Occupation and Hypertension Awareness, Washington State Behavioral Risk Factors Surveillance System, 2003, 2005, 2007, and 2009

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Abstract

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BACKGROUND: Hypertension is associated with substantial morbidity and mortality and is a modifiable risk factor for cardiovascular disease and stroke. Many public health efforts are aimed at the prevention and control of hypertension. Few studies have reported on the prevalence of hypertension awareness by occupation using detailed respondent information.

PURPOSE: The purpose of this study was to determine whether certain occupational groups of workers in Washington State (WA) are associated with a higher risk of having been diagnosed with hypertension and to describe the workers' levels of occupational and leisure time physical activity by occupational group.

METHODS: Using WA Behavioral Risk Factors Surveillance System (BRFSS) survey data for 2003, 2005, 2007, and 2009, we estimated the prevalence of hypertension awareness and the adjusted odds of hypertension awareness by occupational group. We also report the prevalence estimates of levels of occupational and leisure time physical activities by occupational group.

RESULTS: The prevalence of hypertension awareness varied across occupational groups: the highest prevalence was among 'transportation and material moving' workers and the lowest prevalence was among 'health-diagnosing' occupations. The adjusted odds of hypertension awareness were similar or higher for many of the occupational groups when compared to the referent group, 'executive, administrative, and managerial' occupations. While no occupational group demonstrated statistically significantly higher odds of hypertension awareness, three

groups demonstrated statistically significantly lower odds: ‘mathematical and computer scientists’ [adjusted odds ratio 0.63; 95% CI (0.44 to 0.90)], ‘construction and construction trade’ workers [adjusted odds ratio 0.64; 95% CI (0.49 to 0.85)], and the broad group of ‘librarians, archivists, curators, social recreation, religious workers, writers, artists, entertainers and athletes’ [adjusted odds ratio 0.72; 95% CI (0.57 to 0.90)]. Nearly two-thirds of occupational groups indicated sedentary occupational physical activity, and nearly one-half of occupational groups indicated sedentary leisure time physical activity.

CONCLUSION: Our findings indicate that occupation has important associations with hypertension awareness. Certain occupational groups, identified to be at risk for hypertension, may benefit from employee blood pressure screening programs and early detection of hypertension. Hypertension control programs could improve strategies to help reduce stressors at work and increase physical activity to healthy levels. Public health entities may need more rigorous campaign efforts to emphasize the importance of healthy levels of leisure time physical activity.

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Chapter I: Introduction and Background

Hypertension prevention and control are important priorities for public health initiatives. Hypertension was the focus of World Health Day in 2013 and for the 50th anniversary of the World Health Organization. Although preventable, hypertension affects approximately 40% of adults globally and 30% of adults in the United States.[1] The U.S. Department of Health and Human Services program, Healthy People 2020, promotes a comprehensive collection of public health objectives and has set the goal of a 10% reduction in adult hypertension prevalence for a target decrease to 27% by 2030.[2] This goal may prove difficult to achieve: from 2005 to 2009, the prevalence of self-reported hypertension among U.S. adults (aged ≥18 years) increased from 25.8 to 28.3%, and among those reporting hypertension, the proportion using antihypertensive medications increased from 61.1% to 62.6%.[1] Among U.S. adults the prevalence of measured hypertension did not increase significantly from the years 1999-2002 to 2005-2008; however the use of antihypertensive medication and control of hypertension increased significantly.[2] Therefore, the increase in self-reported hypertension is likely the result of the adult patient becoming aware of their condition after a health care professional has informed the person of his or her diagnosis. Yet, there has been no decline in the prevalence of hypertensive disease.

Although modifiable, hypertension is a leading risk factor for cardiovascular disease (CVD) and contributes to approximately half of strokes and ischemic heart disease worldwide.[3] Hypertension was listed as a primary contributing cause of death for 326,000 U.S. residents in 2006.[4] However, less than 50% of adults with hypertension controlled their blood pressure in 2007-2008.[5] Increased hypertension awareness and treatment is beneficial to patients in order to make necessary behavioral and lifestyle changes, such as dietary improvements, increased physical activity, and weight loss. A recent prediction model showed that for every 10% increase

in hypertension treatment, this would prevent 14,000 deaths per year in the adult population ages 25–79.[6] The U.S. Department of Health and Human Services has launched the Million Hearts Initiative, aimed at preventing 1 million heart attacks and strokes by 2017 and has released a guide for public health practitioners which contains strategies to improve blood pressure control.[7]

Hypertension has far-reaching economic and societal impacts. An estimated $155 billion dollars per year were spent on direct and indirect costs of hypertension in 2010, and projections show that by 2030, the total cost of hypertension will increase to an estimated $343 billion.[8] Hypertension accounts for 29.6% of hospital outpatient or office-based provider visits, 12.4% of hospital inpatient stays, 2.7% of emergency room visits, and 45.1% of prescribed medicines.[9] Total life expectancy is 5.1 years longer for normotensive men and 4.9 years longer for normotensive women than for hypertensive people of the same gender at 50 years of age.[10] Therefore, a hypertensive individual may expect to live a shorter life, spend more time at health care appointments or in the hospital, and pay greater health care costs for services and prescriptions than a normotensive individual.

Hypertension is defined as a systolic blood pressure of $\geq$140 mm Hg or a diastolic blood pressure of $\geq$90 mm Hg or use of medication for the condition.[11] Several pathophysiologic conditions and pharmacologic interventions can cause hypertension, such as renal artery stenosis or corticosteroid medications.[11] In the absence of an inciting medical condition or pharmacologic origin, hypertension is most likely the result of behavioral and lifestyle choices potentiated by genetic predisposition. Moreover, occupational factors may also affect blood pressure. Exposure to current and past occupational stress on a regular basis has been associated with an increased risk of hypertension among workers and retirees.[12] Occupational stressors such as high demands,

time pressures, low decision latitude, extended work hours and noxious exposures have demonstrated associations with increased risk of hypertension.[13, 14]

Physical activity is a modifiable lifestyle factor which, when increased, can lower blood pressure.[15] Physical activity spans a spectrum of exertion intensity and can be divided into occupational physical activities (OPA) and non-occupational or leisure time physical activities (LTPA). The trend in OPA among U.S. workers has declined in exertion intensity; occupations that require moderate to vigorous activity, such as construction and mining, have declined from nearly one-half to less than one-quarter the total private job sector over the past five decades.[16] Technological developments and expansion of service-related occupations have replaced more physically demanding production jobs, such as agricultural and manufacturing jobs, and from 1960 to 2008, there was a decrease in occupation-related daily energy expenditure of an estimated 140 calories for men and 124 calories for women in the US.[16] In 1960, more than 30% of private sector occupations required light to moderate physical activity, yet by 2008, only 12% of adults held such jobs in lieu of more sedentary occupations.[16] Efforts to improve worksite physical activity and nutrition programs have achieved only modest improvements in employees' weights and rates of obesity.[16]

In 2008, the U.S. Department of Health and Human Services published the 2008 Physical Activity Guidelines for Americans. These guidelines were the first national guidelines highlighting the benefit of regular LTPA, and the minimal level of activity considered to have some benefit to overall health was defined as "activity beyond baseline but fewer than 150 minutes a week."[17] However, according to 2011 data, 32% of U.S. adults did not engage in LTPA (in this instance, LTPA was defined as "light/moderate or vigorous physical activity of at

least 10 minutes duration per day").[18] There is evidence that LTPA has improved slightly over the last decade but only among an estimated 20% of U.S. adults.[19]

Our study aimed to estimate the prevalence of hypertension awareness by occupational group among employed Washington State residents, using a representative state data set. We also aimed to identify which occupational groups were associated with high odds of hypertension awareness after adjusting for important confounders identified in previous research. Additionally, we sought to estimate the levels of OPA and LTPA by occupational group. A better understanding of the relationship between occupation and hypertension awareness, relative to the amount of OPA and LTPA in each group, may lead to the development of or improvements in workplace hypertension prevention and control programs. Such programs may lead to increased productivity, decreased time lost to illness and disability, and decreased health care costs associated with the long-term effects of hypertension.

Chapter II: Methods and Materials

Using Washington State Behavioral Risk Factors Surveillance System (BRFSS) data for odd years from 2003-2009, we investigated self-reported occupation, the prevalence and odds of hypertension by occupational group, and the levels of occupational and leisure time physical activities among workers residing in Washington State. The BRFSS is a population-based, random-digit-dialed survey of non-institutionalized people aged 18 years or older. BRFSS is administered in all 50 States, U.S. territories, and the District of Columbia. BRFSS collects information on behavioral risks for the leading causes of disease and death and allows for analysis of health outcomes and issues including health risk behaviors, chronic disease, and health care coverage. The BRFSS questionnaire has three parts: CDC core questions, questions from CDC optional modules, and state-added questions. Both English and Spanish language versions of the survey are provided to each state. The Washington State Institutional Review Board approves all Washington State BRFSS survey questions and study protocols. The Washington BRFSS state-added questions for odd years between 2003 and 2009 included questions about CVD risk factors, levels of OPA, and levels of LTPA. The response rates for the WA BRFSS years 2003, 2005, 2007, and 2009 were, respectively, 43%, 46.6%, 44.5%, and 48.2%.[20] Adult respondents, $\geq$18 years, included those who were "currently employed" or "self-employed" (*n*=40,798). Occupational data in BRFSS was not available from other states during this study period.

Demographic characteristics obtained in the BRFSS included age, gender, income, education level, healthcare access, and race/ethnicity. Age groups were collapsed into three categories: 18-24 years, 25-44 years, and 45-64 years based, in part, on BRFSS age-grouping but also to ensure adequate number of respondents per category and to utilize the 18-24 years as a

referent group in our analysis. Participants aged 65 years or older (*n*=2,617) represented less than 6% of employed BRFSS respondents and were excluded from the study as many no longer were employed. Income was also collapsed into three groups: <$35k, $35 to 75k, and $75k+ to ensure adequate number of respondents per category and to utilize the $75k+ as a referent group in our analysis. Education levels were collapsed into three groups to ensure adequate number of respondents per group and with the college-educated as a referent group. Health care access was ascertained by response to the BRFSS question, "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?" Race/ethnicity responses were grouped by BRFSS categories: White, Black or African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, or Other/Multi-National. Native Hawaiian or Other Pacific Islander and American Indian or Alaska Native categories were combined into the group, "Native American or Pacific Islander", to ensure adequate number of respondents in this category (*n*=675). WA State BRFSS respondents were primarily of White or Hispanic origin; therefore, for our logistic regression, we combined the categories of African American, Asian, Native American or Pacific Islander, and Other/Multi-National as our referent group.

Lifestyle behaviors and medical characteristics included smoking status, obesity, high cholesterol, diabetes mellitus, CVD, heart disease, heart attack, and stroke. Respondents were considered current smokers if they currently smoked or had smoked at least 100 cigarettes in their lifetime. Obesity, or Body Mass Index (BMI) $\geq$30, was calculated from self-reported height and weight. Chronic health conditions included self-report of ever having been diagnosed by a doctor, nurse, or other health professional with high cholesterol, diabetes mellitus, CVD, heart disease, heart attack, or stroke.

Hypertension awareness was ascertained by a positive response to the BRFSS question, "Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?" The WA BRFSS 2003, 2005, and 2009 included the response "borderline high or pre-hypertensive"; the WA BRFSS 2007 did not include this response. However, this response was not considered to meet inclusion criteria for the diagnosis of hypertension, and the total number of positive responses was also low for analysis purposes (n=528). Females who were pregnant at the time of their initial hypertension diagnosis (n=417) were excluded to avoid potential confusion with the transient condition of pregnancy-induced hypertension.

Occupation was collected verbatim on all respondents who answered "Yes" to the questions: "Currently employed for wages" or "self-employed"; "What is your job title?" or "What kind of work do you do?" We used the National Institute for Occupational Safety and Health (NIOSH) system, which categorizes jobs into 502 three-digit, detailed occupational categories based on the National Center for Health Statistics (NCHS) Instruction Manuals and Standardized Occupation and Industry Coding or SOIC.[21] SOIC determines codes by type of industry and occupation in conjunction with the *1990 Bureau of the Census, Alphabetical Index of Industries and Occupations*.[22] To ensure sufficient number of current cases of hypertension awareness by occupation, 29 broader occupational subgroups were created for this study using NCHS methods. Collapsing the occupational groups into subgroups by similar job duties, skills, education and/or training is the method used in NCHS surveys. Occupational grouping in this manner is based on the more detailed U.S. Census Standard Occupation Classification System.[23]

Occupational physical activity was assessed by the response to the BRFSS question, "When you are at work, which of the following best describes what you do?" A response of "Mostly sitting or standing" was considered sedentary OPA. A response of "Mostly walking,"

was considered ambulatory OPA, and "Mostly heavy labor or physically demanding work" was considered laborious OPA. Sedentary and laborious OPA was compared to ambulatory OPA in our logistic regression, given that walking, as an aerobic form of exercise, may lower blood pressure.

Leisure time physical activity in the WA BRFSS was surveyed for three levels: moderate, vigorous, or sedentary (neither moderate nor vigorous). These levels are congruent with the 2008 publication, Physical Activity Guidelines for Americans.[17] Sedentary and moderate LTPA were compared to vigorous LTPA as the referent group in our logistic regression, given that increased physical activity may lower blood pressure. Moderate leisure time physical activity was determined by the responses to the series of questions: "In a usual week, do you do moderate activities for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate?"; "How many days per week do you do these moderate activities for at least 10 minutes at a time?"; and "On days when you do moderate activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?" Physical activity that caused some increase in breathing or heart rate and was performed for 30 minutes a day or more for 5 days a week or more qualified as moderate LTPA.

Vigorous LTPA was determined by the responses to the series of questions: "In a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work or anything else that causes large increases in breathing or heart rate?"; "How many days per week do you do these vigorous activities for at least 10 minutes at a time?"; and "On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?" Physical activity that caused large increases in

breathing or heart rate and was performed for 20 minutes a day or more for 3 days a week or more qualified as vigorous LTPA.

The association of hypertension and occupation was assessed by multivariable logistic regression with odds ratios adjusted for age, gender, race/ethnicity, income level, educational level, OPA, LTPA, diabetes mellitus, smoking, obesity, health care access, and occupation. High cholesterol, cardiovascular disease, heart attack, heart disease, and stroke did not add to our model and were therefore not included in the multivariable logistic regression analysis. All analyses were conducted in SAS version 9.2[24] and responses were weighted to account for the BRFSS survey sampling design.

Chapter III: Results

A total of 40,798 respondents, residing and working in Washington State, aged 18 to 64 years, participated in the BRFSS survey in the years 2003, 2005, 2007, and 2009. Demographic, social, and medical characteristics of our study population are shown in Table 1. The prevalence of hypertension awareness varied substantially by age, ranging from 5.6% among participants age18-24 years to 28.8% among participants age 45-64 years; by race/ethnicity, ranging from 12.7% among Asians to 24.3% among African Americans; and by education level, ranging from 13.2% among adults with less than a 12^{th} grade education to 20% among adults with a high school education or some college. In regards to medical characteristics, the prevalence of hypertension awareness varied substantially by heart disease, ranging from 18.1% among adults without heart disease to 60.4% among adults with heart disease; by history of heart attack, ranging from 18.2% among adults without a heart attack to 60% among adults with a heart attack; and by diabetes mellitus, ranging from 16.7% among adults without diabetes mellitus to 56.6% among adults with diabetes mellitus.

The prevalence of hypertension awareness by our study's 29 occupational groups is shown in Table 2. For reference purposes, the 1990 Census Industry and Occupation codes are also shown in this table. The prevalence of hypertension awareness for all occupational groups was 18.3%. While this figure is below the national average, our study excluded a substantial proportion of participants who were age >65 years. Occupational groups with a high prevalence of self-reported hypertension included 'transportation and material moving' workers (26%), 'truck drivers' (23.2%), 'precision production and plant operators' (22.7%), and 'cleaning and building service workers' (21.5%). Occupational groups with a low prevalence of self-reported hypertension included 'health-diagnosing' occupations (11.8%), 'food preparation and service'

workers (12.1%), ‘mathematical and computer scientists’ (13.9%), and ‘military’ personnel (14.2%).

Table 3a shows the results of the multivariable logistic regression model of demographic factors associated with hypertension awareness. Respondents with hypertension awareness were significantly more likely to be male, older, of lower income status, high-school educated, have a past history of smoking, be engaged in either moderate LTPA or be sedentary (neither moderate nor vigorous LTPA), have high cholesterol, be obese, have diabetes mellitus, and have access to health care. Respondents of Hispanic origin were significantly less likely to report hypertension awareness.

Table 3b shows the multivariable logistic regression model estimating the odds between hypertension awareness and occupational groups. ‘Executive, administrative, and managerial’ professions (*n*=5359) was chosen as the referent group because the group was considered to have mid-range control over job circumstances and decision latitude and represented neither of the extremes of the prevalence of hypertension. While no occupational group showed statistically significant higher odds of hypertension awareness, three occupational groups demonstrated statistically significant lower odds of hypertension awareness: ‘mathematical and computer scientists’ [AOR 0.63; 95% CI (0.44 to 0.90)], ‘construction and construction trade’ workers [AOR 0.64; 95% CI (0.49 to 0.85)], and ‘librarians, archivists, curators, social recreation, religious workers, writers, artist, entertainer, and athletes.’ [AOR 0.72; 95% CI (0.57 to 0.90)]. We also ran our multivariable logistic regression model without occupational groups, and the magnitude and direction of our odds ratios remained unchanged.

Table 4a shows the prevalences of OPA levels by occupational group. The prevalence of sedentary OPA for all occupational groups was 64.1%. Occupational groups with a high

prevalence of sedentary OPA were ‘mathematical and computer scientists’ (98.1%), ‘lawyers and judges’ (96.8%), ‘post-secondary teachers’ (92.3%), and ‘engineers, architects, and surveyors’ (91.7%). The prevalence of ambulatory OPA for all occupational groups was 21.3%. Occupational groups with a high prevalence of ambulatory OPA included ‘cleaning and building service’ workers (50.1%), ‘food preparation and service’ workers (48.1%), ‘registered nurses’ (49.8%), and ‘farm, forestry, and fishing’ (37.5%). The prevalence of laborious OPA for all occupational groups was 14.6%. Occupational groups with a high prevalence of laborious OPA included ‘construction and construction trade’ workers (64.9%), ‘handlers, equipment cleaners, helpers and laborers’ (48.3%), ‘farming, forestry, and fishing’ (43.2%), and ‘mechanics and repairers’ (42.1%).

Among the occupational groups with a high prevalence of hypertension awareness (>18.3% in these data, Table 2), three of four groups indicated they were primarily engaged in sedentary OPA including ‘transportation and material moving’ workers (68.1%), ‘truck drivers’ (58.3%), and ‘precision production and plant operators’ (51.3%). ‘Cleaning and building service’ workers were primarily engaged in ambulatory OPA (50.1%). Among the occupational groups with a low prevalence of hypertension awareness (<18.3% in these data, Table 2), three of four groups indicated they were also primarily engaged in sedentary OPA including ‘health-diagnosing’ occupations (76.7%), ‘mathematical and computer scientists’ (98.1%), and ‘military’ personnel (50.4%). ‘Food preparation and service’ workers were primarily engaged in ambulatory OPA (48.1%).

Table 4b shows the level of LTPA by occupational group. The prevalence of sedentary LTPA for all occupational groups was 46.2%. Occupational groups with a high prevalence of sedentary LTPA included ‘handlers, equipment cleaners, helpers and laborers’ (55%), ‘machine

operators and assemblers' (54.4%), 'farming, forestry, and fishing' (52.2%), and 'mathematical and computer scientists' (51.1%). The prevalence of moderate LTPA for all occupational groups was 20%. Occupational groups with a high prevalence of moderate LTPA were 'private household and personal services' (27.2%), 'cleaning and building services' (25.7%), 'health services' (24.3%), and 'natural scientists and social scientists' as well as 'precision production and plant operators' (both 23.2%). The prevalence of vigorous LTPA for all occupational groups was 33.8%. Occupational groups with a high prevalence of vigorous LTPA included 'military' (73.6%), 'protective services' (49.9%), 'health-diagnosing' occupations (44%), and 'post-secondary teachers' (42%).

Among the occupational groups with a high prevalence of hypertension awareness (>18.3% in these data, Table 2), all groups indicated their primary level of LTPA was sedentary including 'transportation and material moving' workers (46%), 'truck drivers' (49.3%), 'precision production and plant operators' (48.3%), and 'cleaning and building service' workers (48.6%). Among the occupational groups with a low prevalence of hypertension diagnosis (<18.3% in these data, Table 2), three of four groups indicated their primary level of LTPA was also sedentary including 'health-diagnosing' occupations (41.9%), 'food preparation and service' workers (44.8%), and 'mathematical and computer scientists' (51.1%). 'Military' personnel had too few respondents in this category ($\leq$30) to report per BRFSS research guidelines.[25]

Table 1. Demographics of Employed Adults, WA BRFSS 2003, 2005, 2007, and 2009*

Demographic Characteristics	Sample		Hypertension Awareness	
	n	%	(n)	(%)
Total	**40798**	**-**	**8781**	**18.3**
Gender				
Male	18018	56.2	4293	19.9
Female	22780	43.8	4488	16.3
Age				
18-24 years	2138	11.7	126	5.6
25-44 years	16534	48.1	2033	12.6
45-64 years	22126	40.2	6622	28.8
Race/ethnicity				
White/Non-Hispanic	34677	82.0	7632	19.0
African American/Non-Hispanic	563	1.7	153	24.3
Asian	916	3.2	151	12.7
Native American or Pacific Islander	675	1.9	155	20.1
Other or Multi-National	1114	3.0	271	19.4
Hispanic	2569	6.3	353	11.1
Income				
< $35K	9654	23.9	1970	16.5
$35k to 75k	15782	38.7	3700	20.3
$75+	12568	37.4	2535	17.9
Education				
Grade < 12	2053	6.3	353	13.2
High school graduate or some college	21597	52.1	5133	20.0
College degree +	17112	41.5	3289	16.9
Smoker				
Current	6965	17.4	1437	18.0
Past	10530	23.7	2820	23.7
Never	23136	58.8	4492	16.3
Occupational Physical Activity (OPA)				
Sedentary	26231	64.1	5873	19.3
Ambulatory	8272	21.3	1622	16.2
Laborious	5331	14.6	1077	16.8
Leisure Time Physical Activity (LTPA)				
Sedentary	18902	46.2	4652	20.9
Moderate	8687	20.0	1951	19.9
Vigorous	12758	33.8	2094	13.9
High Cholesterol				
Yes	11015	31.1	4136	35.0
No	21550	68.9	3829	15.7
Obese				
Yes	10141	24.4	3788	33.0
No	28486	75.6	4534	13.7

Diabetes Mellitus				
Yes	2043	4.1	1233	56.6
No	38755	95.9	7548	16.7
Cardiovascular Disease (CVD)				
Yes	962	2.5	563	54.8
No	30273	97.5	6434	17.7
Heart Attack				
Yes	452	1.2	271	60.0
No	30733	98.8	6711	18.2
Heart Disease				
Yes	510	1.3	321	60.4
No	30665	98.7	6640	18.1
Stroke				
Yes	257	0.6	144	48.9
No	30953	99.4	6845	18.5
Health Care Access				
Yes	37933	91.2	8443	19.3
No	2819	8.8	332	8.4

*Weighted %

Table 2. Prevalence of Hypertension Awareness by Occupational Group (29 groups), WA BRFSS 2003, 2005, 2007, and 2009*

Occupational Group Description (1990 Census Occupation Codes)**	Respondents		Hypertension Awareness	
	n	%	(n)	(%)
Total	**40798**	**-**	**8781**	**18.3**
Health-Diagnosing Occupations (084-089)	474	1.3	68	11.8
Food Preparation and Service (433-444)	1197	3.7	197	12.1
Mathematical and Computer Scientists (064-068)	489	1.6	83	13.9
Military (905)	207	0.8	38	14.2
Other Professional Specialties† (164-165; 174-177; 183-199)	1498	3.3	273	14.6
Farming, Forestry and Fishing (473-499)	1429	3.2	291	14.6
Teachers, Post-Secondary (113-154)	336	0.7	61	14.7
Construction and Construction Trades (553-599)	1338	4.0	241	15.1
Health-Assessment and Treating, except RN (096-106)	406	0.9	69	15.2
Private Household; Personal Services (403-407; 456-469)	1112	2.5	210	16.0
Handlers, Equipment Cleaners, Helpers, Laborers (864-889)	1087	3.2	235	16.5
Teachers, except Post-Secondary (155-163)	3167	6.6	624	17.1
Engineers, Architects, and Surveyors (043-063)	1152	3.6	242	17.3
Registered Nurses (RN) (095)	1252	2.3	268	17.6
Sales (243-285)	3387	8.9	734	17.8
Technicians and Related Support (203-235)	2622	6.7	550	18.0
Machine Operators, Assemblers, and Inspectors (703-799)	642	1.7	152	18.7
Natural Scientists and Social Scientists (069-083;166-173)	533	1.2	103	18.8
Protective Services (413-427)	669	2.0	153	20.1
Management-Related (023-037)	2435	5.6	551	20.2
Executive, Administrative, Managerial (003-022)	5359	13.0	1213	20.3
Admin Support, including Clerical (303-389)	4773	10.5	1123	20.7
Lawyers & Judges (178-179)	283	0.7	49	20.7
Health Services (445-447)	1178	2.4	267	21.0
Mechanics and Repairers (503-549)	870	2.4	215	21.1
Cleaning and Building Services (448-455)	692	1.5	159	21.5
Precision Production; Plant Operators (628-699)	1020	2.7	266	22.7
Truck Drivers (804)	574	1.6	170	23.2
Transportation and Material Moving (803; 806-859)	617	1.3	176	26.0

*Weighted %, in response to the BRFSS question, "Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?"

** Occupation Codes based on the 1990 Census Industry and Occupation Classification System

† Other Professional Specialties include: Librarians, Archivists, Curators, Social Recreation, Religious Workers, Writers, Artists, Entertainers, and Athletes

Table 3a. Multivariable Adjusted Odds Ratios of Hypertension Awareness, WA BRFSS 2003, 2005, 2007, and 2009*

Covariate	**Odds Ratio (95 % Confidence Interval)**
Gender	
Male vs. Female	**1.51 (1.38 – 1.64)**
Age	
25-44 vs. 18-24 years	**2.20 (1.43 – 3.38)**
45-64 vs. 18-24 years	**4.84 (3.15 – 7.43)**
Race/Ethnicity	
White/Non-Hispanic vs. all other Ethnicities	0.91 (0.79 – 1.06)
Hispanic vs. all other Ethnicities	**0.66 (0.50 – 0.86)**
Income	
$35k to 75k vs. $75+	**1.22 (1.11 – 1.33)**
< $35K vs. $75+	**1.37 (1.20 – 1.56)**
Education	
Grade < 12 vs. College	1.17 (0.89 – 1.54)
High School Graduate or some College vs. College	**1.24 (1.13 – 1.35)**
Smoker	
Current vs. Never	1.10 (0.98 – 1.24)
Past vs. Never	**1.11 (1.02 – 1.21)**
Occupational Physical Activity (OPA)	
Sedentary vs. Ambulatory	1.08 (0.97 – 1.20)
Laborious vs. Ambulatory	1.11 (0.95 – 1.30)
Leisure Time Physical Activity (LTPA)	
Moderate vs. Vigorous	**1.18 (1.05 – 1.31)**
Sedentary vs. Vigorous	**1.18 (1.08 – 1.29)**
High Cholesterol	
High Cholesterol vs. No High Cholesterol	**2.06 (1.91 – 2.23)**
Obese	
Obese vs. Not Obese	**2.41 (2.22 – 2.61)**
Diabetes Mellitus	
Diabetes Mellitus vs. No Diabetes Mellitus	**2.94 (2.53 – 3.42)**
Health Care Access	
Health Care Access vs. No Health Care Access	**1.58 (1.23 – 2.04)**

* Adjusted for gender, age, race/ethnicity, income, education, smoking status, OPA, LTPA, high cholesterol, obesity, diabetes mellitus, health care access, and occupation (results for occupation shown in table 4b); statistically significant results are in bold type

Table 3b. Multivariable Adjusted Odds Ratios of Hypertension Awareness by Occupational Group, WA BRFSS 2003, 2005, 2007, and 2009*

Occupational Group	**Odds Ratio (95 % Confidence Interval)**
Executive, Administrative, and Managerial	Referent
Mathematical, Computer Scientists	**0.63 (0.44 – 0.90)**
Construction and Construction Trades	**0.64 (0.49 – 0.85)**
Teacher, Post-Secondary	0.70 (0.47 – 1.04)
Health-Diagnosing Occupations	0.71 (0.49 – 1.04)
Librarians, Archivists, Curators, Social Recreation, Religious Workers, Writers, Artists, Entertainers, Athletes	**0.72 (0.57 – 0.90)**
Mechanics and Repairers	0.84 (0.64 – 1.10)
Engineers, Architects, and Surveyors	0.87 (0.69 – 1.08)
Cleaning and Building Services	0.94 (0.63 – 1.38)
Truck Drivers	0.94 (0.68 – 1.31)
Health-Assessment and Treating except RN; Therapist	0.95 (0.61 – 1.50)
Machine Operators, Assemblers, Inspectors	0.95 (0.69 – 1.33)
Technicians and Related Support	0.95 (0.80 – 1.14)
Private Household; Personal Services	0.98 (0.71 – 1.34)
Protective Services	0.98 (0.72 – 1.32)
Transportation and Material Moving	0.99 (0.72 – 1.36)
Natural Scientist, Social Scientists, Urban Planners	1.00 (0.70 – 1.43)
Registered Nurse (RN)	1.01 (0.80 – 1.27)
Management-related	1.03 (0.86 – 1.23)
Military	1.04 (0.63 – 1.73)
Precision Production; Plant and System Operators	1.06 (0.82 – 1.36)
Sales	1.07 (0.91 – 1.26)
Handlers, Equipment Cleaners, Helpers, Laborers	1.08 (0.81 – 1.43)
Admin Support including Clerical	1.08 (0.93 – 1.26)
Health Services	1.11 (0.86 – 1.43)
Teacher, except Post-Secondary, and Counselor	1.11 (0.94 – 1.32)
Farming, Forestry and Fishing	1.12 (0.80 – 1.57)
Food Preparation and Services	1.13 (0.83 – 1.55)
Lawyers and Judges	1.17 (0.73 – 1.88)

* Adjusted for gender, age, race/ethnicity, income, education, smoking status, OPA, LTPA, high cholesterol, obesity, diabetes mellitus, health care access, and occupation; statistically significant results are in bold type

Table 4a. Prevalence of Occupational Physical Activity Level by Occupational Group (29 groups), WA BRFSS 2003, 2005, 2007, and 2009*

Occupational Group	n	Occupational Physical Activity Level					
		Sedentary		Ambulatory		Laborious	
		(n)	(%)	(n)	(%)	(n)	(%)
Total	**39834**	**26231**	**64.1**	**8272**	**21.3**	**5331**	**14.6**
Executive, Administrative, Managerial	5280	4274	79.7	677	14.0	329	6.3
Mathematical and Computer Scientists	484	473	98.1	-	-	-	-
Construction and Construction Trades	1291	216	15.5	237	19.6	838	64.9
Teachers, Post-Secondary	333	305	92.3	-	-	-	-
Health-Diagnosing Occupations	462	355	76.7	92	19.2	-	-
Other Professional Specialties†	1461	1216	83.2	178	12.3	67	4.5
Mechanics and Repairers	839	299	32.0	212	25.9	328	42.1
Engineers, Architects, and Surveyors	1126	1017	91.7	82	6.5	-	-
Cleaning and Building Services	675	85	11.6	322	50.1	268	38.3
Truck Drivers	550	355	58.3	43	9.8	152	31.9
Health-Assessment & Treating, except RN	395	264	65.3	103	28.3	-	-
Machine Operators, Assemblers, Inspectors	618	305	45.8	111	17.9	202	36.3
Technicians and Related Support	2563	1839	72.5	523	19.0	201	8.5
Private Household; Personal Services	1077	559	52.8	337	33.1	181	14.2
Protective Services	655	404	57.8	165	26.9	86	15.3
Transportation and Material Moving	596	431	68.1	68	14.5	97	17.4
Natural Scientists and Social Scientists	521	419	81.3	73	12.9	-	-
Registered Nurses	1221	494	39.0	604	49.8	123	11.2
Management-Related	2403	2184	89.4	164	7.6	55	2.9
Military	199	116	50.4	40	25.1	43	24.5
Precision Production; Plant Operators	982	529	51.3	222	22.8	231	25.9
Sales	3298	2171	65.6	866	26.7	261	7.8
Handlers, Equipment Cleaners, Helpers, Laborers	1056	329	28.1	252	23.6	475	48.3
Admin Support, including Clerical	4705	3976	82.0	517	12.3	212	5.7
Health Services	1130	459	42.0	434	36.5	237	21.5
Teachers, except Post-Secondary	3108	2086	66.0	908	30.4	114	3.6
Farming, Forestry and Fishing	1359	342	19.2	450	37.5	567	43.2
Food Preparation and Service	1167	456	40.5	554	48.1	157	11.5
Lawyers & Judges	280	273	96.8	-	-	-	-

*Weighted %. Categories with <30 respondents omitted per WA BRFSS Codebook guidelines

† Other Professional Specialties include: Librarians, Archivists, Curators, Social Recreation, Religious Workers, Writers, Artists, Entertainers, and Athletes

Table 4b. Prevalence of Leisure Time Physical Activity Level by Occupational Group (29 groups), WA BRFSS 2003, 2005, 2007, and 2009*

Occupational Group	n	Leisure Time Physical Activity Level					
		Sedentary		Moderate		Vigorous	
		(n)	(%)	(n)	(%)	(n)	(%)
Total	**40347**	**18902**	**46.2**	**8687**	**20.0**	**12758**	**33.8**
Executive, Administrative, Managerial	5328	2456	45.9	1126	20.2	1746	33.9
Mathematical and Computer Scientists	487	248	51.1	73	11.8	166	37.0
Construction and Construction Trades	1309	586	45.1	297	20.9	426	34.0
Teachers, Post-Secondary	333	122	36.3	71	21.7	140	42.0
Health-Diagnosing Occupations	470	198	41.9	75	14.1	197	44.0
Other Professional Specialties†	1490	629	43.9	336	19.2	525	36.9
Mechanics and Repairers	863	406	47.0	181	20.4	276	32.6
Engineers, Architects, and Surveyors	1135	498	42.3	212	17.3	425	40.5
Cleaning and Building Services	683	344	48.6	172	25.7	167	25.7
Truck Drivers	563	289	49.3	119	20.8	155	29.9
Health-Assessment & Treating, except RN	403	179	45.1	82	19.0	142	35.9
Machine Operators, Assemblers, Inspectors	629	332	54.4	138	20.1	159	25.6
Technicians and Related Support	2599	1243	47.2	541	19.8	815	33.1
Private Household; Personal Services	1100	500	42.1	279	27.2	321	30.7
Protective Services	662	251	35.6	104	14.5	307	49.9
Transportation and Material Moving	607	282	46.0	135	21.4	190	32.5
Natural Scientists and Social Scientists	531	211	39.5	116	23.2	204	37.4
Registered Nurses	1242	577	45.1	261	20.4	404	34.6
Management-Related	2412	1166	48.2	501	18.1	745	33.7
Military	206	46	17.4	-	-	137	73.6
Precision Production; Plant Operators	1008	492	48.3	237	23.2	279	28.5
Sales	3345	1615	47.6	717	19.3	1013	33.1
Handlers, Equipment Cleaners, Helpers, Laborers	1066	581	55.0	205	18.2	280	26.8
Admin Support, including Clerical	4725	2372	48.2	1076	21.6	1277	30.2
Health Services	1161	578	48.5	287	24.3	296	27.1
Teachers, except Post-Secondary	3143	1343	42.0	713	21.6	1087	36.4
Farming, Forestry and Fishing	1395	704	52.2	289	18.2	402	29.6
Food Preparation and Service	1173	538	44.8	268	19.7	367	35.5
Lawyers & Judges	279	116	46.9	53	13.4	110	39.7

*Weighted %; Category with ≤30 respondents omitted per WA BRFSS Codebook guidelines

† Other Professional Specialties include: Librarians, Archivists, Curators, Social Recreation, Religious Workers, Writers, Artists, Entertainers, and Athletes

Chapter IV: Discussion and Conclusions

This multi-year study, representative of Washington State workers, is the first to our knowledge to investigate an association of hypertension awareness across occupational groups based on detailed BRFSS survey information including levels of physical activity. Approximately one in five participants reported a diagnosis of hypertension, nearly two-thirds of all participants reported sedentary activity at work, and nearly one-half reported sedentary activity when not at work. The odds of hypertension awareness were not statistically significant for most occupational groups when compared to 'executive, administrative, and managerial' occupations. However, three occupational groups showed statistically significant lower odds of hypertension awareness.

These results contribute to the scientific literature that there is an association between occupation and hypertension awareness. High stress levels such as high psychological demands, high noise levels, and low decision latitude are all occupational factors which have been associated with elevated blood pressure.[26, 27, 28, 29, 30] Many of our study's occupational groups reflect similar stress factors, including the referent group, 'executives, administrators, and managerial' occupations, and this group has been shown to have high odds of self-reported hypertension in another study based on the National Health and Nutrition Examination Survey (NHANES).[14] 'Transportation and material moving' occupations, for example, had the highest prevalence of a hypertension awareness (26%), and yet, in multivariable analysis, no significant difference was found between this group and our referent group.

Occupational groups with significantly lower odds of hypertension awareness included 'mathematical and computer scientists' [AOR 0.63; 95% CI (0.44 to 0.90)], 'construction and construction trades' [AOR 0.64; 95% CI (0.49 to 0.85)], and 'librarians, archivists, curators,

social recreation, religious workers, writers, artists, entertainers, and athletes' [AOR 0.72; 95% CI (0.57 to 0.90)]. Our study's odds of hypertension awareness were lowest among occupations that generally involved tasks that focused on science or creative endeavors and religious service or, in the case of 'construction or construction trades,' primarily performed heavy labor/physically demanding work. These findings are also consistent in the study using NHANES data in which scientists, who were grouped with engineers and architects in this instance, self-reported a low prevalence of hypertension [15%, 95% CI (11.0-20.1)].[14] These occupations may afford employees greater autonomy in respect to occupational factors, such as creative endeavors, working from home, choice of work-shift, or selecting flexible hours. However, research on the health of 'mathematical and computer scientists' is scarce and therefore research is needed to understand this relationship. Certainly, this group did not indicate that they were physically active in our study. 'Mathematical and computer scientists' had the highest prevalence among all the occupational groups for sedentary OPA (98.1%), and had indicated their level of LTPA was primarily sedentary (51.1%). 'Librarians, archivists, curators, social recreation, religious workers, writers, artists, entertainers, and athletes' also indicated their levels of physical activity were primarily sedentary: sedentary OPA (83.2%) and sedentary LTPA (43.9%).

In the case of 'construction and construction trades', our findings were again consistent with the study using NHANES data in which prevalence of self-reported hypertension was low [13.8%, 95% CI (9.9 to18.9)].[14] The 'Construction and Construction Trades' group far exceeded all other occupational groups in our study for the highest prevalence of laborious OPA (64.9%). Moreover, 'construction and construction trades' is an occupational group that has not followed the general trend of declining occupational physical exertion intensity. [16] The group's LTPA was

not likely to account for the low odds of hypertension as the group indicated their level of LTPA was primarily sedentary (45.1%).

Sedentary occupations are associated with an increased prevalence of obesity, a known risk factor for hypertension.[31] The higher prevalences of primarily sedentary OPA observed is consistent with the national trend of declining OPA observed over the past five decades. Self-report of OPA using BRFSS data has shown test-retest reliability and strong correlation with observed occupational physical activity [kappa=0.71; 95% CI (0.49 to 0.94)].[32] Moreover, the number of adults reporting levels of LTPA consistent with the 2008 Physical Activity Guidelines for Americans in the literature remains low and decreases with age.[33, 34] Only thirty-three percent of respondents in a study examining awareness of current US physical activity guidelines had direct knowledge of the recommended levels (i.e., frequency and duration).[35] Yet, adherence to physical activity guidelines is associated with 27% lower all-cause mortality among adults without existing chronic conditions such as diabetes mellitus, cancer, myocardial infarction, angina, CVD, stroke, or respiratory diseases, and with 46% lower mortality among people with chronic comorbidities.[36]

Limitations of our study include self-report of hypertension diagnosis by a medical provider. The effect of the self-report of hypertension was expected to be minimal based on evidence from existing literature: the rates for self-report of hypertension were similar to rates for other national surveys and also to examination-based estimates.[37, 38] Grouping of occupations may have limited our ability to investigate specific occupations, however, a larger sample size would be needed to analyze for all 502 occupational groups. Also, being aware of one's diagnosis of hypertension implies that the individual had access to a health care professional. This leaves open the possibility that participants in our survey may not have reported

hypertension either because they had not seen a health care professional or had other barriers hindering learning or communication. For example, the prevalence of hypertension awareness among adults with less than a 12^{th} grade education (13.2%) was below that of higher educated groups and well below that of the average prevalence. Adults with less than 12^{th} grade education might have been more likely to have low-paying jobs without health care benefits and might possibly have had greater learning or communication difficulties. Another limitation was that our study is cross-sectional in design, which does not include information about change over time, including progression of disease, or give us insight into the cause and effect relationships. Finally, our study did not contain information on previous employment, nor did we have data on specific work stress factors or psychosocial conditions.

Our findings add to the increasing evidence that an individual's occupation has important implications for his or her risk of hypertension. High stress occupations may be particularly challenged to implement effective hypertension control programs and strategies, and in our fast-paced society, Americans face difficulties increasing their levels of physical activity to healthy levels. Hypertension control programs may need more rigorous strategies to be effective at reducing job stress, such as providing preventive counseling and education and making work-place modifications. Improved blood pressure control among workers could improve productivity lost to illness and disability as well as reduce the healthcare cost associated with the long-term effects of hypertension.

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