California Construction Trucking Association

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Air and Radiation Docket
Environmental Protection Agency
Mailcode: 6102T
1200 Pennsylvania Avenue NW
Washington, DC 20460

Re: Docket No. EPA-HQ-OAR-2008-0691

INTRODUCTION:

The California Construction Trucking Association ("CCTA") submits the following comments in response to a "Notice of opportunity for public hearing and comment" published by **the Environmental Protection Agency ("EPA") in the Federal Register** on August 21, 2012. This notice regards "California State Nonroad Engine Pollution Control Standards; California Nonroad Compression Ignition Engines – In-Use Fleets" (non-road diesel standards).

The CCTA is a 501(c) (6) trade association founded in 1941 and our members are active in all facets of construction trucking – including owning and operating non-road diesel powered equipment subject to California Air Resources Board ("CARB") regulations. They will be directly affected should EPA grant CARB the authorization to enforce its non-road diesel standards.

The CCTA has been actively engaged in all facets of CARB's **requirements to** regulate diesel emissions in the State of California. We have attended CARB public meetings throughout the state, attended and testified at numerous public hearings, and submitted written comments. Additionally, we testified against EPA granting CARB the authority to enforce its non-road diesel regulations at a public hearing held by EPA in Washington, DC on September 20, 2012.

The CCTA reincorporates our public objections to granting CARB authorization to enforce its non-road diesel standards announced in our testimony at the September 20th hearing. Specifically, **the CCTA believes CARB's rule is arbitrary and capricious and that** California does not need such California standards to meet compelling and extraordinary condition(s) – two key considerations for the EPA to make in deciding whether to grant California authorization to enforce its non-road diesel regulation.

DISCUSSION:

CARB has admitted the original emissions estimates for non-road diesel powered equipment used to promulgate the original regulation were significantly overstated as shown in the following table:

Table D-1: Comparison of 2007 Rule and Current Emission Estimates

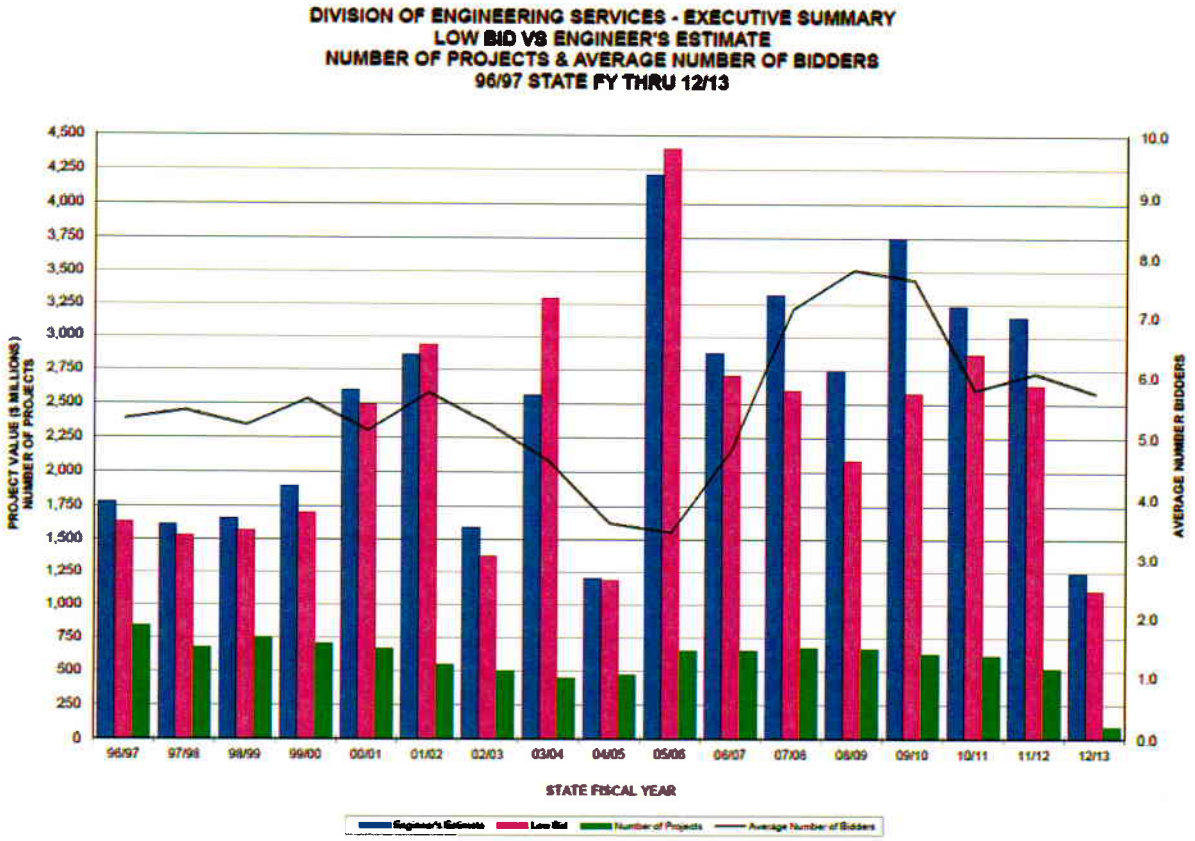
Calendar Year	2007 Inventory (tons/day)		Current Inventory (tons/day)	
	PM2.5	NOx	PM2.5	NOx
2009	18.5	358	3.7	79
2014	13.1	272	3.6	76
2023	5.1	136	2.2	52

CARB's statistical modeling method was originally predicated on overly optimistic assessments of both current and future emissions from off-road diesel powered equipment causing CARB to amend the original regulation, CARB **still makes "estimates"** based on a hypothesized future rebound in construction activity that *may* or *may not* occur in order to justify this amended regulation. For much of California's construction industry the recession is not over. CARB was wrong then and is still wrong by painting rosy economic scenarios in order to justify this regulation.

California's unemployment numbers according to recently released data from the Bureau of Labor Statistics currently stands at a preliminary 10.2 percent (*see*: http://data.bls.gov/timeseries/LASST06000003). Those figures appear to be more assisted by a decline in overall workforce numbers as opposed to any meaningful change in the economy, yet total unemployed still hovers around the two million mark – more than10 percent of total unemployed in the nation!

While CARB acknowledged the population of equipment declined by 26 percent in 2009 related to the recession, that is a static appraisal of a point-in-time and a current update of emissions inventory would likely discover a further decline in equipment population.

CARB's "Recovery Scenario Projections for New Construction Equipment Sales" attempts to postulate that a gradual recovery in sales will occur tied to an economic recovery that has not materialized in the construction sector. An important component necessary for any recovery in the construction sector is federal funding for infrastructure projects and the latest highway bill – Moving Ahead for Progress in the 21st Century (MAP-21) maintains highway funding at stagnant levels. The federal highway trust fund is broke and congress has yet to grapple with keeping it financially solvent. CalTrans is facing significant budget cuts and the number of projects estimated for 2013 thus far is a fraction projects for 2012 as shown in the next graph from Caltrans.



The ongoing economic recession in conjunction with CARB's draconian set of diesel regulations that denies normal industry replacement cycles has placed many businesses in a Catch-22. They face having to replace and/or modify both on-road and off-**road diesel powered equipment and CARB's** regulations have devalued their current equipment to the point that many have lost the equity necessary to secure financing. Even if they could secure financing, many could not secure enough work to satisfy a mortgage obligation.

In perhaps the biggest irony regarding the off-road diesel regulations, while CARB and EPA both maintain that exposure to diesel PM has serious health effects and thus these regulations are somehow warranted to mitigate a public health issue, the alleged health effects will simply migrate to another jurisdiction in the U.S. The regulated equipment still has some residual value and will be legally sold for use outside the State of California. EPA in approving California**'s nonroad standards will a**ctually just cause the migration of alleged negative health effects to other American citizens. Overall, there can be no net positive reduction in health consequences, just the transference of those

consequences thus making a mockery out of CARB's beneficial health and mortality claims.

HEALTH EFFECTS OF EXPOSURE TO PM 2.5

The CCTA adds as addendum **"A"** to these comments a paper published in 2010 by researchers from the National Institute of Occupational Safety and Health titled: Mortality Among Members of a Truck Driver Trade Association.

Any serious research on the effects of exposure to diesel exhaust should necessarily include truck drivers – the proverbial Canary in the mineshaft – in any meaningful study of both mortality and health effects.

The attached study results indicate that those in closest proximity and duration of high levels of exposure to diesel exhaust **don't** seem to share the same deleterious **effects to exposure claimed in other studies. Further, reliance on the "healthy worker effect" to explain away** the unexplainable exposes the researchers misplaced faith in the requirement that truck drivers receive a physical every two years. That process has been replete with fraud for many years and is currently the focus of numerous rulemaking by U.S. DOT to close loop-holes.

Additionally, as noted by the researchers, truck drivers smoke at a rate higher than the average population. The industry is only now beginning to grapple with an obesity epidemic among truck drivers that further confounds their overall health statistics.

CONCLUSION

For these reasons, the CCTA believes EPA cannot authorize CARB's nonroad diesel engine regulations under section 209(e) (2) of the Clean Air Act because:

- The determination of California is arbitrary and capricious and;
- California does not need such California standards to meet compelling and extraordinary conditions.

Respectfully submitted

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Mortality Among Members of a Truck Driver Trade Association

by Jan Birdsey, MPH, Toni Alterman, PhD, Jia Li, MS, Martin R. Petersen, PhD, and John Sestito, JD, MS

RESEARCH ABSTRACT

Previous studies report that truck drivers are at increased risk for illness and on-the-job mortality. It is unknown whether owner-operator truck drivers face the same risks as employee drivers, yet few studies have targeted owner-operators as a study population. This study examined the overall and cause-specific mortality ratios for a cohort with owner-operator truck drivers constituting 69% of the study population. Of the 26 major disease classifications and 92 specific causes of death examined, only mortality due to transportation accidents was significantly elevated (standardized mortality ratio = 1.52, 95% confidence interval = 1.36-1.70). Leading causes of death were ischemic heart disease and lung cancer, although risk was below that of the general population. Transportation accidents pose a particular hazard for members of the trade association. The absence of excess disease mortality deserves careful interpretation, and may be due to both a strong healthy worker effect and a short monitoring period.

The safety and health of truck drivers is a topic of special interest both within the United States and abroad (Saltzman & Belzer, 2007). Previous research suggests that truck drivers are at increased risk for lung cancer (Garshick et al., 2008; Jarvholm & Silverman, 2003; Menvielle et al., 2003; Steenland, Deddens, & Stayner, 1998), prostate cancer (Jarvholm & Silverman, 2003), heart disease (Bigert et al., 2003; Laden, Hart, Smith, Davis, & Garshick, 2007; Leigh & Miller, 1998; Robinson & Burnett, 2005), hypertension (Koda et al., 2000; Korelitz et al., 1993; Sato, Taoda, Wakaba, Kitahara, & Nishiyama, 1999), stomach ulcers (Koda et al., 2000), bladder cancer (Boffetta & Silverman, 2001; Colt et al., 2004), and stomach cancer (Cocco, Ward, & Dosemeci, 1998). Truck drivers also face extraordinary risk of on-the-job mortality. In 2008, the fatality rate for "driver/sales workers and truck drivers" was 22.8 per 100,000 workers, compared with a rate of 3.6 per 100,000 for all workers (Bureau of Labor Statistics, 2008a), and drivers of heavy and tractor-trailer trucks had more fatalities (715 deaths) than any other single occupation (Bureau of Labor Statistics, 2008b).

Although truck drivers are at increased risk for specific diseases and on-the-job mortality, it is unknown whether drivers who own and operate their own trucks have the same risk as drivers who are company employees. Information with which to evaluate the health and safety of owner-operators is limited because (1) drivers who work independently or as contractors for larger companies are not included in the Bureau of Labor Statistics' Survey of Occupational Injuries and Illnesses, and (2) the

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Applying Research to Practice

Compared to the average worker, truck drivers are at high risk for on-the-job mortality. In addition, studies suggest that truck drivers are at increased risk for a variety of diseases, including cancer and heart disease. Members of the study cohort were more likely than the general U.S. population to die from transportation accidents. Ischemic heart disease and lung cancer were responsible for the greatest number of deaths among cohort members. Occupational health nurses can have a positive impact on the health of truck drivers by helping drivers reduce their risk of transportation accidents, lung cancer, and ischemic heart disease.

wide variety of possible work arrangements for owner-operators complicates the task of recruiting them into a study cohort.

This study examined the overall and cause-specific mortality for members of a trade association whose membership includes 69% owner-operators.

MATERIALS AND METHODS

Study Cohort

Electronic membership data were obtained for current and former members of a trade association that provides services to independent truck drivers. In addition to demographic information, the database provided the most recent occupation or type of business in which the member was engaged, although specific work history was not available. The study cohort included all individuals who were regular members of the association at any time between September 29, 1989, and December 31, 2004, and for whom year of birth was available (156,241 individuals).

These membership data were submitted to both the Social Security Administration and the National Death Index (NDI), as described by Buchanich, Dolan, Marsh, and Madrigano (2005). Review of mortality data was completed through December 31, 2004.

Techniques for Handling Missing Data

Missing data created analytical challenges. For example, the trade association did not collect information on race. In addition, approximately 75% of the records in the full membership data set were missing information on sex, 33% were missing Social Security number, and 5% were missing date of birth. To the extent possible, this information was obtained from the Social Security Administration under a confidential data-sharing agreement. This strategy reduced the percentage of records missing race to 23%, missing sex to 16%, missing Social Security number to 10%, and missing date of birth to 3%.

Because a large percentage of records were still missing information on race and sex, single imputation was employed to fill in the data gaps (Little & Rubin, 2002). To impute sex, data from the Current Population Survey (CPS) (Bureau of the Census, 2002), the 1990 U.S. Census (Bureau of the Census, 1995), and the NDI (2001) were used to estimate the probability of a member being male or female. The NDI and the 1990 Census data were used to calculate the proportion of men and women in the general population with each first name, and the CPS data were used to account for the majority of truck drivers being male. If an individual's first name did not appear in either the NDI or the Census data, then sex was not imputed and the individual was excluded from the analyses (1% of the cohort; Table 1).

A similar method of single imputation was used for records that were missing information on race/ethnicity. The surname data file derived from the 2000 Census (Bureau of the Census, 2007) provided the racial and ethnic distribution for 151,671 unique surnames (Word, Coleman, Nunziata, & Kominski, 2007). The likelihood that an individual would be assigned to a particular race/ethnic group was determined by the race/ethnicity distribution of the cohort member's surname. For the analyses, Hispanic and non-Hispanic White individuals were categorized as White, and all other races were categorized as non-White. If an individual's surname did not appear in the Census surname list, then race/ethnicity was not imputed and the individual was excluded from the analyses (2% of the cohort; Table 1).

Statistical Analyses

Standardized mortality ratios (SMRs) and 95% confidence intervals (CIs) were calculated using the Life Table Analysis System.Net (LTAS), a public-domain software package developed at the National Institute for Occupational Safety and Health (Robinson et al., 2006). LTAS calculates SMRs for a standard set of 26 major disease classifications and 92 specific causes of death. In addition, SMRs were calculated for all causes of death combined and all cancers combined. The data were stratified by age (5-year age groups), racial group (White and non-White), sex, and calendar period (5-year intervals). The LTAS software and technical documentation are available at www.cdc.gov/niosh/LTAS.

RESULTS

The study cohort was composed primarily of White men; 12% of the members were non-White, and 6% of the members were female (Table 1). Most members (69%) identified themselves as owner-operator truck drivers during their most recent contact with the trade association. Three percent of the cohort had died as of December 31, 2004.

Among the 26 major disease classifications, the three leading causes of death were cancer (n = 1,435; 33% of deaths), heart disease (n = 1,299; 30% of deaths), and accidents (n = 474; 11% of deaths) (Table 2). Among the 92 specific causes of death, the three leading causes of death were ischemic heart disease (n = 1,084; 25% of deaths), lung cancer (n = 557; 13% of deaths), and transportation accidents (n = 319; 7% of deaths) (Table 3).

The overall SMR was 0.76, indicating that the rate of death for the cohort was lower than that of the U.S. population (Table 2). Furthermore, the cohort did not have a statistically significant elevation in mortality for any of the 26 major disease classifications, although it did have significant deficits in mortality for several of them. Of particular note, mortality due to mental and psychiatric disorders was much lower than the general population (SMR = 0.30, 95% CI = 0.20-0.44), as was mortality due to diseases of the digestive system (SMR = 0.33, 95% CI = 0.27-0.40) and diseases of the genitourinary system (SMR = 0.38, 95% CI = 0.25-0.55) (Table 2).

Of the 92 specific causes of death examined, only mortality due to transportation accidents was significantly elevated among members of the trade association (SMR = 1.52, 95% CI = 1.36-1.70; Table 3).

Members of the cohort were less likely than the general population to die of ischemic heart disease (SMR = 0.91, 95% CI = 0.86-0.97; Table 3). The risk of death due to either liver disease or alcoholism was extremely low for members of the cohort, with SMRs of 0.25 (95% CI = 0.18-0.33) and 0.17 (95% CI = 0.08-0.32), respectively (Table 3).

Smoking-adjusted SMRs were generated using ordinary sensitivity analysis (Arah, Chiba, & Greenland, 2008) and smoking prevalence data from the 2000 National Health Interview Survey. Because truck drivers are more likely than the general population to be current or former smokers, SMRs for all smoking-related diseases were modestly depressed by the adjustment. However, because no smoking-related diseases were elevated in the cohort, the adjustment did not change the direction of the estimates.

Between the ages of 25 and 74, each 5-year age group had reduced mortality compared to the U.S. population. This demonstrated that the overall SMR did not obscure mortality differences among age groups (Table 4).

Table 1

Characteristics of Members of the Truck Driver Trade Association Study Cohort, 1989-2004

	N	%
Total	156,241	100
Gender		
Male	146,261	94
Female	9,099	6
Unknown[a]	881	1
Race		
White[b]	133,635	86
Non-White	18,945	12
Unknown[a]	3,661	2
Occupational category		
Owner-operator	107,286	69
Driver (not an owner-operator)	29,823	19
Non-driver	7,993	5
Unknown	11,139	7
Vital status		
Living	151,791	97
Deceased	4,450	3
Age at cohort entry (years)		
< 25	4,022	3
25-34	33,535	21
35-44	56,383	36
45-54	45,238	29
55-64	14,672	9
> 64	2,391	2
Years of follow-up		
< 5	64,450	41
5-9	41,970	27
> 9	49,821	32

Note. [a]*After imputation completed; excluded from analyses.* [b]*Includes Hispanic and non-Hispanic individuals.*

DISCUSSION

For this cohort, composed primarily of owner-operator truck drivers, overall mortality was lower than that of the general U.S. population. Of the 92 specific causes of death examined, only one had a statistically significant elevation—transportation accidents. It is not surprising that the SMR for transportation accidents was elevated in this cohort, given that truck drivers can spend as much as 11 hours behind the wheel each day (Federal Motor Carrier Safety Administration, 2008). In 2008, transportation incidents were responsible for 78% of the occupational fatalities among truck drivers (Bureau of Labor Statistics, 2008b).

Mortality was not increased for any of the health conditions previously shown to be elevated among truck drivers (Bigert et al., 2003; Boffetta & Silverman, 2001; Cocco et al., 1998; Colt et al., 2004; Garshick et al., 2008; Jarvholm & Silverman, 2003; Koda et al., 2000; Korelitz et al., 1993; Laden et al., 2007; Leigh & Miller, 1998; Menvielle et al., 2003; Robinson & Burnett, 2005; Sato et al., 1999; Steenland et al., 1998), although the lack of statistically significant estimates for cancers of the stomach, bladder, and prostate indicates that excess mortality from these causes cannot be totally eliminated (Table 3). A small but statistically significant deficit in mortality due to ischemic heart disease was found.

Although not elevated compared with the general population, ischemic heart disease and lung cancer were responsible for the greatest numbers of deaths in this group. The trade association conducted a survey of its members in 2001. Based on these unpublished data, three risk factors for lung cancer and heart disease are of

Table 2

Observed Deaths, Standardized Mortality Ratios, and 95% Confidence Intervals by Major Cause Among Members of the Truck Driver Trade Association Study Cohort, 1989-2004

Major Disease Classification	*Observed Deaths*	*SMR*	*95% CI*
All causes	4,368	0.76	0.74-0.78
All cancers	1,435	0.88	0.84-0.93
Buccal and pharynx	21	0.52	0.32-0.80
Digestive and peritoneum	359	0.86	0.78-0.96
Respiratory system	567	0.98	0.90-1.06
Breast	7	0.47	0.19-0.96
Female genital organs	6	0.86	0.31-1.87
Male genital organs	63	0.87	0.67-1.12
Urinary	84	1.03	0.82-1.27
Other and unspecified site	176	0.70	0.60-0.81
Lymphatic and hematopoietic	152	0.94	0.80-1.10
Benign and unspecified neoplasms	14	0.74	0.40-1.23
Tuberculosis	0	0.00	0.00-1.07
Diabetes mellitus	96	0.57	0.46-0.70
Diseases of the blood and blood-forming organs	14	0.70	0.38-1.17
Mental and psychiatric disorders	26	0.30	0.20-0.44
Nervous system disorders	49	0.49	0.36-0.65
Diseases of the heart	1,299	0.85	0.81-0.90
Other diseases of the circulatory system	256	0.76	0.67-0.86
Diseases of the respiratory system	180	0.54	0.46-0.62
Diseases of the digestive system	99	0.33	0.27-0.40
Diseases of the genitourinary system	26	0.38	0.25-0.55
Diseases of the skin and subcutaneous tissue	3	0.68	0.14-1.99
Diseases of the musculoskeletal and connective tissue	9	0.55	0.25-1.05
Symptoms and ill-defined conditions	43	0.54	0.39-0.73
Accidents	474	1.05	0.96-1.15
Violence	202	0.71	0.62-0.82
Other and unspecified causes	143	0.42	0.35-0.49

Note. *Compared to the general U.S. population for the same time period. SMR = standardized mortality ratio; CI = confidence interval.*

particular concern for this cohort; smoking, obesity, and airborne particulate matter.

Smoking is a known risk factor for both lung cancer and heart disease (U.S. Department of Health and Human Services, 2004). According to the trade association's data, approximately 35.1% of members were current smokers of cigarettes, pipes, or cigars in 2001. This is similar to data from the National Health Interview Survey showing a prevalence of 34.8% for cigarette smoking among motor vehicle operators in 2000. In comparison, the prevalence of cigarette smoking for all workers 18 years and older was 25% (National Institute for Occupational Safety and Health, 2003).

Obesity and its consequences (e.g., hypertension and diabetes) are also risk factors for heart disease (Libby & Braunwald, 2008). Approximately 43.5% of members who responded to the trade association's 2001 survey were obese. This finding is somewhat lower than the results of a recent study of unionized truck drivers, which reported an obesity prevalence of 49.8% (Federal Motor

Table 3

Observed Deaths, Standardized Mortality Ratios, and 95% Confidence Intervals for Select Specific Causes of Death Among Members of the Truck Driver Trade Association Study Cohort, 1989-2004

Specific Cause of Death	*Observed Deaths*	*SMR*	*95% CI*
Cancer			
Pharynx	12	0.56	0.29-0.98
Stomach	33	0.79	0.54-1.11
Intestine	132	1.04	0.87-1.23
Bladder and other urinary	29	0.93	0.62-1.34
Biliary, liver, gallbladder	43	0.72	0.52-0.97
Trachea, bronchus, lung	557	1.00	0.92-1.09
Prostate	61	0.90	0.69-1.16
Kidney	55	1.08	0.82-1.41
Skin	30	0.64	0.43-0.92
Brain and other nervous system	45	0.76	0.56-1.02
Non-Hodgkin's lymphoma	66	0.93	0.72-1.18
Leukemia	54	0.94	0.71-1.23
Alcoholism	10	0.17	0.08-0.32
Ischemic heart disease	1,084	0.91	0.86-0.97
Other heart disease	153	0.64	0.54-0.75
Cerebrovascular disease	140	0.70	0.59-0.83
Pneumonia	33	0.43	0.30-0.61
Chronic obstructive pulmonary disease	109	0.59	0.48-0.71
Pneumoconiosis and other respiratory disease	33	0.54	0.37-0.76
Cirrhosis and other chronic liver disease	45	0.25	0.18-0.33
Nephritis and renal failure	17	0.37	0.21-0.59
Transportation accidents	319	1.52	1.36-1.70
Accidental poisoning	37	0.42	0.30-0.58
Accidental falls	19	0.55	0.33-0.86
Suicide	166	0.82	0.70-0.95
Homicide	36	0.48	0.34-0.67

Note. *Compared to the general U.S. population for the same time period. SMR = standardized mortality ratio; CI = confidence interval.*

Carrier Safety Administration, 2006). In comparison, the national prevalence of obesity among adults 20 years or older was 33.9% in 2007-2008 (Flegal, Carroll, Ogden, & Curtin, 2010).

Finally, exposure to airborne particulate matter is associated with both lung cancer (Valavanidis, Fiotakis, & Vlachogianni, 2008) and heart disease (Araujo & Nel, 2009; Valavanidis et al., 2008). Truck drivers are exposed to high levels of particulate matter ($PM_{2.5}$) when they sit or sleep in the truck while it is parked and idling (Fu, Calcagno, & Davis, 2010), a potentially common occurrence given that only 21% of drivers indicated they stayed in motels when making deliveries that took more than 1 day (unpublished trade association data). Interventions that reduce smoking, obesity, and exposure to environmental particulate matter may benefit the truck driver population.

Healthy Worker Effect

Using the general U.S. population as the referent population has the advantage of providing stable mortality estimates. However, it has the disadvantage of poten-

Table 4

Observed Deaths, All-Cause Standardized Mortality Ratios, and 95% Confidence Intervals by Age Group Among Members of the Truck Driver Trade Association Study Cohort, 1989-2004

Age Group (years)	Observed Deaths	SMR	95% CI
20-24	1	0.13	0.00-0.71
25-29	28	0.60	0.40-0.87
30-34	103	0.81	0.66-0.98
35-39	173	0.67	0.57-0.78
40-44	321	0.73	0.65-0.81
45-49	461	0.70	0.64-0.77
50-54	623	0.73	0.68-0.79
55-59	767	0.74	0.68-0.79
60-64	794	0.78	0.73-0.84
65-69	565	0.80	0.74-0.87
70-74	338	0.85	0.76-0.94
75-79	152	0.99	0.84-1.16
80-84	33	0.78	0.53-1.09
85+	9	0.61	0.28-1.15

Note. *Compared to the general U.S. population for the same time period. SMR = standardized mortality ratio; CI = confidence interval.*

tially masking occupational risks because workers are usually healthier than the general population. Workers must maintain a certain level of health to perform their jobs; the general population includes individuals with health-related conditions that render them unemployable. Known as the healthy worker effect (HWE) (Pearce, Checkoway, & Kriebel, 2007), this phenomenon might exert a particularly strong effect among truck drivers, given that drivers must pass regular physical examinations to renew their commercial driver's licenses.

Although the HWE suppresses SMRs among the actively employed, it may not suppress SMRs equally for each specific cause of death; the less a given health condition is associated with employment status, the less impact from the HWE. Furthermore, the HWE may vary by the occupation studied. For example, strict federal regulations regarding alcohol use by truck drivers may be partially responsible for the low risk of alcoholism-related death in this cohort (Commercial Driver's License Standards, 2009; Driving of Commercial Motor Vehicles, 2009).

The HWE may explain why few published studies report elevated disease mortality among truck drivers when compared to the general population. One exception is a study by Laden et al. (2007), which estimated SMRs using a methodology similar to this study. Although the study cohort of unionized workers also had deficits for most causes of death, researchers did observe elevated mortality due to ischemic heart disease among long-haul truck drivers (SMR = 1.49, 95% CI = 1.40-1.59), in contrast to a small deficit of mortality due to ischemic heart disease in this study cohort (SMR = 0.91, 95% CI = 0.86-0.97).

Ischemic heart disease mortality may differ between the two studies for several reasons. One explanation could be differences in monitoring time; in the Laden et al. (2007) study, the entire cohort was followed for 16 years (1985 through 2000), whereas 41% of the trade association cohort was followed for less than 5 years (Table 1). Additionally, Laden et al. (2007) calculated occupation-specific SMRs, which was not possible for the trade association cohort. Finally, differences in calendar years for the two studies may have resulted in significantly different levels of exposure to harmful substances for each cohort, due to changes in either industry practices or the formulation of diesel fuel.

Limitations

The data used for these analyses were not originally collected for research purposes. Therefore, information that would have been valuable to the analyses either was missing or had unsuitable categories. For example, occupation-specific SMRs are not presented because 11,139 records either had missing occupational categories or did not indicate if the member was a driver (Table 1). To avoid misrepresenting the data by either excluding these records from the analyses or arbitrarily categorizing them as drivers, the researchers calculated SMRs for all members combined. The missing occupational categories also prevented the researchers from conducting internal analyses.

The data also lacked information on several factors that are recognized as potential confounders (Checkoway, Pearce, & Crawford-Brown, 1989), including whether members were actively working, the age at which they started driving trucks, and the duration of their employment as truck drivers. As of July 25, 2005, 46% of the study cohort were no longer active members of the trade association. Although active members were likely to have been employed in the trucking industry during their entire study period, the employment status of former members was unknown.

Single imputation was used to create missing race and sex information within the data set. Although the researchers felt this approach was superior to excluding the incomplete records from analysis, imputing each missing value only once could have resulted in CIs that were too narrow, meaning the standard error was underestimated (Donders, van der Heijden, Stijnen, & Moons, 2006). Multiple imputation generally provides standard errors that properly reflect the uncertainty of missing data. However, multiple imputation was problematic for these analyses; multiple imputation would have required use of normal approximation to construct CIs, whereas the exact method was more appropriate for rare causes of death.

To ascertain the effect single imputation had on these results, the researchers performed two additional analyses: estimating the SMRs and 95% CIs with the incomplete observations excluded, and calculating coefficients of variation for SMRs from five imputed data sets.

Each analysis method yielded similar results. Compared to single imputation, excluding the incomplete observations resulted in minor differences in the SMR estimates, and only three causes of death changed significance levels. The SMRs for liver cancer and breast cancer became nonsignificant, whereas the SMR for brain cancer became significantly depressed (SMR = 0.67, 95% CI = 0.46-0.94).

Multiple imputation also had very little impact on the results. The largest coefficient of variation was only 0.27% (cancer of the female genital organs; Table 2), and for the overall SMR it was only 0.02%.

CONCLUSION

This study presents the first characterization of mortality in a cohort primarily composed of owner-operator truck drivers. With a median follow-up period of 6 years, overall mortality and most cause-specific mortality were lower than expected when compared with the U.S. population. HWE may be strong in this population, given that a high percentage of individuals are likely to be actively working in a profession with stringent health requirements. The researchers expect HWE to diminish in this cohort over time, and will reanalyze the data in the future with additional monitoring.

Only death due to transportation accidents was significantly elevated; however, the numbers of deaths due to ischemic heart disease and lung cancer were high. Occupational health nurses can have a positive impact on the health of truck drivers by assisting them to reduce their risk for these three causes of death.

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