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Understanding Occupational Injuries

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ABSTRACT

UNDERSTANDING OCCUPATION INJURIES

The purpose of this project is to better understand the potential negative impact of longer commute times on work-related health complaints and its relationship with frequency of work-related injuries among general assembly workers from various factories in the Bay Area. Companies in the United States seek to reduce the cost of work-related injuries by investigating the causes of and implementing necessary programs in their workplaces. According to the U.S. Census Bureau, there are about 115,000 employees who spend more than 90 minutes commuting to their jobs in the San Francisco Bay and San Jose Silicon Valley areas (2013). However, there are no studies in the Bay Area that address potential correlation of work-related injuries and commute time. The targeted population for this study is general assembly workers in the Bay Area who are clients at Access Omnicare, an occupational clinic in Fremont, CA. The study included a survey, Hege Eriksen's Subjective Health Complaints (SHC) Inventory. The SHC Inventory was used to measure outcome variables such as symptoms of musculoskeletal, psychological, and gastrointestinal disorders. Moreover, clients' demographic data were collected to examine how their exposure variables such as age, length of, and method of commute, and years of employment, are associated with the outcome variables. The methods of analysis applied were multiple regression and linear regression. The results revealed that female assembly workers reported increased number of work-related injuries and that length of employment and musculoskeletal complaints may be the predictor variables for occupational injuries. Moreover, each subscale from SCH showed a relationship to the number of occupational injuries in 1 year. Although the length or mode of commute did not show correlation with occupational injuries; the majority of participants stated that they believe that longer commutes cause harm in their health. It is hoped that this project will encourage other researchers and various factories in the Bay Area to develop programs and policies that better support the assembly workers and decrease the frequency of occupational injuries.

Hanbit (Joyce) Choi
April 2018

UNDERSTANDING OCCUPATIONAL INJURIES

by

Hanbit (Joyce) Choi

A project

submitted in partial

fulfillment of the requirements for the degree of

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Doctor of Nursing Practice

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APPROVED

For the California State University, Northern Consortium
Doctor of Nursing Practice:

We, the undersigned, certify that the project of the following student meets the required standards of scholarship, format, and style of the university and the student's graduate degree program for the awarding of the doctorate degree.

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It is my hope that this study be used to shine a light for those who are vulnerable in their work places.

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CHAPTER 1: INTRODUCTION

According to the U.S. Census Bureau, there are about 115,000 employees who spend more than 90 minutes to commute to their jobs in the San Francisco Bay area and San Jose Silicon Valley areas (2013). Due to the high cost of living in the Bay Area, there are increasing numbers of workers who choose to commute from the outskirts. Fatigue is inevitable for the employees who work longer hours and spend additional hours to commute. Fatigue is defined as "a condition that causes distress and decreased ability to function due to lack of energy; a sense of tiredness or exhaustion that limits an individual's ability to perform usual activities" (Smith, 2004, p. 39).

The Bureau of Labor Statistic (BLS) stated in 2014 that approximately 32 percent of reported occupational injuries were Musculoskeletal Disorders (MSDs) in origin. In addition, approximately 3 million workers in private industry and 821,000 workers in state and local government were reported to have experienced a nonfatal occupational injury or illness in 2010 (Baron, Steege, Marsh, Menéndez, & Myers, 2013). To reduce or eliminate costs of preventable injuries and to improve the well-being of the employees, any possible hazards in the workplace must be removed. According to the Occupational Safety and Health Administration (OSHA), the United States spends approximately 1 billion dollars per week on the Worker's Compensation program (2016). This social insurance

provides medical benefits and protects workers from some of the economic consequences of occupational injuries (Olliffe & Han, 2014). Due to the repetitive and long hour of labor at work, assembly workers have an increased incidence of work related injuries (Menegon & Fisher, 2012).

Purpose of the Study

Although there are many studies that relate fatigue and repetitive tasks with occupational injuries, there are few, if any, studies on the impact of commute time on occupational injuries. The aims of this study is to understand the potential impact of longer commute times on work-related injuries and the general perception of health among the general assembly workers from various factories in the Bay Area. The goals of the study are to examine if there is any relationship between: commute time, work-related injuries, and subjective health complaints in general assembly workers. The justification of this project is to decrease the number of occupational injuries among assembly workers in the Bay Area, CA, and reduce the associated cost of occupational injuries. The findings of this study may influence companies to invest in new and current policies and programs that will decrease any harms associated with longer commute time for their employees.

Hypothesis

- 1) Assembly workers who commute more than 1 hour per journey are likely to have symptoms that may contribute to work related injury.
- 2) Assembly workers who commute more than 1 hour per journey are associated with worse perceptions of health than those who commute less than 1 hour per trip.
- 3) Assembly workers who commute more than 1 hour per journey have increased incidents of work related injury.

CHAPTER 2: LITERATURE REVIEW

Literature Review

Many researchers have reported that a longer commute is associated with negative health outcomes. Hansson and his colleagues conducted a cross sectional study to investigate associations between commuting and health outcomes in Sweden (Hansson, Jakobsson, Mattisson, Bjork, & Ostergren, 2011). The researchers were also interested in observing the differences between employees' subjective feelings about commuting to work before and after each trip. For the study, researchers turned to the database from the public health survey of Scania, Sweden. The responses of eligible 21,088 participants' responses were analyzed. The participants met the inclusion criteria of: residents of Sweden, between the age of 18 and 64, and working more than 30 hours per week (Hansson et al., 2011).

The researcher included survey to gain information about the participants' mode and length of commute, their perceived sleep quality, subjective everyday stress level, mental health, self-rated health, and reported sickness in the last 12 months. The subjective survey questions' validity could not be evaluated according to Hansson et al. The researcher applied multivariate analysis and found that there was a close interaction between mode and length of commute (exposure variables) with both perceived sleep quality ($p=0.06$) and stress ($p=0.08$).

However, it was inconclusive that exposure variables were related to self-reported health ($p=0.20$), exhaustion ($p=0.30$), low general mental health ($p=0.46$), or sickness/absence of more than 5 days ($p=0.79$) (Hansson et al., 2011). Although this research was conducted in Sweden and may not be representative of the U.S. population, the large sample size makes the results robust. However, the nature of a cross sectional study design means the result only shows close associations between variables and these variables were interpreted in isolation. Therefore, this study cannot conclude that a longer commute causes negative health outcomes.

Gatersleben and Uzzell conducted a similar study to examine how different methods of commute affect people's attitude about health. Researchers sent an email invitation to all employees of the University of Surrey, U.K. to participate in the study. A total of 389 employees participated in the study and the survey. The study included a survey posted on the university's website, which could be completed online. There were no other inclusion criteria mentioned in the study. The survey questionnaires included 11 sections and participants were asked to provide their method of commute, length of commute, their subjective stress level with commute using a Likert scale (Gatersleben and Uzzell, 2007). Gatersleben and Uzzell stated that the survey questionnaires were aimed to measure a participant's attitude, intention, and their psychological responses to commute.

However, they did not offer any information of validity or reliability of the survey tool in their study. A series of chi-square tests were done for the analysis. The researchers found that increased level of stress showed a positive correlation with each travel distance ($p < 0.001$) and travel time ($p < 0.001$) (Gasterlesben & Uzzell, 2007). Through a regression analysis, they found that the most significant factor that correlates with a participants' stressfulness of commute was mode of travel ($\beta = .37, p < .001$). Gasterlesben and Uzzell concluded that when employees have an easier mode of commute, they responded positively to their overall commute experience.

A cross-sectional study to investigate subjective health complaints (SHC) in their association with duration of commute was conducted in Norway by Urhonen, Lie, and Aamodt. They recruited 2,215 individuals via e-mail from the Norwegian Train Drivers Union and the Norwegian Union of Railway for the study (2016). The SHC survey was originally created by H.R. Eriksen and its purpose was to measure the prevalence of commonly reported subjective health complaints in the general population. The questionnaires were available on the website, Survey Monkey, and the participants were to report their musculoskeletal, gastrointestinal, and neurological complaints, as well as their stress level and their commute time. Although the researchers stated that the SHC survey tool has been proven reliable in the past, this article does not provide any measurement of the

survey's validity or reliability. To study the associations between variables, researchers applied chi-square tests. They found that participants with long duration of commute (more than 60 min) reported more musculoskeletal pain ($p < 0.001$), pseudo-neurologic complaints ($p < 0.001$), and gastrointestinal problems ($p = 0.003$) than participants shorter duration of commute (Urhonen, Lie, & Aamodt, 2016). These results lend credence to the idea that people with a longer commute are more vulnerable to musculoskeletal, pseudo-neurologic, and gastrointestinal disorders.

A qualitative study was done by Jones and Ogilvie to explore the reasons people give for commuting. Jones and Ogilvie included 26 participants from the Commuting and Health in Cambridge study cohort in the U.K (2012). The participants were interviewed regarding their experiences and travel behaviors and their responses were recorded digitally at participants' homes or workplaces. Interview questions were discussed between the researchers and other members of the Commuting and Health in Cambridge study team to validate the emerging findings (Jones & Ogilvie, 2012). Jones and Ogilvie found that efforts to promote active commuting may be most effective when not emphasizing the potential health benefits. In addition, they found that people were more motivated to walk or bike to work when the relative convenience, cost, speed and reliability were improved (Jones & Ogilvie, 2012). This study provides a new perspective

regarding people's decision to commute and why people choose to commute despite negative health outcomes. In additions, it invites researchers to investigate how participants' subjective health is impacted by their daily commute.

Louise-Hill, a Ph. D. student from University of California, San Francisco, conducted a study in 2014 to explore factors that were associated with work related injuries in an urban area. For her cross-sectional study, she recruited 134 participants between ages 18 to 80, who were working full time from a federal qualified community health center in California. The participants were reached by mail to complete the Primary Care Occupational Injury and Employment Experience Survey (PCOIEES) and the Adverse Childhood Experience (ACE) Questionnaire. Participants they were compensated monetarily for participating in the study (Louise-Hill, 2014). Lousie-Hill stated that the ACE questionnaire is reliable with scores between 0.56 and 0.72 for Cohen's kappa coefficients. Chi-squared tests and ANOVA were used to analyze the data and Louise-Hill found that amongst 134 individuals, 51% reported work-related injuries, and 43% reported health problems exasperated by work. Moreover, work related injuries were closely associated with participants who had adverse childhood experiences ($p=0.037$), who were non-Latino or white ($p=0.004$), and who had history of smoking ($p=0.037$) (Louise-Hill, 2014). This study suggests more studies to

investigate factors that are associated with frequency and severity of work-related injuries.

To explore the association between physical activity and leisure time in older adults, Mourao, Novais, Andreoni, and Ramos (2013) conducted a cross-sectional study. The study included 319 individuals who were older than 60, via the cluster sampling method in Maceio, Brazil. The participants completed the International Physical Activity Questionnaire at their residence. The researcher used multiple regression to analyze the effect of their exposure variables on their outcome variables. The outcome variables for the study were BMI of participants and their perspective on their health. Some of the exposure variables that were analyzed include: participants' length of, and method of, commute (sedentary or active); and physical activities during occupational and leisure time; participants' sex; age; education level; and income level. Mourao and his colleagues found that 87.5% of participants whose commuting style were sedentary and who had higher educational levels, reported dissatisfaction with their physical health. Additionally, 76.2% of those who were not active during their leisure time and earned less income, reported dissatisfaction with their health. The researchers concluded that no significant associations were found between each exposure variable and participants' BMI (Mourao, Novais, Andreoni, & Ramos, 2013). The researchers concluded that sedentary method of commute is associated with negative

perspective on health. The use of probabilistic sampling method, cluster sampling, adds strength to the findings of this study as a probabilistic sampling offers a degree of randomization so that the sample group and the results of the study can be better generalized compared to studies that utilize non-probabilistic sampling.

Mauss, Jarczok, and Fischer (2016) from the Mannheim Industrial Cohort Studies in Germany conducted a cross-sectional study to examine if daily commute to work has any negative effects on their working population's health. The targeted population of the study was employees from an airplane manufacturing plant in southern Germany. Employees of the company had an opportunity to volunteer September 2009 and May 2011 in a health risks assessment during their working hours between. A total of 3,805 employees participated in the study they were asked to rate their subjective health such as their perceived stress, exhaustion, sleep quality and they also reported their duration of commute in the Likert-type scale. Then the researchers measured the participants' BMI, waist circumference, blood pressure, fasting sugar level, and total cholesterol level. This study was approved by the Medical Ethic Committee of the Medical Facility Mannheim from the Heidelberg University, Germany (Mauss, Jarczok, & Fischer, 2016).

In the study, ANOVA, Pearson correlation, and linear regression models were used to analyze the data. The researchers found that a longer duration of

commute did not associate with self-rated variables such as participants perceived stress, exhaustion, and sleep quality. Instead, they found that longer commute was inversely associated with triglycerides ($r = 0.04, p < 0.05$) and it showed strong correlation with participants' waist circumference ($r = 0.04, p < 0.05$) (Mauss, Jarczok, & Fischer, 2016). Although their study showed that daily commute did not negatively impact employees' health, they did not examine different methods of commute; it is possible that some methods of commute have varying impact on the employees' health. For some employees, longer time to commute may be due to biking, walking to work. These employees may feel indifferent about their health in relationship to their daily commute. Although the sampling method was not randomized, the large number of participants allowed the researchers to generalize their findings for the general industrial workers in Germany. However, it possible that this study does not represents a general industrial population in the United States.

Conclusion of Literature Review

There is a need to understand the correlation between the rate of work related injuries and duration of commute in the United States. None of the studies in the preceding literature review answers the question, "Does a longer commute duration increase work related injury and negatively impact subjective health among general assembly workers in the Bay Area?" As there are increasing

numbers of the population and job opportunities, a population experiences a longer commute daily in the Bay Area (U.S. Census Bureau, 2013). There must be studies done for this specific population to see how a longer commute duration and a method of commute contribute to workers' health and if they play a major role in occupational injury. This study directly addresses the impact of longer commute times on occupational injury instead of an indirect impact via fatigue, which would then cause occupational injuries. Therefore, this study offers different perspective on how researchers and employers can work together to create a better work environment for the assembly workers.

Theoretical Framework

The Health Belief Model (HBM) is the selected framework for this study. The health belief model (HBM) was chosen because it emphasizes gathering data from participants to identify the cause of a problem and helps researchers to create interventions for the targeted population (Cummings, Jette, & Rosenstock, 1978). Hochbaum, Rosentock, Leventhal, and Kegels, the developers of the HBM, stated that in order for individuals to adopt health promoting behaviors, they must first perceive the severity of a health problem and its consequences (Rosenstock, Strecher, & Becker, 1988). When individuals understand that a health problem can cause discomfort, pain, and even death, then they are more likely to act to avoid it. This framework was applied to find the significant predictors for the work-related

injuries and examine if a longer commute significantly increases the incidence of work-related injuries and is negatively related to perceived health of the participants.

CHAPTER 3: METHODOLOGY

Purpose of the Study

The aim of this doctoral project is to better understand the potential impact of longer commute duration on work-related injuries and its association with perception of health among the general assembly workers from various factories in the Bay Area. A cross sectional study including a survey was done to test this study's hypothesis, "a longer duration of commute contributes to frequency of occupational injury," and "a longer duration of commute is negatively associated with a general assembler's perception of health." Moreover, an optional question, "Do you think your length or mode of commute influences your health?" was asked to assess participants' perspective on their health and its relationship with commute. The data were interpreted the data using statistics.

Location

The project took place at Access Omnicare, an occupational clinic in Fremont, California. The site approval was received by the Medical Director, Troy Manchester. The address is 39180 Farwell Drive, Suite 231 Fremont, CA 94538. The data collection portion of the project began in July 2017 and ended in September 2017. IRB approval was received by Dr. Troy Manchester on May 4th, 2017 and on June 8th, 2017 from CSU Fresno.

Participants

The targeted population for this study was general assembly workers in the Bay Area who were clients at the Access Omnicare. In order to participate in the study, the employees had to be older than 18 years old and younger than 66 years old and were able to speak and read English. Employees who provided other services such as engineering, designing, on-site nursing, and accounting, were excluded from this project. Eligible candidates were given an informed consent form in the waiting room by the researcher at Access Omnicare in Fremont, California. The informed consent form contains a brief introduction about the purpose of the study. If candidates decided to participate in the study, then they were asked to answer the survey questions in the waiting room before they were seen by a medical provider. Survey questions took about 5-10 minutes to complete. Each participant was able to participate only once for this project.

Procedure

This cross-sectional study utilizes Eriksen's Subjective Health Complaints (SHC) Inventory survey. For cross sectional studies that involve surveys, it is not uncommon for researchers to utilize validated survey questionnaires from a different author to further minimize self-reporting bias. The SHC inventory offers an efficient and reliable way to numerate subjective health complaints from the general working population during the last 30 days. The SHC inventory is

composed of 29 Likert-scale questions that are easy to comprehend, and it has been validated by the public health community since 1999 (Urhonen, Lie, & Aamodt, 2016). Cronbach's alpha values were 0.82 for women and 0.75 for men (Eriksen, Ihlebaek, & Ursin, 1999). Permission to use the study was gained by the author.

SHC inventory questions are using Likert type scale and range from “not at all (0)” to “serious (3) (Eriksen et al. 1999).” In a similar study, Urhonen and colleagues (2016) categorized questions into five subscales to measure dependent variables such as musculoskeletal pain (headache, migraine, neck pain, lower back pain, upper back pain, arm pain, shoulder pain, and leg pain); pseudo-neurology (palpation, heat flushes, sleeping problems, tiredness, dizziness, anxiety, depression); gastrointestinal disorders (heartburn, stomach discomfort, ulcer and non-ulcer dyspepsia, stomach pain, bloating, diarrhea, and constipation); allergies (asthma, breathing difficulties, eczema, allergies, and chest pain), and influenza-like symptoms (cough and flu). To analyze data for five different SHC subscales, the researcher summed the values of degree of complaints in each subscale.

Demographic Questionnaire

The demographic questionnaire had nine multiple choice questions and one optional question. The questionnaire was given to obtain demographic data to

collect variables such as age, sex, length, distance, mode of commute, and years of employment. Participants were also asked about their subjective view on duration and mode of commute and its relationship with their health. Moreover, participants were asked to report how many work-related injuries they had over 1 year. The number of injuries in 1 year was separated into five groups: 0 (1), 1-3 (2), 4-7 (3), 7-9 (4), and more than 10 (5), and this value was used as the dependent variable for the study. The researcher categorized length of employment into six groups: less than 6 months (1), 6 months-1.5 years (2), 1.6-2 years (3), 2.1-3 years (4), 3.1-4 years (5), and more than 4 years (6). Length of commute per journey was categorized into four groups: less than 30 min (1), 30-59 minutes (2), 60-89 minutes (3), and more than 90 minutes (4). Distance of commute per journey were categorized into five groups: 0-14 miles (1), 15-29 miles (2), 30-44 miles (3), 45-59 miles (4), more than 60 miles (5). Variables were further categorized in smaller subgroups so that the researcher can better explore to what degree contributing factors correspond with work-related injuries. The mode of commute was grouped into five categories: walk (1), bike (2), private car (3), public transit (4), and carpool (5). Participants were also asked to write their work status: full time, part time, and no longer employed, and if there was any change in their mode of commute.

Potential Benefits

This project was designed to examine if there is any relationship between: length of commute, number of occupational injuries in one year, and subjective health complaints. If any negative association is found, then the project's findings could be used to create policies and programs to protect the employees from an increased rate of occupational injury. All subjects who participate in the study could increase their awareness of their health by answering questions about their subjective perception of health. Participating in the study may encourage them to live a healthier life. No immediate gain for the subject population was noted.

Precautions to Minimize Risks

The risk of social pressure was reduced through an emphasis on voluntary participation. The participants were allowed to withdraw from the project at any time without prejudice or penalty. Moreover, the researcher provided a short and easily understood survey questions to the participants to minimize time consumption. In addition, confidential precautions were implemented by keeping all information at the researcher's private office, stored in a locked drawer. All materials collected were private and did not include names, ethnicity background, gender, or social security numbers. All subjects were asked to write their names to maintain anonymity and confidentiality. Only the researcher of this project had

access to the lock. All documents were destroyed by shredding after project completion.

Data Analysis

In the study, predictor/independent variables are: age, length of employment, length of commute, distance of commute, mode of commute, musculoskeletal complaints, pseudo-neurological complaints, gastrointestinal complaints, allergy, and influenza-like symptoms. The dependent variable is number of occupational injuries in a 1-year period. Both linear and multiple regression were used to see if one or multiple independent variables were significant to the dependent variable.

Multiple regression is one of the statistical analysis methods that is used to find any association between multiple explanatory variables and multiple outcome variables. One can assume that one independent variable, such as a lengthy commute, cannot be entirely responsible for causing a complex outcome such as an occupational injury. Use of multiple linear regression prevents researchers from drawing an over-generalized and simplified conclusion. By taking consideration of multiple independent variables at once, researchers can also minimize any errors involving confounding variables (Leech, Gliner, Morgan, & Harmon, 2003).

Moreover, a two-tail t-test was applied to examine a significant relationship with an independent variable between unequal numbers of groups.

Limitations

Some limitations of the project were restricted participation time and the small number of participants. Not all eligible participants were able to take part in the project, and they only could share limited number of minutes of their time due to their private schedule. For this reason, any written survey about their satisfaction and feedback of the project were omitted. In addition, the sample of the study was collected via a convince sampling method and the data was collected only at one location. This may have screwed the result as the participants may not be representative of assembly workers in the Bay Area. Other statistical analysis methods (NIST Sematech, 2015) were excluded because they are beyond the scope of this project.

Conclusion

The project was well received by the participants. Participants stated that the presentation was easy to follow and that it motivated them to reflect on their health. One participant reported that it was a great exercise to evaluate his own health and the study motivated him to be more physically active and make healthier choices in his life. A few patients declined to answer the surveys as they

believe that this project was not going to benefit the workers. Moreover, some participants declined to answer as they viewed survey questions as not related to their work or their own health.

CHAPTER 4: Results

Review of Methodology

The data collection period took place from July to October 2017.

Approximately 70 patients from Access Omnicare, Occupational Clinic, were approached to take part in the project, however, only 53 agreed to participate. Three participants did not complete the survey, therefore, only 50 participants' data were analyzed for this project. The number of participants who met the inclusion criteria was limited and that may have skewed the results due to the small sample size (NIST Sematech, 2015).

Results

This survey included 13 females (26%), 36 males (72%), and one non-binary participant (2%). The age ranged between 18 - 65 ($M=41$, $SD=13.19$) years old as shown in figure 1. The mean for female's age was 43.46 ($SD=14.05$) and for male was 38.92 ($SD=13.07$). Figure 2 shows that majority of participants' mode of commute was driving their private car. As shown in figure 2 and 3, five participants reported that their distance of commute per journey was longer than 60 miles (10% of participants), 12 participants reported that their duration of commute per journey was between 60-89 minutes (24%), and 1 participant reported it was more than 90 minutes (2%). Using a two tailed t-test, it was found

that females reported significantly increased number of work-related injuries compared to males $t(47)=2.06, p<0.05$).

Table 1

Two Tailed t-test to Compare Number of Injuries between Different Genders

	<u>Female</u>		<u>Male</u>		t(df)	p
	M	SD	M	SD		
Injury	2.54	0.52	2.08	0.73	2.06(47)	0.05*

Note. Injury refers to number of injuries in a 1-year period.

*The p value was 0.045 and is significant at the 0.05 level.

Figure 1. Box and whisker plot for participants' ages.

Figure 2. Pie chart for participants' mode of commute.

Figure 3. Pie chart for participants' distance of commute.

Figure 4. Pie chart for participants' distance of commute.

In addition, when all the predictor variables (age, length of employment, length of commute, distance of commute, mode of commute, musculoskeletal complaints, pseudo-neurological complaints, gastrointestinal complaints, allergy, and influenza-like symptoms) were examined with multiple regression, a significant multiple regression equation was found ($F(10, 39) = 3.73, p < 0.01$) with R^2 of 0.49. The multiple R square value shows that all the predictor variables combined account for approximately 50% of variance in work-related injuries in this population. Length of employment and musculoskeletal complaints were the two predictor variables that were significant in this analysis as shown in the Table 2.

Table 2

Multiple Regressions Anyalysis Summary for Variables Predicting Annual Injury

Variable	<i>B</i>	<i>SE B</i>	<i>t</i>	<i>p</i>
Age	0.00	0.01	-0.16	0.87
Length of Employment	0.12	0.06	2.06	0.05*
Length of commute	0.09	0.16	0.55	0.59
Distance of commute	-0.02	0.11	-0.21	0.84
Mode of commute	0.01	0.15	0.06	0.95
Musculoskeletal Complaints	0.07	0.02	3.30	0.00**
Pseudo-neurological complaints	-0.02	0.03	-0.59	0.56
Gastrointestinal complaints	0.06	0.06	1.06	0.30
Allergy	0.03	0.07	0.45	0.65
Influenza-like symptoms	0.12	0.11	1.10	0.28

Note. $R^2=0.49$ (N=50), $p< 0.05$.

*The p value for length of employment was 0.046.

**The p value for musculoskeletal complaints was significant at .01 level.

Moreover, when a simple linear regression was calculated, a significant linear regression equation was found between the length of employment and the number of work-related injuries in 1 year ($F(1,48)=4.14$, $p< 0.05$) with an R^2 of 0.08. This implies that the length of employment is a significant predictor variable

for the independent variable, the number of injuries in 1 year. Additionally, each subscale of SHC had a significant linear regression equation with the number of work-related injuries in 1 year as shown in Table 3.

Table 3

Simple Regression and Equations of SHC subscale and its Relationship with Number of Injury

	F	p	R ²	Equation
Musculoskeletal complaints	24.17	0.00	0.33	$y=1.59+0.09x$
Pseudo-neurological complaints	5.34	0.03	0.10	$y=2.00+0.05x$
Gastrointestinal complaints	8.45	0.01	0.15	$y=2.05+0.13x$
Allergy	9.87	0.00	0.17	$y=1.10+0.16x$
Influenza-like symptoms	5.40	0.02	0.10	$y=2.08+0.26x$

Note. y represents prediction of number of work-related injuries, a represents intercept, b represents coefficient of each predictor variable, and X represents value of predicable variable (Likert-type scales scoring of SHC).

Another notable finding of the study lies in the answers to the optional question. When participants were asked the optional question, “Do you think your length or mode of commute influences your health?” 22 people said yes, 13 people said no, and 15 people did not respond to this question. Some participants explained their subjective view on their commute and its relationship with health. Majority of participants who said “yes,” stated that a longer commute causes fatigue and increases stress. Moreover, they voiced that sitting in their vehicles after performing repetitive tasks at work increases stiffness of their bodies. One participant stated that some of his coworkers choose to sleep in their vehicles when they work a 12 hour or longer shift to get a little more sleep. Another participant wrote, “... longer commutes create more stress for the workers during the ride to work, which could possibly impact their mental health.” Moreover, several other participants also voiced that feel that a longer commute affects their mental health as much or even more than their physical health. One participant who carpool with his coworker to commute more than 60 miles per journey responded “no” for the optional question. However, he added that he volunteered to work a 2pm-10pm shift to avoid rush hour and if he was not carpooling with a coworker, then he “... would never work this far away from home.”

Conclusion

This project had approximately 93% of completion rate as three participants out of fifty-three participants did not complete the survey. This study revealed that female assembly workers reported increased number of work-related injuries and that length of employment and musculoskeletal complaints may be the predictor variables for occupational injuries. Moreover, each subscale from SCH (musculoskeletal complaints, pseudo-neurological complaints, gastrointestinal complaints, allergy, and influenza-like symptoms) showed a relationship to the number of occupational injuries in 1 year. Although the length or mode of commute did not show any correlation with occupational injuries statistically, the majority of participants stated that they believe that longer commutes cause harm in their health.

CHAPTER 5: DISCUSSION AND CONCLUSION

Limitations and Recommendations

The results of the study imply that musculoskeletal complaints and length of employment account for a significant amount of variability in an employee's number of work-related injuries in 1 year. Simple regression shows that there is a relationship between each subscale of SHC and the number of occupational injuries per year. However, using multiple regression analysis, only musculoskeletal complaints from SHC and the length of employment were significant predictors when controlling for all the independent variables. In addition, a two-tailed t-test analysis showed that female workers were more likely to get injured when compared to male workers. Nevertheless, we should consider that the sample size was 50 which consisted of 13 females, 36 males, and 1 nonbinary individual. The small sample size may have skewed the result. The result may have been different if the researcher had a larger sample and had equal or close to equal participants from each gender.

In addition, although the majority of participants answered “yes” to the optional question, “Do you think your length or mode of commute influences your health?” the result of a two-tail t-test assuming unequal variance analysis was not significant. This may be due to various reasons such as participants' belief in commute time and its relationship with occupational injury. Moreover, they may

not currently have a longer commute, or they may have answered the questions based on of their friends and family's experience. However, if more participants responded to the optional question, then the result may have been different and could offer more of an insight to future researchers regarding their health and length or mode of commute. In the future, project conductors can increase the number of participants and obtain a more representative pool by conducting the project at multiple locations.

This project does not investigate its actual use in practice. It does not provide any insights for participants to avoid occupational injuries. For future studies, project conductors could use this study and the participants' feedback from the optional question which indicates possible interventions to decrease occupational injuries. Although this study does not reveal any direct association with a longer commute and increased frequency of work-related injuries, there are many studies that link a longer commute with fatigue and fatigue with a higher rate of occupational injury. Moreover, many research, including this study show that a longer commute is associated with negative subjective health complaints among employees. Based on the studies' findings, companies in the Bay Area should seek to reduce the cost of work-related injuries and prevent associated injuries for the targeted population. This study will be used as a reference for other

researchers to design implementations to lessen the frequency and severity of work-related injuries among the general assembly workers.

Implication for Future Practice

Some innovative companies in the Bay Area such as Tesla Motors, understand the importance of supporting and providing services to their employees to reduce fatigue and its related occupational injuries. For example, Tesla Motors has a gym and encourages their employees to engage in an exercise program as a study shows that physical exercise can reduce musculoskeletal pain from performing repetitive tasks (Fletcher, Behrens, & Domnia, 2008). Moreover, Tesla Motors provides shuttle buses for their employees and even provides monetary incentives to workers who bike or walk to their office located in Palo Alto, CA (Fehely, 2017). Their motive behind this action was to reduce overflow of parking and these services are not yet provided in their factory site in Fremont, CA. However, the company will soon adopt the same approach for their general assembly workers if evidence proves that these implementations can substantially reduce their company's cost of occupational injuries among assemblers.

Interacting with human resource representatives from various factories in the Bay Area is highly recommended for future researchers. By doing so, future researchers can find solutions for employers to reduce the cost of work-related

injuries. Sharing the findings of the study with employers will encourage them to increase their understanding of the possible causes of work-related injuries and will help them to develop programs and policies that better support the targeted population.

Moreover, future researchers should present occupational injury to employers and employees as a preventable condition. Employees must know that they are in control of their wellbeing at work. For any interventions to reduce occupational related injuries, it is essential that they are supported by the employers and aimed to promote self-efficacy. Presenting the information to employers in a scientific manner and providing evidence and highlighting facts about how preventive programs save significant amounts of money for the company is vital.

Conclusion

This project was designed and conducted to explore if there is any impact of commute time on occupational injuries. Although this study did not find any significant relationship between a longer commute and an increased frequency in work-related injuries, most of the participants in the study stated that they believed there was a correlation between a longer commute and work-related injuries. The author hopes that the purpose and the findings of the study may encourage more

researchers to conduct related studies. Most occupational injuries are preventable. Therefore, it is important for researchers to continue to engage both employees and employers to lessen the frequency and severity of work-related injuries. Most adults spend substantial amount of time at work, therefore, one can say that investing in caring for employees' health directly relates to caring for their personal health which would increase the overall health of the community.

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APPENDICES

APPENDIX A: NATIONAL INSTITUTES OF HEALTH
CERTIFICATE OF COMPETITION

APPENDIX B: INFORMED CONSENT

Informed Consent

Joyce Hanbit Choi FNP, RN, PHN, invites you to partake in the research project of, "*Understanding Occupational Injury*." The participants must fully understand the project including its purpose, procedure, potential risks, and benefits and are aware of the following conditions below.

The purpose of this project is to learn if there is an association between longer commute times and work-related injuries or symptoms. Although the many causes of occupational injuries are being studied and subsequent implementations are taking place at workplaces, studies on how commute time contribute to occupational injury are limited. If this study shows correlation between longer commute and negative perception of subjective health and work-related injury, then this study can help create policies and programs to protect the assembly workers in the Bay Area from a high rate of occupational injury.

The project involves a survey. The SHC inventory will be used to measure outcome variables such as symptoms of musculoskeletal, psychological, and gastrointestinal disorders. Moreover, participants' demographic data will be collected to examine how their exposure variables such as age, length of, and method of commute, years of employment, are associated with the outcome variables. A total duration of 10-15 minutes of a participant's time is anticipated.

The potential risks that participants may experience from this project include time consumption and stress. Benefit include increased awareness of health. Moreover, the findings of the study will be used to mend policies and create programs decrease the rate and the cost occupational injuries.

All subjects will not be asked to write their names. All information is to remain confidential and documents collected for the project will be destroyed after the project's completion. The Involvement of this project is strictly voluntary. Participants have the right to withdraw from the project any time without prejudice or penalty. In addition, participants will not be provided with any compensation.

Permission for volunteers to participate in the project was obtained from the Medical Director of Access Omnicare. The research investigator, Joyce Hanbit Choi, can be contacted any time for questions or concerns via phone 925-519-5646 or email hanbitsun@gmail.com

To take part in this project and to allow the use and disclosure of my input for the purposes of the project, I must sign and date this page.

By signing this page, I confirm the following:

- I voluntarily agree to take part in this project, to follow the project's procedures, and to provide necessary information to the researcher.
- I understand that I may choose to stop being a part of this project at anytime.
- I understand the project including its purpose, procedure, potential risks, and benefits.
- All of my questions and concerns were asked about the project has been answered to satisfaction.

Name of Participant (Printed)	Signature of Participant and date
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APPENDIX C: APPROVAL FROM PARTICIPATING
INSTITUTION

Access Omnicare Occupational/Urgent Care Clinic

39180 Farwell Dr #231, Fremont, CA 94538

To whom it may concern,

I understand the research project of Hanbit (Joyce) Choi DNP student at California State University, Northern California Consortium Doctor of Nursing Practice. I approve the project will be done at Access Omnicare over period of July 2017 - September 2017.

Terry Manchester MD

5-4-17

Medical Director of Access Omnicare

Date

**APPENDIX D: SUBJECTIVE HEALTH COMPLAINTS
INVENTORY AND APPROVAL TO USE THE INSTRUMENT**

Joyce Choi

to hege.eriksen, Eriksen

Feb 8 [View details](#)

Hello, Dr. Eriksen

[Hide quoted text](#)

My name is Joyce Choi and I am currently enrolled in the doctorate in nursing practice program at CSU Northern California Consortium in the United States. I am interested in studying factors that contribute to occupational injuries, such as: amount of sleep, caffeine consumption, amount or time of working hours, and especially time spent commuting.

I am contacting you regarding your paper, "A Scoring System for Subjective Health Complaints," published by Journal of Public Health, which I found while searching for surveys and/or survey questions that could be used for my own study.

Looking through the paper *Subject Health Complaints Inventory*, I see sections that describe the types of questions that you used in your questionnaire, but I was hoping to be able to reuse your questionnaire, in whole or in part. If possible, I am wondering if you could direct me to where I can find the questionnaire, or related material, that you used, or if you could share these materials with me directly.

Thank you for your time!

Hanbit Jovce Choi RN. PHN. FNP

Dear Joyce,

Enclosed is the SHC, with as the reference. I would be pleased if you would send me any publications you will get using the instrument. Also let me know if you need a syntax file.

All best
Hege

From: Joyce Choi <hanbitsun@gmail.com>

Date: Thursday 9 February 2017 08:59

To: "hege.eriksen@psych.uib.no"

<hege.eriksen@psych.uib.no>, "Eriksen@uni.no"

<Eriksen@uni.no>

Subject: Interest in your questionnaire materials for "A Scoring System for Subjective Health Complaints"

Health problems last month

On the following page you find some ordinary health problems and complaints. We want you to look at each and every one of them and report **to what extent you have been affected** during last month, and the **number of days** you have been suffering from the problem.

Example

If you feel you have been suffering *some* with cold/flu last month, and the *duration* was approximately one week, this is recorded the following way:
Circle the suitable number.

Ordinary health	Not at all					Number of days
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shceng.rtf

Additional file 1

English version of the Subjective Health Complaints Inventory.

As presented in Eriksen HR, Ihlebaek C, Ursin H. A scoring system for subjective health complaints (SHC). Scand J Public Health. 1999 Mar 1;27(1):63–72.

Ordinary health problems and complaints last month (circle the correct number)	Not at all	A little	Some	Serious	Number of days
1. Cold, flu	0	1	2	3	.....
2. Coughing	0	1	2	3	.....
3. Shoulder pain	0	1	2	3	.....
4. Neck pain	0	1	2	3	.....
5. Upper back pain	0	1	2	3	.....
6. Arm pain	0	1	2	3	.....
7. Headache	0	1	2	3	.....
8. Low back pain *	0	1	2	3	.....
9. Leg pain during physical activity *	0	1	2	3	.....
10. Migraine	0	1	2	3	.....
11. Anxiety	0	1	2	3	.....
12. Sadness/depression	0	1	2	3	.....
13. Sleep problems	0	1	2	3	.....
14. Tiredness	0	1	2	3	.....
15. Extra heartbeats	0	1	2	3	.....
16. Heat flushes	0	1	2	3	.....
17. Dizziness	0	1	2	3	.....
18. Stomach discomfort	0	1	2	3	.....
19. Heartburn	0	1	2	3	.....
20. Ulcer/non-ulcer dyspepsia	0	1	2	3	.....
21. Stomach pain	0	1	2	3	.....
22. Gas discomfort	0	1	2	3	.....
23. Diarrhoea	0	1	2	3	.....
24. Obstipation	0	1	2	3	.....
25. Asthma	0	1	2	3	.....
26. Breathing difficulties	0	1	2	3	.....
27. Allergies	0	1	2	3	.....
28. Eczema	0	1	2	3	.....
29. Chest pain	0	1	2	3	.....

* The items 8. *Low back pain* and 9. *Leg pain during physical activity* were excluded in all analyses.

APPENDIX E: DEMOGRAPHIC QUESTIONNAIRE

Thank you for taking this voluntary survey.

Your responses are anonymous.

1. How old are you? _____

2. What is your gender? _____

3. Are you working full time or part time?

4. How long have you been employed as an assembly worker in your current job?

- a) Less than 6 months
- b) 6 months - less than 1 year
- c) 1 year - less than 2 years
- d) 2 years - less than 3 years
- e) 3 years - less than 4 years
- f) More than 5 years

5. What is your length of commute per journey?

- a) Less than 30 minutes
- b) 30 minutes - 59 minutes
- c) 60 minutes - 89 minutes
- d) More than 90 minutes

6. What is the distance of your commute per journey?

- a) 0 - 14 miles
- b) 15 - 29 miles
- c) 30 - 44 miles
- d) 45 - 59 miles
- e) more than 60 miles

7. What is your mode of commute? Select all that apply.

- a) Walk
- b) Bike

- c) Private car
- d) Public transit
- e) Carpool

8. Have you changed your mode of commute in the last year?

- a) Yes
- b) No

9. How many injuries have you had while working as an assembly worker in the last year? Count any acute injuries such as falling and breakage of skin or bone and any non-acute injuries such as stiffness/pain in neck, arms, and back.

- a) 0
- b) 1-3
- c) 4-7
- d) 7-9
- e) More than 10

OPTIONAL QUESTION. Do you think your length and mode of commute influences your health? If yes, how so?