

The Association between Low Back Pain and Fatigue among Commercial Drivers

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Abstract

Objective: To examine the association between low back pain and fatigue among commercial drivers.

Methods: A self-selected group of 90 current commercial drivers from 3 locations participated in an anonymous survey. Low back pain was assessed by the Oswestry Disability Index (ODI). Fatigue was measured by the Brief Fatigue Inventory. Multiple linear regression (MLR) was used to quantify the association between LBP and fatigue.

Results: MLR showed that increased level of low back pain is a significant predictor of increased fatigue when adjusted for age, gender, BMI, job satisfaction, years and miles driven ($p < 0.001$).

Conclusion: These results confirm the existence of a significant association between back pain and fatigue in this population. This suggests that addressing the causes of back pain among drivers could reduce their level of fatigue and thereby promote improved highway safety.

Keywords: Fatigue; Low back pain; Bus/truck commercial drivers

Introduction

Highway safety is an important public health issue. In 2009, according to the National Highway Traffic Safety Administration, there were 30,797 fatal motor vehicle crashes and these accounted for 33,808 deaths. The estimated cost of these crashes was \$230.6 billion [1]. In 2004, motor vehicle traffic crashes were the leading cause of death for every age. Because of the young lives consumed, motor vehicle traffic crashes ranked third overall in terms of the years of life lost, i.e., the number of remaining years that the person would be expected to live had they not died, behind only cancer and heart disease [2]. Commercial drivers are an important component of highway safety. Large trucks accounted for 3,215 or 7 per cent of the vehicles involved in fatal crashes, and 73% of these were combination trucks [1].

Fatigue has been shown to negatively impact driver safety [3,4]. Many factors contribute to driver fatigue. There are numerous studies implicating excessive sleepiness as a risk factor for traffic accidents. Documented causes for driving while fatigued in other studies include excessive work hours [5,6], unrealistic delivery schedules [7], lack of physical activity, high rates of obesity [8], and associated sleep apnea [9-11].

One of the most common medical complaints among commercial drivers is low back pain. Back pain is 2 to 4 times more common in commercial drivers than it is in the general population [12]. Causes of this back pain include extended hours in a seated position, awkward posture, exposure to whole body vibration, lifting and carrying associated with materials handling [12], and improperly fitting or uncomfortable seat position [13]. Whole body vibration has been extensively studied as a cause of low back pain in truck drivers [14-16]. European drivers have laws specifically limiting the duration and intensity of their exposure to whole body vibration [17], but there are no similar restrictions for drivers in the US. A relevant study from 1987 analyzed the mood states and fatigue of patients with episodic low back pain. They found that mood states did not predict the onset of pain, but fatigue followed the onset of pain by about 24 hours. So, according to their work, low back pain was a predictor of fatigue [18].

Methods

Design

This cross-sectional study summarizes the responses of 90 commercial drivers who were given a survey between August and October 2011. Subjects were volunteers who were recruited either at their work place or while waiting for their DOT physical examination. Drivers were asked as they signed in at the reception desk whether they would volunteer to participate. They completed a survey which consisted of 52 questions, including demographic information, information regarding type, duration and frequency of their driving activity, the Oswestry Disability Index (ODI) and the Brief Fatigue Inventory (BFI).

The process of collecting the surveys was structured so that each subject received a consent form, after which he or she had the opportunity to answer the questions addressed in the survey. After completion, the survey was placed into an attached envelope, sealed and deposited into a box at the reception desk. The survey was therefore anonymous. The principal investigator collected the surveys at the end of each week. This study was approved by the Loma Linda University Institutional Review Board.

Study sample

Subjects included in this study are adult men and women currently working as commercial drivers, who are willing to participate in the study and are age 18-65 years old. Drivers excluded are those less than

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Received November 20, 2012; Accepted January 30, 2013; Published February 02, 2013

Citation: Christensen A, Petersen F, Soret S, Spencer-Hwang R (2013) The Association between Low Back Pain and Fatigue among Commercial Drivers. *Occup Med Health Aff* 1: 101. doi:10.4172/2329-6879.1000101

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18 years or above 65 years of age, pregnant, or who have been diagnosed with ankylosing spondylitis, Reiter's syndrome, psoriasis, infection, inflammation, malignancy, fibromyalgia, or chronic fatigue syndrome.

The subjects were recruited from three different sources. Twenty-three drivers were employed as bus drivers by OmniTrans, a public transportation agency in San Bernardino County, California. Forty-four drivers were recruited at Fox Occupational Medicine Clinic in San Bernardino, which is a clinic serving commercial drivers who are receiving their biannual Department of Transportation (DOT) physical examination. The final group of twenty-three drivers were recruited at P and S (Parts and Service) in San Bernardino where commercial drivers stop to have service performed on their trucks. No compensation was paid to subjects for their participation in the study.

Measures

The Oswestry Disability index was initially published in 1980 in the journal *Physiotherapy*, and it has been widely used as a convenient and validated measure of spine-related disability. As of 2000, the index has been published in at least four formats in English and in nine other languages. It has been validated on both normal populations, and on groups of patients with specific spinal diseases, and serial administrations of the index questionnaire are sensitive to clinical improvement or decline [19]. The version of the test that we included in our study contained 9 items, each with a value from 0 to 5. The responses were then added together and expressed as a percentage of the highest possible score, resulting in a numeric scale between 0 and 100.

The Brief Fatigue Inventory is also a widely used assessment tool. It is copyrighted by the University of Texas MD Anderson Cancer Center, and is used in this study by permission of the author. It was initially developed for grading the severity of fatigue related symptoms in cancer patients, and has been validated on that population. It is specifically designed to evaluate the severity of fatigue and the impact of fatigue on daily functioning within the past 24 hours [20]. The BFI is a visual analog scale with 8 items. Each item is graded on a scale of 1-10, and the total score is the sum of the items, resulting in a numeric scale from 0 to 80.

Analyses

Potential sources of fatigue were analyzed using multiple linear regressions (MLR). The regression model was adjusted for age, gender, miles driven, ethnicity, BMI and level of job satisfaction. A result was considered statistically significant where $p < 0.05$. All analyses were conducted using SPSS 20.0 (SPSS Inc., Chicago, IL).

Variable	Mean ± SD (min-max) or N (%)
Age	42.9 ± 11.5 (24-70), (3 missing)
Gender	Male: 61 (72.6) Female: 23 (27.4)
Weight	211.2 ± 45.2 (115-347), (1 missing)
Height (inches)	67.3 ± 4.8 (52-75), (2 missing)
BMI	32.9 ± 7.4 (21-53)
Ethnicity	Hispanic: 21 (25.0) Non-Hispanic: 59 (70.2) (4 missing)
Race	Caucasian: 44 (52.4) African-American: 17 (20.2) Asian or Pacific Islander: 3 (3.6) Other: 6 (7.1) (14 missing; 16.7%)

Table 1a: Characteristics of study population.

Variable	Mean ± SD (min-max) or N (%)
Year of Driving Commercially	13.74 ± 10.0 (1-50)
Type of Vehicle Most Often Driven Commercially	Bus: 29 (34.5) Large truck (with trailer): 38 (45.2) Small truck: 16 (19.0) Other: 1 (1.2)
Average number of Days Driven Each Week	5.1 ± 0.9 (0-6)
Average Miles/Week Driven Commercially	1220 ± 1051 (0-4, 500) (11 missing)
Rate of Job Satisfaction	Poor: 3 (3.6) Good: 59 (70.2) Great: 20 (23.8) (3 missing)
While at work performance of the following	Lifting: 67 (79.8) Pushing: 55 (65.5) Pulling: 56 (66.7)

Table 1b: Characteristics of study population driving history.

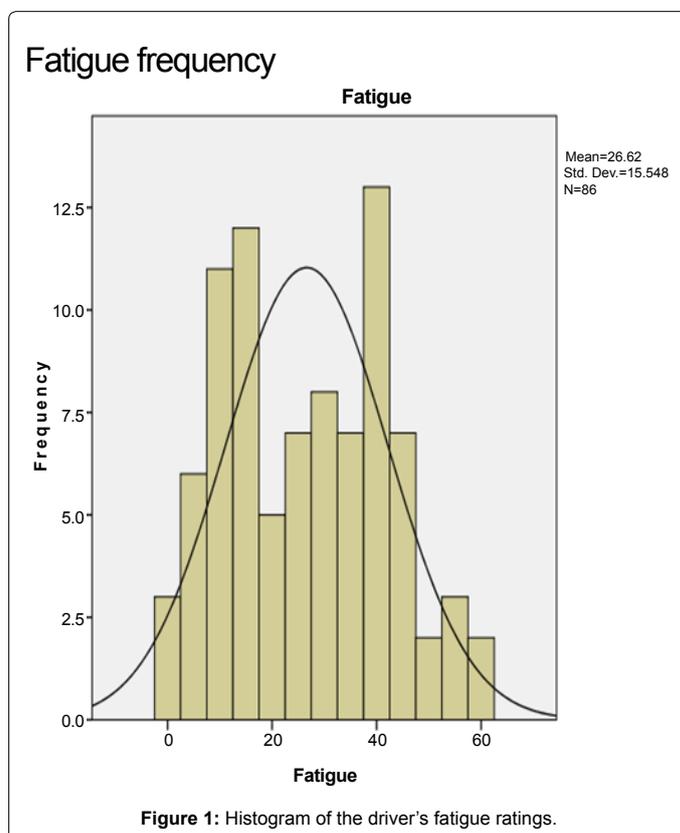


Figure 1: Histogram of the driver's fatigue ratings.

Results

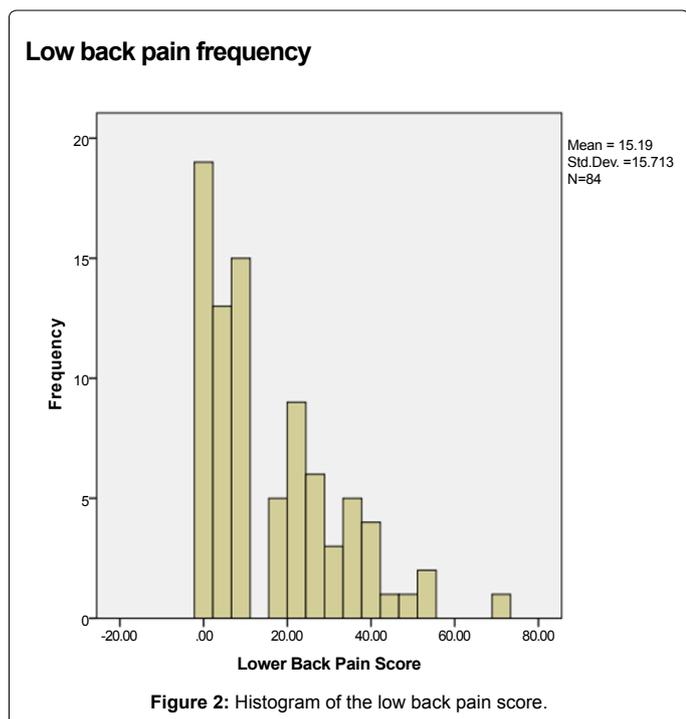
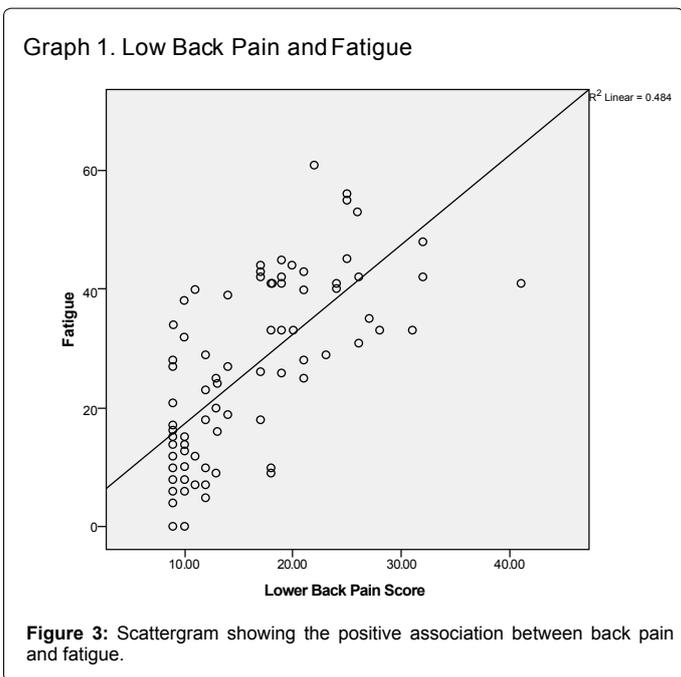
Descriptive statistics presented in tables 1a and 1b, show the participants in this study were predominantly middle-aged (mean=42 years), males (72.6%). Their mean BMI was 32.9, which places them in the obese category. The sample represent a wide range of driving experience (1-50 years, mean=13.7 years). The distance driven per week varied from 0 to 4500 miles (mean=1051 miles). The majority of these drivers were satisfied with their job, with only 3 rating their job satisfaction as poor.

Figure 1 is a histogram of the driver's fatigue ratings (mean=26.6), which exhibit a bimodal distribution. Figure 2 is a histogram of the Low

Back Pain score (mean=15.2), which is skewed to the right. Notable is that 65.5% of the drivers said that they did not experience their lower back pain while driving. This is consistent with our observation that the majority of the drivers had back pain ratings from none to mild. Table 2 shows the results of the full linear regression model. Low back pain ($p < 0.001$) and female gender ($p = 0.043$) were the only significant predictors of LBP. A reduced model which included years driving, gender and LBP score yielded virtually the same results. Figure 3 is a scattergram showing the positive association between back pain and fatigue ($r^2 = 0.48$). The full model yielded a total $r^2 = 0.56$.

Discussion

The results of this survey indicate that there is a strong association ($p < .0001$) between the degree of back pain and the level of fatigue reported by the drivers in this study. It is interesting to note that most of the subjects reported little or no back pain, and there were no drivers whose pain fell into the severe category. This is not unexpected, since all of our subjects were still working and none were bedridden or completely disabled. There were many drivers who continue working despite significant levels of back pain, and those are the drivers who also reported high levels of fatigue. This is especially concerning because of the documented negative impact of fatigue on driver safety. The fact that drivers will continue working despite back pain and discomfort



suggests that more research into the causes and treatment of back pain along with efforts to incorporate that understanding into the design of driving positions and the training of drivers could be helpful in the ongoing effort to reduce highway mortality.

The authors recognize that there are significant limitations to this study. The number of participants was relatively small, with only ninety subjects. The subjects were self-selected volunteers, so there may be some selection bias in favor of drivers who have back pain. Further, the instruments used to quantify the degree of disability and the severity of fatigue have not been used in this specific context before, so there may be legitimate questions about their applicability. Despite these limitations, the results show a clear association between back pain and fatigue, which deserves more rigorous examination. Additional research suggested by these findings would be a larger study, perhaps with randomized recruitment and a prospective design, which could also include an objective measure of spine-related disability along with the subjective reports of pain. Such a design would also permit comparison of actual accident and fatality rates between groups of drivers with and without complaints of back pain. Additional work could also be done to characterize the mechanism or mechanisms producing the back pain and suggest beneficial interventions.

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Variable	B	SE	p
LB pain score	0.564	0.090	<0.001
Age	-0.085	0.135	0.530
Gender (Female)	8.15	3.94	0.043
Ethnicity	-4.29	3.24	0.191
Years Driving	0.271	0.17	0.120
Miles/Week	0.001	0.001	0.370
Job satisfaction	-5.14	3.46	0.142
BMI	0.050	0.190	0.794
Total R ² =0.540			

Table 2: Linear Regression Model Predicting Fatigue.

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