has been an increase in the prevalence of many of the conditions from the FMCSA Medical Review Board multiple conditions matrix between 2005 and 2012. Conditions with a statistically significant increase include (1) opioid and/or benzodiazepine use, (2) BMI more than $35 \, kg/m^2$, (3) sleep problems, (4) hypertension, (5) diabetes mellitus, (6) cardiovascular disease, (7) kidney disease, and (8) psychiatric disorders. Vision problem was the only condition that statistically improved over this time frame. There also was an increase in the prevalence of drivers who had multiple conditions over this time frame, which may be indicative of an increase in crash risk. The strong increase in prevalence of having four or more conditions (POR = 7.40) is the most concerning, as this is the recommended threshold for not medically certifying a driver. Although 8 of the 13 conditions significantly increased over time, it is not known how these individual factors relate to crashes.

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