Cardiovascular Risk Factors of Taxi Drivers

Rami Azmi Elshatarat and Barbara J. Burgel

ABSTRACT *In the United States (U.S.), cardiovascular disease (CVD) is a major leading cause of death. Despite the high mortality rate related to CVD, little is known about CVD risk factors among urban taxi drivers in the U.S. A cross-sectional design was used to identify the predictors of high cardiovascular risk factors among taxi drivers. Convenience sampling method was used to recruit 130 taxi drivers. A structured questionnaire was used to obtain the data. The sample was male (94 %), age mean (45 ± 10.75) years, married (54 %), born outside of the USA (55 %), had some college or below (61.5 %), night drivers (50.8 %), and driving on average 9.7 years and 41 h/week. About 79 % of them were eligible for CVD prevention, and 35.4 % had high CVD risk factors (4–9 risk factors). A CVD high-risk profile had a significant relationship with the subjects who were ≥ 55 years old; had hypertension, diabetes, or hyperlipidemia; were drinking alcohol ≥ 2 times/week; and had insufficient physical activity. Subjects who worked as a taxi driver for more than 10 years (OR 4.37; 95 % CI 1.82, 10.50) and had mental exertion from cab driving > 5 out of 10 (OR 2.63; 95 % CI 1.05, 6.57) were more likely to have a CVD high-risk profile. As a conclusion, system-level or worksite interventions include offering healthy food at taxi dispatching locations, creating a work culture of frequent walking breaks, and interventions focusing on smoking, physical activity, and weight management. Improving health insurance coverage for this group of workers is recommended.*

KEYWORDS *Cardiovascular disease, Risk factors, Urban taxi drivers, San Francisco drivers, Occupational health, Health promotion*

INTRODUCTION

In the United States (U.S.), cardiovascular disease (CVD) is a major leading cause of death for both genders and for people from different ethnicities, including African Americans, Hispanics, and Whites.^{1,2} Annually, more than 500,000 people die from CVD, which accounts for 25 % of all U.S. deaths.² Coronary artery disease is the most common type of CVD-related deaths, with 380,000 people dying annually.^{1,3} Coronary artery disease costs the U.S. approximately \$109 billion annually for treatment, health care services, and lost productivity.³

About half of people (47 %) with sudden death from cardiac events died outside the hospital and without early warning signs.⁴ Therefore, identifying individuals at higher risk for CVD is important to prevent CVD morbidity and mortality. Hypertension, elevated low density lipoprotein (LDL) cholesterol, and smoking are the major CVD risk factors, where half of Americans have one or more of these three CVD risk factors.⁵ Moreover,

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diabetes mellitus, unhealthy diet, obesity, physical inactivity, and alcohol use are additional risk factors for CVD.^{6,7} These risk factors are modifiable at the individual level through behavior and lifestyle modification.⁶⁻⁸ Individuals may choose to change their lifestyle to decrease their risk of CVD.^{9,10} Similarly, system-level interventions at the worksite and in the community are powerful ways to modify the risk profiles of populations. For example, using peer influences to provide social support at work, combined with an organizational culture of health, may be effective at reducing CVD risk factors such as smoking.¹¹ Using decision alert systems as reminders to include clinical prevention services during health care visits is another example of an effective system-level intervention.^{11,12} Smoke-free worksites, easier access to healthy foods, and a safe environment for physical activity are all examples of population-level CVD interventions.^{11,13-15} Addressing and control of these CVD risk factors are recommended, particularly for individuals who have non-modifiable risk factors, such as age and a family history of CVD.^{6,10}

Many investigators report that the prevalence of CVD is higher among occupational drivers than other occupations such as office workers and industrial workers.^{16,17} Moreover, many epidemiological studies show a significant relationship between occupational taxi driving and CVD including ischemic heart disease and cardiac arrhythmia.¹⁸⁻²² There are many etiological factors which may contribute to CVD among taxi drivers. Taxi drivers are commonly exposed to many unhealthy working conditions such as long hours, irregular shift work, sleep disturbances, stressful conditions, and unpredictable and harmful exposures to environmental pollution.²³⁻²⁶ Drivers may experience prolonged sitting and physical inactivity, with limited access to healthy foods.^{17,27,28} These conditions are major etiological factors for developing CVD; for example, eating an unhealthy diet and physical inactivity can cause hypertension, diabetes mellitus, and obesity.^{17,22} Also, long-term exposure to environmental pollutants increases the probability to develop atherosclerosis and ischemic heart disease.^{24,26,29} Therefore, identifying high-risk factors of CVD among occupational drivers is very important for early detection and prevention of CVD.^{17,22,30}

Two recent studies have explored CVD risks in U.S. taxi drivers.^{13,17} Apantaku-Onayemi et al. (2012) reported that 24 % of their sample ($n=751$ taxi drivers in Chicago) were current smokers, only 5.9 % exercised more than five times/week for at least 30 min/day, and only 4.6 % of drivers ate the recommended five servings of fruits and vegetables/day. Furthermore, 23.5 % of the sample reported that their "blood pressures were high."¹⁷ Gany et al. (2015) explored CVD risk factors in 413 New York taxi drivers. Fourteen percent of this sample were current smokers, 77.4 % were found to have a body mass index (BMI) ≥ 25 , and 52 % were found to have blood pressure readings over 140/90 mmHg, with 28 % reporting a history of hypertension.¹³ In their multivariate analysis, immigrant drivers who had lived ten or more years in the U.S. were more than twice as likely to have elevated blood pressure readings, after controlling for years driving a taxi, age, region of birth, marital status, health insurance, having a primary care provider, and exercise status.¹³

Despite known risk factors for CVD among occupational drivers and the high mortality rate caused by CVD in the U. S., more needs to be known about the CVD risk profile among urban taxi drivers in the U.S.^{13,17}, exploring specifically those modifiable work-related factors that may contribute to a CVD high-risk profile. This gap of knowledge about CVD work-related risk factors among taxi drivers¹⁷ is a major barrier to fully understanding the health status of taxi drivers. Health care providers need baseline information about the CVD risk profile among occupational

drivers to implement successful strategies to prevent CVD morbidity and mortality.¹⁷ Data describing taxi drivers' demographic characteristics, working conditions, and risk factors for CVD, with an understanding of factors associated with a CVD high-risk profile are needed.¹⁷ Once known, developing system-level interventions and health programs to prevent occupational drivers from CVD can be established.

Research Aims

This study aims to describe risk factors for CVD among taxi drivers. The specific objectives of this study of a sample of urban taxi drivers are to (1) describe their demographical data, (2) identify their work characteristics, (3) describe their risk factors for CVD, (4) describe their health characteristics and medical insurance, (5) describe the association between their data and high-risk factors for CVD, and (6) identify the predictors of a CVD high-risk profile.

METHODS

The taxi driver health and safety study used mixed methods, including focus groups conducted in 2009,²⁸ with a cross-sectional study with personal interviews of 130 drivers conducted in 2010. This was a non-probability convenience sample from a population of approximately 7000 taxi drivers currently working in San Francisco, driving a minimum of 20 h/week. Recruitment letters were sent to all taxi companies ($n=34$), asking owners to post flyers about the study. Taxi drivers were recruited through personal outreach at various dispatch lots, the airport holding lot, and through word of mouth. This study was approved by the University of California, San Francisco Committee on Human Research; written consent was obtained at the time of their interview, and drivers received compensation for their time.

For this study analysis, approximately ten pages of a survey tool, developed by the co-author, assessed subjects work-related information, health conditions, and CVD risk factors. This survey tool was generated and pre-tested, in part, from prior focus group work by the research team.²⁸ Researchers used survey tool in one-to-one interviews. Interviews were conducted in a range of the settings, including private rooms at a community agency or the university library, and less commonly in a taxi cab at the airport holding lot. Socio-demographic variables used in this study included gender, age, marital status (married/partnered vs. all others), education (associate degree or higher vs. all others), country of birth (USA born vs. all others), primary language spoken at home, and years living in the USA (if born outside the USA).

Work variables included years worked as a taxi driver, shift (day vs. night), hours worked in the prior week, miles driven per week, whether they earned sufficient income to support their family through their taxi work alone, and if they held other paid employment (in addition to driving a taxi), and hours worked at this second job. Drivers who drove a mixed schedule were classified as day vs. night if the majority of their shifts were day or night. Day hours typically began at 4 AM up until 4 PM; night shift hours typically began at 4 PM and extended up to 4 AM.

Cardiovascular risk factors included age (in decades); past and present medical history (ever diagnosed by a doctor or nurse with heart disease, hypertension, diabetes, hyperlipidemia, or depression); a family history of heart disease, hypertension, diabetes, or stroke; current smoking (and number of cigarettes smoked/day); alcohol consumption (number of times/week); physical activity or exercise, including asking about moderate and vigorous exercise for at least 10 min/

activity and number of times per week [item used from the Centers for Disease Control Behavioral Risk Factor Surveillance System (2009)];³¹ and nutritional factors (eating at least five cups of fruits/vegetables each day (yes-no), or drinking more than three caffeinated beverages per day (yes-no). Physiological measurements included three blood pressure readings with pulse as measured using a digital blood pressure cuff (Omron). Height was self-reported, and weight was measured using a digital scale. Blood pressure readings were averaged and categorized into normal, pre-hypertension, stage 1 and stage 2 hypertension per the Joint National Commission VII, and most recently revalidated by the American Heart Association in 2013.³²

Other health factors included the drivers perception of their general health status (very good/excellent, good, or fair/poor), if they had health insurance, if they had a regular health care provider/doctor for health care, how many visits in the prior 12 months, if they sought care for emotional or mental distress in the prior 12 months, how they rated fatigue, physical and mental exertion from taxi driving (range from 0 to 10), and if they were currently taking medications for hypertension, elevated cholesterol, or diabetes. Body mass index was calculated, and categorized as normal, overweight ($BMI \geq 25$ – 29.99), and obese ($BMI \geq 30$).

Nine factors were explored to determine CVD risk profile, including age (≥ 55 year of age), past and present medical history (answering yes to any one of these conditions: hypertension, diabetes, or hyperlipidemia), family history of CVD (answering yes to any one of these conditions: heart disease, hypertension, or stroke), tobacco use (current smoking), drinking alcohol (≥ 2 times/week), physical activity/exercise (no regular exercise), and a body mass index ≥ 25 . Drivers with a CVD high-risk profile included any driver with more than three risk factors. Chi squares were conducted to determine if there were significant differences in these nine factors between these two groups. Additionally, those who were considered eligible for CVD prevention included anyone who had a $BMI \geq 25$ and who reported being told by a doctor or a nurse that they had hypertension, hyperlipidemia, or diabetes (Omura et al., 2015).

All socio-demographic, work, and health variables were also compared by CVD risk profile to determine if there were significant differences. Chi square analysis was conducted to examine the relationship between subjects' data and cardiovascular risk groups. A logistic regression analysis was conducted exploring which socio-demographic and work factors maintained their association with CVD high-risk profile, including in the model those socio-demographic, work, and health variables which were significant in the univariate analysis at a p value of <0.05 . Data were analyzed using SPSS, version 20.

RESULTS

Driver Demographics and Working Conditions

A total of 130 urban taxi drivers were recruited. Table 1 shows subject demographic data and work characteristics. Most of the subjects were male (93.8 %), married (53.8 %), had completed some college (not graduated) or had a lower level of education (61.5 %), born outside of the United States of America (55.4 %), spoke English language at home (45.4 %), were White race (39.8 %), and were middle-aged (45.3 years).

About half of the subjects (50.8 %) worked night shift. Less than half of the subjects (48.5 %) reported that their income was sufficient from cab driving alone,

TABLE 1 Demographical data and work characteristics

Demographical data	<i>n</i> (%)	
Gender		
Male	122	(93.8)
Marital status		
Married or partnered	70	(53.8)
Other	60	(46.2)
Education		
≤Some college (not graduated)	80	(61.5)
≥Associate degree or higher	50	(38.5)
Place of birth		
United States of America (USA)	58	(44.6)
Outside of the USA	72	(55.4)
The primary language spoken at home		
English	59	(45.4)
Spanish	5	(3.8)
Arabic	31	(23.8)
Others	35	(26.9)
Latino or Hispanic	11	(8.5)
Race		
White	51	(39.8)
Black/African American	9	(7.0)
Indian (American)	3	(2.3)
Arabic	31	(24.2)
Chinese	6	(4.7)
Others ^a	30	(23.1)
	Mean (±SD)	
Age (years)	45.3	(±10.75)
For non-USA born, lived in the USA (years)	15.3	(±9.72)
Work characteristics	<i>n</i> (%)	
Work shift		
Day driver	64	(49.2)
Night driver	66	(50.8)
Income is sufficient from cab driving alone	63	(48.5)
Other paid work (yes)	24	(18.6)
	Mean (±SD)	(Minimum–maximum)
Worked as a taxi driver (year)	9.73 (±8.39)	(2–40)
Number of hours worked prior week	40.94 (±12.96)	(15.5–70)
Miles driven per week	539.26 (±200.96)	(175–1000)
Number of hours worked in other paid job per week	17.12 (±11.57)	(2–40)

^aOthers: Alaska Native, Asian Indian, Filipino, Japanese, Korean, Native Hawaiian, Vietnamese, and others

and 18.6 % reported working another paid job. Those working in a second job reported working an average of 17 h per week. On average, the subjects worked as a taxi driver for about 10 years and drove on average 41 h per week.

Cardiovascular Disease Risk Factors

Table 2 shows subjects' CVD risk factors. About one third (35.4 %) of subjects were 50 years or older, which indicates a high-risk age group. The subjects reported that they had received a diagnosis of hyperlipidemia (21.9 %), hypertension (17.7 %),

TABLE 2 Cardiovascular disease risk factors

Cardiovascular risk factors	<i>n</i> (%)	
Age		
20–29 years	7	(5.4)
30–39 years	38	(29.2)
40–49 years	39	(30.0)
50–59 years	29	(22.3)
60–70 years	17	(13.1)
Past and present medical history		
Heart disease	5	(3.8)
Hypertension	23	(17.7)
Diabetes mellitus	11	(8.5)
Hyperlipidemia	28	(21.9)
Depression	18	(13.8)
Family history		
Heart disease	37	(28.5)
Hypertension	52	(40.0)
Diabetes mellitus	46	(35.4)
Stroke	28	(21.5)
Life style behavior		
Tobacco use		
Current tobacco user	47	(36.2)
Cigarettes smoked per day (<i>n</i> = 43)		
≤10 cigarettes	17	(39.5)
11–20 cigarettes	20	(46.5)
21–30 cigarettes	5	(11.6)
≥31 cigarettes	1	(0.8)
≥Drinking alcohol		
Never	55	(42.6)
Monthly or less	18	(14.0)
Two to four times per month	22	(17.1)
Two or three times per week	14	(10.8)
Four or more times per week	20	(15.5)
Physical activity or exercise		
No regular physical activity or exercise	43	(33.1)
Participate in regular physical activities or exercise	87	(66.9)
Participate in moderate activity for at least 10 min at a time (<i>n</i> = 87) ^a	78	(89.7)
Participate in moderate activity: ≥5 days/week (<i>n</i> = 78)	41	(52.5)
Participate in vigorous activity for at least 10 min at a time (<i>n</i> = 87) ^a	51	(58.6)
Participate in vigorous activity: ≥5 days/week (<i>n</i> = 51)	10	(19.6)
Nutrition		
Eat five cups of fruits and vegetables each day (a cup is equal to one small apple or 16 grapes)	37	(28.5)
Drink more than three caffeinated beverages each day (coffee, tea, cola, and/or energy drinks)	52	(40.0)
Physiological risk factors	Mean (±SD)	Minimum–maximum
Average pulse reading (bpm)	74.4 (±11.2)	(43–110)
Average blood pressure reading (mm Hg)		
Systolic blood pressure (SBP)	132 (±18.32)	(99–208)
Diastolic blood pressure (DBP)	81 (±12.29)	(57–140)
Blood pressure stage (mm Hg)		<i>n</i> (%)
Normal: “SBP: 90–119 or DBP: 60–79”		25 (19.2)

TABLE 2 *Continued*

Cardiovascular risk factors	<i>n</i> (%)
Pre-hypertension: "SBP: 120–139 or DBP: 80–89"	63 (48.5)
Stage 1 hypertension: "SBP: 140–159 or DBP: 90–99"	27 (20.8)
Stage 2 hypertension: "SBP: $\geq$ 160 or DBP: $\geq$ 100"	15 (11.5)
Body mass index (BMI) kg/cm ² : (Mean [$\pm$ SD] = 27.3 [$\pm$ 4.8])	<i>n</i> (%)
Normal (18.5–24.9)	41 (31.5)
Overweight (25.0–29.9)	57 (43.8)
Obese (30.0–39.9)	32 (24.7)
Eligible for CVD prevention ^b (<i>n</i> = 128)	101 (78.9)

^aThe total is not equal 100 %; the subjects may have participated in moderate activity and/or vigorous activity

^bEligible for CVD prevention: BMI $\geq$ 25 and having one or more of these risk factors (hypertension, hyperlipidemia, or diabetes)

depression (13.8 %), or diabetes mellitus (8.5 %). When the subjects were asked about family history related to CVD, they reported that their family members had hypertension (40.0 %), diabetes mellitus (35.4 %), heart disease (28.5 %), or stroke (21.5 %).

More than one third (36.2 %) of subjects were current tobacco users. Most of them (46.5 %) smoked between 11 and 20 cigarettes per day. In the prior 30 days, less than half (42.6 %) of the subjects said that they never drank alcohol, 31.1 % of the subjects drank alcohol less than four times per month, and 26.4 % of the subjects drank alcohol greater than two times per week.

When the subjects were asked if they participated in regular physical activities or exercise during the prior 30 days, the majority of the subjects (66.9 %) participated for at least 10 min at a time in regular physical activities or exercise such as running, calisthenics, playing soccer, basketball or golf, gardening, or walking. Of subjects who participated in regular physical activities or exercise, 89.7 % participated in moderate activity; 58.6 % participated in vigorous activity.

Only 28.5 % of the subjects reported that they were eating five cups of fruits and vegetables daily. Forty percent of the subjects reported that they were drinking more than three caffeinated beverages daily.

On average, the pulse reading was 74.4 beats per minute, mean systolic blood pressure measurement was 132 mmHg, and mean diastolic blood pressure measurement was 81 mmHg. According to averaged blood pressure measurements, the classifications of subjects' blood pressure were normal (19.2 %), pre-hypertension (48.5 %), stage 1 hypertension (20.8 %), and stage 2 hypertension (11.5 %).

The mean of the subjects' body mass index (BMI) was 27.3 kg/cm². Based on BMI measurement, the subjects were classified as overweight (43.8 %) and obese (24.7 %). The findings show that about 79 % of the subjects were eligible for CVD prevention (Table 2).

Health Characteristics and Medical Insurance

As noted in Table 3, the majority of drivers perceived their general physical health status as very good or excellent (63.1 %). Less than half of the subjects (46.2 %) had a regular health care provider (HCP) or a place for medical care. Only 14.1 % of the subjects received health care through the city-funded health care program.

TABLE 3 Health characteristics and medical insurance

Health characteristics and medical insurance	<i>n</i> (%)
Taxi drivers' perception of their general physical health	
Very good or excellent	82 (63.1)
Good	25 (19.2)
Fair or poor	23 (17.3)
Have a regular health care provider (HCP) /doctor or a place for medical care	60 (46.2)
Received health care through the city health care program	19 (14.8)
Have any kind of health insurance (yes)	54 (41.9)
Type of health insurance (<i>n</i> = 54)	
MediCal/Medicaid	21 (38.2)
Medicare	6 (10.9)
Veteran's benefits	2 (3.6)
Kaiser/other private insurance	20 (36.4)
Do not know	3 (5.5)
Other	3 (5.5)
Visited HCP for emotional or mental distress in the last 12 months	13 (10.2)
	Mean ($\pm$ SD)
Number of HCP/doctor visit in the last 12 months	2.87 ($\pm$ 5.75)
Fatigue and exertion from taxi driving (range: 0–10)	
Rate of fatigue during the prior week	3.93 ($\pm$ 2.45)
Rate of physical exertion	3.72 ($\pm$ 2.11)
Rate of mental exertion	4.50 ($\pm$ 2.68)
Receiving medications	<i>n</i> (%)
Currently on hypertension medications	14 (10.8)
Currently on medication for elevated cholesterol	11 (8.5)
Currently on medication for diabetes	8 (6.3)

Moreover, less than half of the subjects (41.9 %) had any kind of health insurance. Of those insured, 38.2 % had MediCal/Medicaid, and 36.4 % had Kaiser or other private insurance. Approximately 10 % of the subjects visited a HCP/doctor for emotional or mental distress in the prior 12 months of this study.

On average, the number of HCP visits in the last 12 months was 2.87 times. Self-rating of fatigue during the prior week was 3.93 (out of 10), self-rating of physical exertion when driving was 3.72 (out of 10), and self-rating of mental exertion when driving was 4.50 (out of 10). The subjects reported that they were currently on hypertension medications (10.8 %), anti-lipid medication (8.5 %), and medication for diabetes (8.5 %).

Relationship between Subjects' Data and Cardiovascular Risk Groups

Table 4 shows that subjects' total of CVD risk factors ranged from 0 to 8 factors. On average, the mean number of CVD risk factors was 3.21. About all the subjects (99.2 %) had at least one CVD risk factor. About 10 % of the subjects had only one CVD risk factor. Thirty-five percent (*n* = 46) had more than three CVD risk factors.

Chi square analysis was done to identify the relationship between subjects' CVD risk factors and cardiovascular risk groups. A CVD high-risk profile had statistical relationship with the subjects who were $\geq$ 55 years old; had hypertension, diabetes mellitus, or hyperlipidemia; were drinking alcohol $\geq$ two times per week; and did not participate in any physical activity or exercise. Surprisingly, smoking status was not

TABLE 4 Relationship between subjects' data and cardiovascular risk groups

	Low-risk group ^a	High-risk group ^b		
	(<i>n</i> = 83)	(<i>n</i> = 46)		
Risk factors of CVD (<i>n</i> = 129)	<i>n</i> (%)	<i>n</i> (%)	χ^2	<i>P</i> value ^d
1. Age				
≥55 years	7 (8.4)	22 (47.8)	26.3	<0.05 ^d
Past and present medical history				
2. Hypertension (yes)	1 (1.2)	22 (47.8)	43.9	<0.05 ^d
3. Diabetes mellitus (yes)	1 (1.2)	10 (21.7)	16.0	<0.05 ^d
4. Hyperlipidemia (yes)	6 (7.2)	22 (47.8)	29.2	<0.05 ^d
5. Family history of CVD (yes) ^c	31 (37.30)	38 (82.6)	24.4	<0.05 ^d
6. Tobacco use				
Current tobacco user	28 (33.7)	19 (41.3)	0.7	0.45
7. Drinking alcohol				
≥Two times per week	12 (14.5)	22 (47.8)	17.7	<0.05 ^d
8. Physical activity/exercise				
No regular exercise	37 (44.6)	5 (10.9)	15.3	<0.05 ^d
9. Body mass index (BMI) kg/cm ²				
Overweight/obese (BMI ≥25)	55 (66.2)	34 (73.9)	0.8	0.43
Number of CVD risk factor(s) ^e (<i>n</i> = 130)			<i>n</i> (%)	
No CVD risk factor			1 (0.8)	
One CVD risk factor			13 (10.0)	
Two CVD risk factors			36 (27.7)	
Three CVD risk factors			34 (26.2)	
>Three CVD risk factors (4–9 risk factors)			46 (35.4)	
Total CVD risk factors (nine risk factors)	Mean (±SD)	Median	Minimum	Maximum
	3.21 (±1.60)	3.0	0	8

^aLow-risk group: ≤3 CVD risk factors

^bHigh-risk group: >3 CVD risk factors

^cFamily history: yes if answered yes to a family history of heart disease, hypertension, or stroke

^dStatistically significant

^eCVD risk factors included 1) age, 2) hypertension, 3) diabetes mellitus, 4) hyperlipidemia, 5) family history of CVD, 6) tobacco use, 7) drinking alcohol, 8) physical activity/exercise, and 9) BMI

significantly associated with a CVD high-risk profile, nor was overweight/obesity status.

Predictors of a CVD High-Risk Profile

Univariate analyses were done to identify the relationship between one outcome variable (CVD high-risk profile) and each independent variable (socio-demographical variables, work characteristics variables, health characteristics, and medical insurance variables). The significant variables from each univariate analyses (with *p* values <0.05) were added to one multiple logistic regression model to predict a CVD high-risk profile. The results of the multiple logistic regression analysis (Table 5) show that subjects who worked as a taxi driver for more than 10 years (OR: 4.37; 95 % CI 1.82, 10.50) and had self-rated their mental exertion from cab driving more than five on the scale (out of 10) (OR 2.63; 95 % CI 1.05, 6.57) were

TABLE 5 Multiple logistic regression analysis to predict CVD high-risk profile

Significant variables from previous univariate analysis ^a	OR	CI 95 %	P value*
Education (≤ some college [not graduated])	1.54	(0.66, 3.61)	0.32
Place of birth (outside of the USA)	0.65	(0.25, 1.70)	0.38
Worked as a taxi driver (≥10 years)	4.37	(1.82, 10.50)	<0.05*
Have a regular HCP/doctor or a place for medical care (no)	0.45	(0.18, 1.09)	0.08
Rate of fatigue during the prior week (≥4 out of 10)	0.66	(0.24, 1.81)	0.42
Mental exertion from cab driving (≥5 out of 10)	2.63	(1.05, 6.57)	0.04*

Outcome variable was coded as 0: low-risk group = ≤3 CVD risk factors; 1: high-risk group = >3 CVD risk factors

^aComparisons: education (≥ associate degree or higher); place of birth (inside of the USA); Worked as a taxi driver (<10 years); have a regular HCP/doctor or a place for medical care (yes); rate of fatigue during the prior week (<4 out of 10); and mental exertion from cab driving (<5 out of 10)

*P value is significant (<0.05)

more likely to have a CVD high-risk profile, after adjusting for education, place of birth, having a regular health care provider, and level of fatigue in the prior week.

DISCUSSION

This is a distinctive study conducted in the U.S. that describes risk factors for CVD among urban taxi drivers. There are few published studies conducted in the U.S. that assessed risk factors for CVD among taxi cab drivers.^{13,17,27} The findings of our study identified the CVD risk factors for 130 taxi drivers, out of a possible 7000 drivers, who were recruited from ten different taxi companies in San Francisco.

The majority of subjects were male, married or partnered, completed some college or below, born outside of the USA, spoke English as the primary language at home, and were White. The average age was 45 years old, which is older than previous studies investigating risk factors for CVD in American,^{13,17} Korean,²⁰ Taiwan,²¹ Iranian,³³ and Chinese²⁹ taxi drivers. Older age is a non-modifiable CVD risk factor. Therefore, assertive counseling and pharmacological interventions about modifiable risk factors, in addition to system-level interventions, are needed to prevent taxi drivers from CVD.^{6,8,10}

In regards to working conditions, about half of the subjects worked night shift, and on average, they worked 10 years as taxi drivers. This finding is consistent with a U.S. study, whereas 10.6 years is the average of years working as taxi drivers.¹³ Subjects reported that they were working an average 41 h/week on taxi, which is equal to approximately 170 h/month. Chen et al. (2005) reported that drivers who drove 208 h/month had higher hematological markers for increased CVD risk including white blood cells count, hematocrit, and platelets.²¹ In our study, 33 % of the subjects were working more than 208 h/month (result not presented). Further exploration of inflammatory markers associated with hours of driving and/or exposure to environmental pollutants and its association with CVD is needed.

Predisposing risk factors for CVD are divided into non-modifiable risk factors including (gender, age, and family history) and modifiable risk factors (hypertension, tobacco use, drinking alcohol, diabetes, physical inactive, unhealthy diet, hyperlipidemia, and obesity). In this study, about 94 % of the subjects were male. Nearly one third of subjects aged between 50 and 70 years. More than one third of the subjects had a family history of hypertension or diabetes mellitus. The high prevalence of

these non-modifiable risk factors contributes to drivers' high risk for CVD. Therefore, these drivers should visit health care providers to get education about CVD risk factors, receive counseling, regular checkups, and medical treatment.³⁴

Hypertension, diabetes mellitus, overweight/obesity, hyperlipidemia, tobacco use, and alcohol use are major modifiable CVD risk factors. Pharmacological therapies are highly recommended to manage these CVD risk factors.^{7,9,10} Moreover, cognitive behavioral counseling therapy and enhancing individuals' self-efficacy have significant positive impact on preventing CVD by changing adverse lifestyle behaviors such as smoking, alcohol use, insufficient physical activity, and unhealthy eating.^{34,35} In addition to HCP interventions with individuals, organizational-level health care system interventions, including clinic reorganization, use of multicomponent and multidisciplinary teams, and coordination and cooperation between health care providers particularly nurses and community health workers, were found to be effective in reducing multiple CVD risks.^{34,36}

More than one third of the subjects were smokers. About 60 % of them smoked more than 11 cigarettes daily. Smoking is a major preventable risk factor for CVD, including coronary syndrome and cardiac arrhythmias.^{3,37,38} Tobacco use is estimated to cause about 10 % of all CVD globally.³⁹ Young male smokers and heavy smokers have a higher risk for developing CVD.⁴⁰

There was a high prevalence (36 %) of current smoking in this sample when compared to community rates of current smoking. In San Francisco, the current smoking prevalence in males in 2011, according to the California Health Interview Survey, was 17.4 % in men between the ages of 21 and 65; in 2014, the current smoking rate for men is 15.7 %.⁴¹ Therefore, there is a disparity in higher smoking prevalence rates in taxi drivers in San Francisco.

HCPs can successfully support behavior change through the use of motivational interviewing strategies aimed at building confidence for smoking cessation. Establishing smoking cessation programs for taxi drivers is necessary to prevent cardiac events and sudden death. Taxi drivers must be educated about health hazards of tobacco use and effective treatments to quit tobacco use. Providing tailored self-help materials and referring taxi drivers to call the toll-free telephone quit line may help the taxi drivers to quit smoking.^{37,38}

System-level interventions may include group support at the worksite as an additional strategy for smoking cessation. For example, Sorensen et al. successfully reduced smoking prevalence in those who received a telephone intervention tailored to the population of unionized truck drivers and dock workers and some of the working conditions (e.g., long hours, sleep deprivation).⁴² Current local policies require drivers not to smoke in their vehicles (San Francisco Health Code). The Affordable Care Act now requires all new private health insurance plans to cover services recommended by the U.S. Preventive Services Task Force (USPSTF) with no cost-sharing; this includes tobacco cessation treatments.⁴³ In addition to negative consequences for society of drinking alcohol, there is an increase in unintentional injuries and accidents, violence and aggressive behavior, and decreased worker productivity. Alcohol use is also a major cause of many diseases such as CVD, cancer, and liver disorders.^{44,45} Many investigations indicate there is association of alcohol abuse and CVD and increase its risk factors. For example, increasing alcohol intake is associated with an increase in blood pressure, HDL and platelet aggregation.⁴⁴⁻⁴⁶ In our study, 15.5 % of the subjects reported drinking alcohol four or more times per week. Similarly, in the U.S. between 2008 and 2010, 15.4 % of adults reported drinking alcohol 3 to 14 times per week, and 5.4 % drank more than 14 times per week.⁴⁷

Alcohol consumption may lead to alcohol dependence and need for treatment. Treatment for alcohol dependence includes providing self-help materials, mutual support groups, behavioral therapies, psychological therapy, motivational interviewing, and pharmacotherapy, as well as a combination of treatments.^{48,49} HCPs have a key role in treating alcohol dependence by early identification and diagnosis, counseling, and providing brief interventions.⁴⁹

Insufficient physical activity is defined as participating in moderate intensity aerobic physical activity for less than 150 min per week. Participating in regular physical activity reduces the prevalence of many diseases such as diabetes mellitus and CVD; whereas, physical inactivity is responsible in increasing the risk of CVD including coronary artery disease, hypertension, stroke, elevated blood sugar, and being overweight.^{50,51}

In our study, about one third of subjects had no participation in regular physical activity. This is slightly higher than the comparable 2009 data in San Francisco where 27.2 % of men reported no physical activity/sedentary.⁵² However, in our study, there was good participation of those who were physically active, with a large proportion of the total sample doing vigorous activity ($51/130 = 39\%$), and a smaller proportion limiting themselves to moderate activity ($27/130 = 20.7\%$). Comparable 2009 data for men between 21 and 65 years of age shows a 5.7 % prevalence for moderate physical activity (excluding walking) and 19.4 % vigorous physical activity for at least 20 min/day.⁵² Therefore, in our sample, drivers who were physically active tended towards more vigorous activities, when compared to the sample of male counterparts in San Francisco (note: definitions varied by time). Targeted strategies for drivers who are physically inactive would be a health promotion approach, emphasizing the benefits of participating in even short periods of moderate to vigorous physical activity. Tailoring the message would include the following considerations: to be active, it should be based on his/her preferred way to be active, finding the most convenient time to participate in physical activity; participate in physical activity with friends and family; start small, and practice what he/she can do, then add more activity by time; the best way to start physical activity is walking 10 min a day during the first couple of weeks, then increasing the time to 15 min or more per day; keep walking most of days per week and try to walk faster; try to add biking on the weekends; and to participate in other moderate and some regular vigorous activity.⁵⁰ System-level or worksite interventions to increase physical activity include some of these same individual strategies: for example, incentivizing group involvement and social support for physical activity while at work, and providing group sport opportunities when there are extended wait times for drivers, for e.g., at airport holding lots.

Overweight and obesity prevalence is high in our sample of drivers as well: 68.5 % of drivers had BMIs 25 or higher. This compares to 46.8 % of men (between the ages of 21 and 65) in San Francisco in 2009.⁵³ Of note, only 28 % of the sample ate five servings of fruits/vegetables per day, as compared to 56.9 % of men, between the ages of 21 and 65 in San Francisco in 2005, the most recent data source.⁴¹ These disparities of weight and fruits/vegetable intake in this sample of taxi drivers may contribute to the development of diabetes, hyperlipidemia, and hypertension, all risk factors for CVD; obesity is an independent risk factor for CVD.⁴¹ Comparing the results of this study and other previous studies in the U.S., only 4.6 % of taxi drivers in Chicago ate the recommended five servings of fruits and vegetables per day.¹⁷ Also, Gany et al. (2012) reported that about all of South Asian taxi drivers in New York regularly ate unhealthy food at work including fast

food and soda.²⁷ Moreover, the South Asian taxi drivers said that healthy food was bland, expensive, and inaccessible.²⁷ These unhealthy dietary habits resulted in increased weight and CVD risk.²⁷ Providing a healthy food campaign with access to fresh fruits and vegetables at airport holding lots is an example of a system-level intervention.

The U.S. Preventive Services Task Force (USPSTF) defined adults who are overweight or obese ($\text{BMI} \geq 25$) and having one or more of these CVD risk factors (hypertension, hyperlipidemia, or impaired fasting glucose) as eligible for CVD prevention.⁵⁴ The USPSTF recommended that these adults should be offered or referred to intensive behavioral counseling interventions for CVD prevention.⁵⁴ In 2013, a nationwide survey was conducted in 50 United States to identify eligible adults for CVD prevention.⁵⁴ About one third (36.8 %) of adults over age 18 in the nation were eligible for CVD prevention; in the state of California, 33.3 % adults were eligible for CVD prevention.⁵⁴ Based on these criteria of the USPSTF, about 79 % of the taxi drivers in our study were eligible for CVD prevention. Therefore, health care providers should promote preventive health behaviors for these taxi drivers who are at high risk for CVD by assessing, counseling, and referring them to health care, with the goal to promote a healthy diet with participation in aerobic physical activity.

Elevated blood pressures (specifically those with stage 2 hypertension) were documented in 15 drivers, including one driver with life-threatening readings who was referred to the emergency department. Of these 11 drivers with stage 2 hypertension, 4 were taking medications for blood pressure control. One recommended intervention is to ensure that drivers with elevated blood pressures are referred for diagnosis and treatment with a health care provider, and encouraged to maintain medications even if not symptomatic. However, a large proportion of the sample was uninsured: 42 % reported having health insurance, with another 15 % covered by a city-sponsored health care program, with the remaining 43 % uninsured. In contrast, in 2009, only 10.8 % of men in San Francisco were uninsured for health care.⁵⁵ Lack of health insurance was also found in Chicago taxi drivers: only 30.3 % of Chicago taxi drivers had health insurance;¹⁷ in New York, 52 % of taxi drivers were uninsured.¹³ A system-level strategy, which was implemented in 2014 through the Affordable Care Act, would provide government subsidies for health insurance coverage and expand those who may qualify for MediCal/Medicaid.⁵⁶

In our study, more than one third of the subjects have more than three CVD risk factors. In a previous Korean study,²⁰ which is conducted among manufacturing workers, drivers, office workers, only 7.1 % of all subjects were in a high CVD risk group. Our study showed that age (≥ 55 years), past and present medical history including (hypertension, diabetes mellitus, or hyperlipidemia), family history of CVD, drinking alcohol (≥ 2 times per week), and insufficient physical activity were significantly associated with a CVD high-risk profile in the univariate analysis. These findings are similar with the Korean study.²⁰ Park and Hwang (2014) reported that subjects who were older, had higher triglyceride levels, had a history of heart diseases, had less participation in exercise, and who were working as taxi drivers were more likely to be high risk for CVD.²⁰ In contrast to our study, Park and Hwang found that overweight or obesity ($\text{BMI} \geq 25$) was associated with a higher risk for CVD.²⁰

In our study, working as a taxi driver (≥ 10 years) and having mental exertion from cab driving (≥ 5 out of 10) were predictors of a high-risk profile for CVD.

Years of driving were associated with a fourfold increase in having a CVD high-risk profile (i.e., more than three CVD risk factors). Perceived mental exertion was also associated with a 2.6-fold odds of having a CVD high-risk profile, and this is a potentially modifiable risk factor. The vigilance required when driving in an urban environment, dealing with drunk/rowdy passengers, and the fiscal insecurities associated with taxi driving^{28,57} may contribute to this perceived mental exertion. Further studies are needed to examine the association of perceived mental exertion and developing of CVD among taxi drivers.

Study Strength and Limitation

This study is the first survey conducted to explore CVD risk factors among urban taxi drivers in San Francisco. Moreover, it is a unique study, because it provides important baseline information about the significant predictors of CVD risk factors among urban taxi drivers. Despite the significance of this study, there are several limitations. Using a convenience sampling method with 130 drivers is not representative of all of the taxi-driving population. Our study most likely oversampled primary Arabic speakers and under-sampled drivers of Asian ethnicities, when compared to two taxi driver surveys done in this city.^{15,56} The cross sectional design method does not allow us to determine cause and effect. Additionally, subjects self-report of information may be inaccurately reported due to social desirability (e.g., reporting being physically active or eating fruits and vegetables), or embarrassment (e.g., underreporting alcohol use).

CONCLUSION

There is a high prevalence of cardiovascular risk factors in this group of urban taxi drivers, with higher prevalence of smoking, overweight/obesity, physical inactivity, and lower intake of fruits and vegetables, when compared to other men in San Francisco. Working conditions associated with a CVD high-risk profile includes working over 10 years as a taxi driver and a score of 5 or more on the perceived mental exertion when driving. The majority of this sample also lacked health insurance at the time of this study. Individual and group health promotion strategies include culturally tailored interventions focusing on smoking, physical activity, and weight management. Population health interventions may include offering heart healthy food options at taxi dispatching locations, and creating a work culture of frequent walking breaks and smoke-free group incentives. The Affordable Care Act, enacted in January 2014, may be improving health insurance coverage for this group of workers.⁵⁶ The most challenging health determinant may be mitigating the stressful working conditions requiring driving strangers, alone, often at night, where safely driving passengers to their destination requires constant vigilance. This will prove challenging for public health and occupational health professionals.

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