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Cardiovascular Disease Risks, Knowledge, Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Mixed Methods Study

Camillus Okwudili Ezeike, LLM, JD, RN

A dissertation submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Nursing.

2018

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Acknowledgements

This has been a long, tedious, and challenging journey for me. I would like to extend my warmest gratitude and appreciation to the following faculty who assisted and guided me at every point in this journey to achieve this goal:

My dissertation Chair, Dr. Acierno, was always available to provide me the needed guidance, despite other commitments. My dissertation committee member, Dr. Pope, has been my greatest cheerleader, mentor, and advisor. She has been invested in my academic success at MUSC and was available to me every weekend for the past year and half to touch base with me and provide needed direction. I cannot thank her enough for believing in me even when I had self-doubts. Dr. Mulugetha agreed to serve on my committee despite short notice and other commitments. I am eternally grateful for his interest in my research topic and the statistical guidance he provided me throughout this process.

Finally, I wish to recognize my wife, Dr. Adaku Ezeike, for always being there for me throughout this journey. I thank my children Chioma, Chisom, Nneka, and Nnamdi for their love, patience, and understanding throughout these years. I am equally grateful to my Mom and late Dad, for planting and nurturing in me, early in life, the love for learning.

Abstract

Taxi drivers have a higher cardiovascular disease (CVD) prevalence compared to the general population. Many African immigrants in the US work as taxi drivers. Studies have also shown increased rates of CVD among African immigrants compared to other ethnic groups. However, very few studies have examined CVD risk among African immigrant taxi drivers in the US.

This dissertation is a compendium of three manuscripts that represent an integrative review of CVD and taxi driver studies, followed by qualitative and quantitative studies relevant to the understanding of the CVD risk knowledge and perceptions of African immigrant drivers in the Baltimore-Washington area. The first manuscript is an integrative review of CVD risk and taxi driver studies. The second manuscript examines the CVD knowledge of this population using the Heart Disease Fact Questionnaire. The final manuscript involves a qualitative study of the CVD perceptions and experiences of AITD, using Kleinman's Explanatory Models post-coding and initial analysis for subsequent clinical application.

Findings from both studies provide a better understanding of the CVD risk knowledge, perceptions, and experiences of African immigrant taxi drivers in the Baltimore-Washington area as a basis for future intervention.

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Introduction

Cardiovascular disease (CVD) is one of the leading causes of death in the United States (US) (Mozaffarian et al., 2016). The World Health Organization (WHO) (2017) estimates that approximately 17.7 million people or 31.1% of global deaths result from CVDs. According to the American Heart Association (AHA), about 2,200 Americans die of cardiovascular diseases each day (American Heart Association, 2017). There are modifiable and non-modifiable risk factors associated with CVD, including physical inactivity, tobacco use, diet, blood lipid levels, hypertension, obesity, family history of cardiovascular disease, diabetes, age, gender, ethnicity, and socio-economic status. Other CVD risk factors include high-level stress and exposure to exhaust fumes (Apantaku-Onayemi, F. et al., 2012). The likelihood of developing CVD depends, to a large extent, on the number of CVD risk factors present and the individual's efforts at modifying behavior to prevent compromised health status (World Heart Federation, 2018). Taxi drivers are at risk for many of these risk factors.

Cardiovascular risk factors associated with taxi driving include lack of insurance coverage, long work hours, frequent shift changes, irregular meal times, sedentary lifestyle, and daily contact with exhaust fumes (Apantaku-Onayemi, F. et al., 2012). Consequently, there is a higher prevalence of CVD among taxi drivers compared to other occupations (Apantaku-Onayemi, F. et al., 2012; Bigert et al., 2003). To effectively understand the CVD risk of taxi drivers and tailor interventions appropriately, it is necessary to identify a sub-population greatly affected by these factors.

In 2000, immigrants to the US made up 38% of the approximately 230,000 taxi and limousine drivers in the US, with Africans making up 6.3% of that number (Schaller Consulting, 2004). In Washington DC alone, it is estimated that the majority of the 6,000 taxi cab drivers are of African and Middle Eastern descent (International Brotherhood of Teamsters, 2013). The African immigrant taxi driver population is unique because of CVD risks associated with their occupation in combination with the CVD risk prevalence among African immigrants in general.

The few studies that have looked at the cardiometabolic health of Africans in the US have consistently found that, compared to African Americans, African immigrants have a low prevalence of obesity and smoking, but a higher prevalence of hypertension, diabetes, and pre-diabetes (O'Connor et al., 2014; Osei & Schuster, 1995; Ukegbu et al., 2011; Yu, Ramsey, Castillo, Ricks, & Sumner, 2013). Because African immigrants make up one of the fastest growing immigrant populations in the US (Venters & Gany, 2011), there is need for an exploratory study that examines their knowledge of health risks associated with this common occupation among African immigrants in the US. Although a few US studies have investigated CVD risks among taxi drivers (Apantaku-Onayemi, F. et al., 2012; Elshatarat, R. A. & Burgel, B. J., 2016; Gany, Francesca et al., 2016; Gany, Francesca M., Gill, Pavan P., Ahmed, Ayaz, Acharya, Sudha, & Leng, Jennifer, 2013), only one survey study has examined perceived CVD risks among African immigrant male taxi drivers (United African Organization, 2013). Therefore, this dissertation study assists in filling the gap regarding research on African immigrant taxi drivers.

This dissertation explores the subjective opinions, attitudes, and perceptions of taxi drivers on cardiovascular risk factors associated with their occupation for effective future intervention mapping. The current mixed methods approach allowed for the collection of quantitative and qualitative data that captured African taxi drivers' objective cardiovascular risk factor knowledge, as well their subjective views and perceptions of their CVD risks, for better future intervention studies tailored to the participants' lived experiences.

Moreover, the dissertation study establishes a baseline of CVD risk factor knowledge-and-perceptions for African immigrant taxi drivers in the Baltimore-Washington area, thereby assisting in highlighting potential facilitators and barriers to behavioral change in this specific population. This current review allows health provider to adapt evidence-based care interventions that can reduce the risk of cardiovascular diseases in this population.

Theoretical Framework

Kleinman's Explanatory Disease model (KEDM) was used in the second Manuscript to analyze participants' perspectives to generate their explanatory models of CVD disease and risk factors. According to Kleinman, explanatory models (EMs) may include one or all of the following components of illness: (a) etiology, (b) symptoms onset over time, (c) pathophysiology, (d) course of sickness, and (e) treatment (Kleinman, 1980b). Explanatory models (EMs) of illness are used to analyze personal beliefs that aid how individuals recognize, interpret, and react to a specific illness experience within the modern health care system (Kleinman, 1980b). Healthcare outcomes of individuals within a health care system depend on how individuals with different EMs are able to negotiate transactions involved in healthcare encounters (Buchbinder, 2013). The findings in Manuscript three are analyzed using this framework.

Manuscripts

This dissertation comprises three related studies that examined the issue of CVD among taxi drivers in the Baltimore-DC area. The first manuscript is an integrative review of the literature on cardiovascular disease and taxi drivers in the US and other nations. This integrative review critically assessed studies (n=22) that have examined taxi drivers and cardiovascular disease risk factors highlighting the potential need for interventions, as well as gaps in the current literature, thus forming the basis for Manuscripts 2 and 3 in this compendium. The second manuscript used a quantitative survey design to study the CVD risk knowledge of African immigrant taxi drivers in the Baltimore-Washington area. The third Manuscript is a qualitative study that explores the CVD risk perspectives and attitudes among African immigrant taxi drivers in the same area using constructivist grounded theory for data gathering.

References

American Heart Association. (2017). Heart disease and stroke statistics 2017 at- a- glance. Retrieved from https://healthmetrics.heart.org/wp-content/uploads/2017/06/Heart-Disease-and-Stroke-Statistics-2017-ucm_491265.pdf

Apantaku-Onayemi, F., Baldyga, W., Amuwo, S., Adefuye, A., Mason, T., Mitchell, R., & Blumenthal, D. S. (2012). Driving to better health: Cancer and cardiovascular risk assessment among taxi cab operators in Chicago. Journal of Health Care for the Poor and Underserved, 23(2), 768-780. doi:10.1353/hpu.2012.0066

Bigert, C., Gustavsson, P., Hallqvist, J., Hogstedt, C., Lewne, M., Plato, N., . . . Scheele, P. (2003). Myocardial infarction among professional drivers. Epidemiology, 14(3), 333-339.

Buchbinder, M. (2013). THE CANON - 5. Patients and healers in the context of culture: an explorationof the borderland between anthropology, medicine, and psychiatry, by Arthur Kleinman. Anthropol Med, 20(1), 109-111. doi:10.1080/13648470.2012.762337

Elshatarat, R. A., & Burgel, B. J. (2016). Cardiovascular Risk Factors of Taxi Drivers. Journal of Urban Health, 93(3), 589-606. doi:10.1007/s11524-016-0045-x

Gany, F., Bari, S., Gill, P., Ramirez, J., Ayash, C., Loeb, R., . . . Leng, J. (2016). Step On It! Workplace Cardiovascular Risk Assessment of New York City Yellow Taxi Drivers. Journal of Immigrant and Minority Health, 18(1), 118-134. doi:10.1007/s10903-015-0170-8

Gany, F. M., Gill, P. P., Ahmed, A., Acharya, S., & Leng, J. (2013). “Every disease…man can get can start in this cab”: Focus Groups to Identify South Asian Taxi Drivers’ Knowledge, Attitudes and Beliefs About Cardiovascular Disease and Its Risks. Journal of Immigrant and Minority Health, 15(5), 986-992. doi:10.1007/s10903-012-9682-7

International Brotherhood of Teamsters. (2013). Teamster taxi drivers call on D.C. Mayor to apologize for offensive comment [Press release]. Retrieved from http://dctaxidrivers.com/files/2013/11/11.07.13dctaxidrivers.pdf

Kleinman, A. (1980). Patients healers in the context of culture: an exploration of the borderland between athropology, medicine, and psychiatry. Berkeley, CA: University of California Press.

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Turner, M. B. (2016). Executive Summary: Heart Disease and Stroke Statistics--2016 Update: A Report From the American Heart Association. Circulation, 133(4), 447-454. doi:10.1161/cir.0000000000000366

O'Connor, M. Y., Thoreson, C. K., Ricks, M., Courville, A. B., Thomas, F., Yao, J., . . . Sumner, A. E. (2014). Worse cardiometabolic health in African immigrant men than African American men: reconsideration of the healthy immigrant effect. Metabolic Syndrome and Related Disorders, 12(6), 347-353. doi:10.1089/met.2014.0026

Osei, K., & Schuster, D. P. (1995). Metabolic characteristics of African descendants: a comparative study of African-Americans and Ghanaian immigrants using minimal model analysis. Diabetologia, 38(9), 1103-1109.

Ukegbu, U. J., Castillo, D. C., Knight, M. G., Ricks, M., Miller, B. V., 3rd, Onumah, B. M., & Sumner, A. E. (2011). Metabolic syndrome does not detect metabolic risk in African men living in the U.S. Diabetes Care, 34(10), 2297-2299. doi:10.2337/dc11-1055

United African Organization. (2013). The health of the African taxicab driver in Chicago: Health survey report. Retrieved from http://uniteafricans.org/wp-content/uploads/2016/05/UAO-African-Taxicab-Driver-Health-Survey-Report.pdf

Venters, H., & Gany, F. (2011). African immigrant health. Journal of Immigrant and Minority Health, 13(2), 333-344. doi:10.1007/s10903-009-9243-x

World Heart Federation. (2018). Cardiovascular risk factors. Retrieved from https://www.world-heart-federation.org/resources/risk-factors/

Yu, S. S., Ramsey, N. L., Castillo, D. C., Ricks, M., & Sumner, A. E. (2013). Triglyceride-based screening tests fail to recognize cardiometabolic disease in African immigrant and

African-American men. Metabolic Syndrome and Related Disorders, 11(1), 15-20. doi:10.1089/met.2012.0114

Manuscript 1

Cardiovascular Risk Factors and Taxi Drivers: An Integrative Review

Abstract

Background: Cardiovascular diseases (CVD) are the leading causes of death worldwide. Certain occupations and lifestyles have higher cardiovascular risk factors than others. Taxi drivers, perhaps because of their sedentary work style, among other factors, have a higher prevalence of cardiovascular diseases than the general population.

Purpose: The purpose of this integrative review was to critically examine studies that have assessed the cardiovascular disease risk of taxi drivers

Conclusions: The result of this integrative review (n=22) showed that taxi drivers have an increased prevalence of cardiovascular risk factors compared to the general population. Further research on taxi drivers and cardiovascular risk factors has the potential to highlight actionable mediators of their risks for cardiovascular diseases, thereby facilitating development and design of CVD risk reduction interventions. Furthermore, a better understanding of the phenomenon can contribute to the development of a tailored intervention specific to the cardiovascular disease risks of taxi drivers.

Clinical Implications: As more and more people depend on hired driver (e.g., Uber) forms of transportation to move around, combined with the projected growth of the number of taxi drivers (12% in the next decade), the health of taxi drivers becomes an occupational health priority. This integrative review highlights this potential need, as well as gaps in current research. From knowledge gained from this review, health professionals who care for drivers may also focus on improving their patients' health outcomes and decreasing healthcare costs.

KEY WORDS: Cardiovascular disease, taxi drivers, risk assessment, occupational exposure

Introduction

Cardiovascular diseases (CVD) are the number one cause of death in the world (World Health Organization, 2017). Approximately 17.7 million deaths resulted from cardiovascular diseases in 2015. This number represented about 31% of all global deaths (World Health Organization, 2017). As a result, CVD risk factors rank very high among global health concerns. CVD include the following heart and blood vessel disorders: coronary heart disease, cerebrovascular disease, peripheral heart disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism (World Health Organization, 2017).

Cardiovascular diseases present both global health and financial burdens. Between 2011 and 2012 for example, the US spent approximately $316.6 billion in both direct and indirect costs for CVD (Mozaffarian et al., 2016). Data from Europe also show the high financial burden associated with CVD. According to the European Society of Cardiology, approximately 210 billion Euros are spent each year by European Union member states for CVD (European Society of Cardiology, 2017). Most CVD result from a combination of behavioral risk factors, including tobacco use, unhealthy diet, obesity, lack of physical exercise, and alcohol use, which appear in association with hypertension, diabetes, and hyperlipidemia. Other underlying contributors to CVD include stress, poverty, and hereditary factors (World Health Organization, 2017).

Taxi drivers (and the expanding field of related professions like Uber and Lyft drivers) have a risk profile also associated with major CVD risk factors, including lack of insurance coverage, long work hours, frequent shift changes, irregular meal times, sedentary lifestyle, and daily contact with exhaust fumes (Apantaku-Onayemi, F. et al., 2012). Furthermore, studies show a higher prevalence of CVD among taxicab drivers compared to other occupations (Apantaku-Onayemi, F. et al., 2012; Bigert et al., 2003). It is important to understand studies focusing on taxi drivers and cardiovascular diseases in order help health providers' focus on improving their patients' health outcomes and decrease healthcare costs.

Problem and Purpose of the Review

This integrative review critically examines studies of taxi drivers and cardiovascular disease risk factors. Findings and research gaps are discussed, with particular attention to implications for future research and practice.

Methods

Following Whittemore and Knafl's (2005) recommendations, five stages of review were completed: problem identification, literature search, data evaluation, data analysis, and presentation (Whittemore & Knafl, 2005).

Literature Search

The literature was searched using the following online databases: CINAHL, Scopus, and PubMed for studies published from January 1998 to July 2017. Key search terms were "taxi drivers" or "cab drivers" and "cardiovascular disease" or "CVD." The literature search yielded 46 articles. Inclusion criteria were peer reviewed published studies in the English language that address both cardiovascular disease risk factors and taxi drivers. Studies in languages other than English were excluded. Finally, studies that met the selection criteria were selected for review. References of retrieved studies were analyzed to add to the list of potential articles. Duplicate and non -relevant articles were discarded after review of titles and abstracts for content. Finally, 22 articles were chosen for this review (See Table 1 for matrix of studies).

Data Evaluation

Selected articles were critically appraised using the Centre for Evidence-Based Medicine criteria. The Centre for Evidence-Based Medicine provides a mechanism for appraising the level of evidence in published studies (OCEBM Levels of Evidence Working Group, 2009). Studies were evaluated and rated based on the strength of evidence. The majority of the selected studies were cross-sectional investigations.

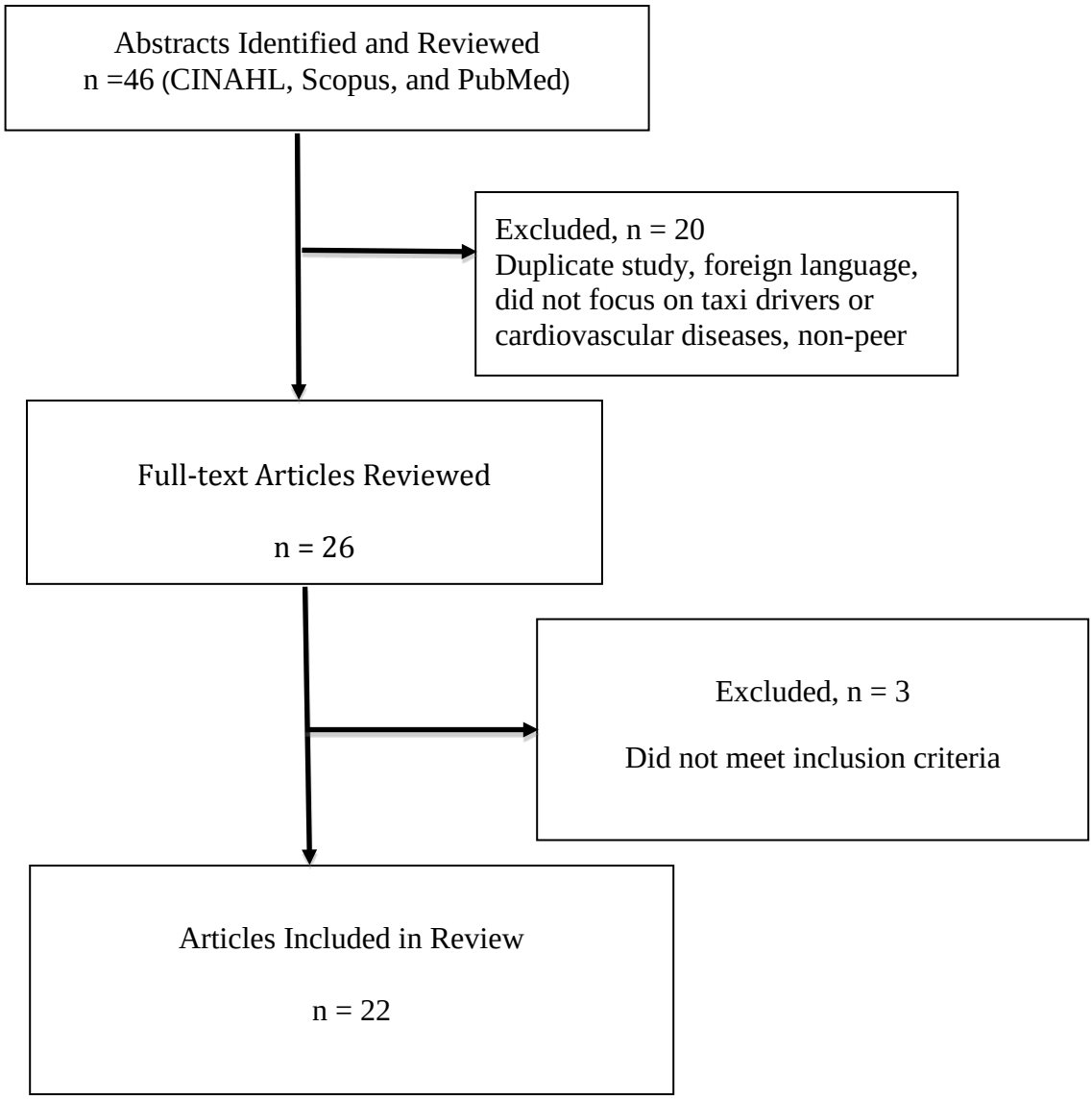


Figure 1. Literature Search Results

Data Analysis and Presentation

The purpose, design, theoretical framework, sample/location, findings, strengths and limitations are summarized in Table 1. Tabulation allowed for easier comparison of the selected studies.

Results

Seventeen of the reviewed studies were conducted outside the United States (US). The five US studies included urban taxi drivers in San Francisco, Chicago, and New York City. Various design characteristics were noted in the studies reviewed. Convenience sample selections were mainly used to recruit participants to the studies. The review shows that six studies used surveys (Apantaku-Onayemi, F. et al., 2012; Gany, F. et al., 2016; Hattori & Azami, 2001; Ramukumba Tendani, 2016; Siu et al., 2012), four used case-control studies (Bigert et al., 2003; Brucker et al., 2015; Kurosaka et al., 2000; Nasri & Moazenzadeh, 2010), nine used cross-sectional studies (Bawa & Srivastav, 2013; Chen, Chen, Chang, & Christiani, 2005; Elshatarat, Rami Azmi & Burgel, Barbara J., 2016; Ishimaru, Arphorn, & Jirapongsuwan, 2016; Kobayashi et al., 2005; Martin, Sharif, & Flaherty, 2016; Navadeh, Moazenzadeh, & Mirzazadeh, 2008; Park & Hwang, 2015; Zagury, Le Moullec, & Momas, 2000), one was a panel study (Wu et al., 2010), and two were qualitative studies, with one employing a focus group (Gany, Francesca M. et al., 2013) and one using interviews, informants, and participant observations (Facey, 2003). The majority of the studies reviewed or explored CVD risk factors among taxi drivers categorized into modifiable and non-modifiable risk factors. Modifiable CVD risk factors included hypertension, tobacco and alcohol use, diabetes, physical inactivity, unhealthy diet, overweight and obesity, hyperlipidemia. Non–modifiable CVD risk factors included gender, age, and family history (Elshatarat, R. A. & Burgel, B. J., 2016). Other CVD risk factors included high-level stress and exposure to exhaust fumes (Apantaku-Onayemi, F. et al., 2012).

However, three studies focused specifically on the environmental CVD risk factor of air pollution (Brucker et al., 2015; Wu et al., 2010; Zagury et al., 2000). One of the studies

investigated the effects of traffic related air pollution on cardiac function changes in taxi drivers in Beijing, China and found an association between traffic related air pollution and altered cardiac function in taxi drivers, indicating a likely effect on each participant's cardiovascular system (Wu et al., 2010). Another study examined the relationship between toxic pollution and CVD; in Porto Alegre, Rio Grande do Sul, Brazil. The researchers discovered that taxi drivers in Porto Alegre, Rio Grande do Sul, Brazil showed higher levels of toxic metals in the blood, elevated inflammatory biomarkers, and greater renal damage, all of which can lead to CVD (Brucker et al., 2015). The third study looked at the potential exposure of Paris taxi drivers to automobile pollutants during work (Zagury et al., 2000). The investigators concluded that Paris taxi drivers were highly exposed to automobile pollutants, such as carbon monoxide, compared to the general population.

Two Japanese studies looked at the effect of nighttime driving on CVD (Hattori & Azami, 2001; Kobayashi et al., 2005). Hattori (2001) examined the effect of nighttime driving and lack of sleep on CVD risk factors among taxi drivers. According to this study, nighttime taxi driving increases CVD risks among taxi drivers. The other study found that nightshift taxi drivers who smoke have higher CVD risk factors than dayshift drivers who smoke (Kobayashi et al., 2005).

Four studies looked at smoking as a CVD risk factor among taxi drivers (Bawa & Srivastav, 2013; Ishimaru et al., 2016; Kurosaka et al., 2000; Martin et al., 2016). One study in Mumbai, India found that taxi drivers' health status is affected by, among other things, the individual factors, such as smoking. The study identified the prevalence of CVD risk factors such as smoking and tobacco chewing among taxi drivers (Bawa & Srivastav, 2013). A study of Bangkok, Thailand taxi drivers found that smoking habits of drivers were among many factors associated with increased hematocrit (HCT) levels that may in turn predict increased CVD risk factors in taxi drivers (Ishimaru et al., 2016). Martin et al., (2016) noted smoking as one of the lifestyle CVD risk factors among Irish drivers in Galway. The fourth study examined whether

taxi driving is associated with severity of coronary heart disease (Kurosaka et al., 2000). This Japanese study concluded that taxi driving is associated with high prevalence of coronary risk factors, such as smoking, obesity and diabetes mellitus.

Few of the studies looked at the relationship between number of hours taxi drivers spend behind the wheel and CVD risk (Chen et al., 2005; Kobayashi, Tomita, & Okada, 2002; Kobayashi et al., 2005). Chen (2005) evaluated the relationship between driving time and hematological markers of CVD risks and found that long driving hours are associated with higher hematological markers for increased CVD risk factors, such as white blood cells count, hematocrit, and platelets. A Japanese study found that the length of work as a taxi driver as well as long work hours affect cardiac autonomic balance (Kobayashi et al., 2005). Kobayashi et al., (2002) examined the effect of long hours driving on blood pressure and heart rate variability; the researchers found that long hours of driving are associated with increased blood pressure among taxi drivers (Kobayashi et al., 2002). However, Ishimaru et al., (2016) found that working hours were not directly associated CVD risks for Aichi, Japan taxi drivers.

The length of time worked as a taxi driver and the number of years as a US resident were found by two studies in the review to be associated with increased CVD risk factors among taxi drivers (Elshatarat, Rami Azmi & Burgel, Barbara J., 2016; Gany, Francesca et al., 2016). One study found that age, working as a taxi driver for more than ten years, and the accompanying reported stress level from the job were associated with CVD high–risk profile among taxi drivers (Elshatarat, Rami Azmi & Burgel, Barbara J., 2016). The other study found that taxi drivers with greater than ten years US residency have increased CVD risk factors compared to those with lesser US residency (Gany, Francesca et al., 2016). New York City taxi drivers with greater than 10 years US residency were found to have increased CVD risk factors.

Stress is one of the CVD risk factors. This review shows that four studies looked at the relationship between taxi driving related stress and CVD (Bawa & Srivastav, 2013; Elshatarat, Rami Azmi & Burgel, Barbara J., 2016; Gany, F. M., Gill, P. P., Ahmed, A., Acharya, S., &

Leng, J., 2013; Ishimaru et al., 2016). One study identified high stress level among taxi drivers as one of the predictors of CVD (Elshatarat, Rami Azmi & Burgel, Barbara J., 2016). Gany (2013) identified work related stress as one of the reasons taxi drivers perceive their health to be at risk for CVD and other health related issues. Another study found that unhealthy working conditions may be associated with higher hematocrit (HCT) levels that could predict CVD risk factors among taxi drivers (Ishimaru et al., 2016). Bawa et al., (2013) looking at the influence of work environment and stress on the health of taxi drivers concluded that taxi drivers' health status was affected by work environment stress, among other factors.

One intervention-based study was reviewed (Gany, Gill, Baser, & Leng, 2014). The Supporting South Asian Taxi Drivers to Exercise through Pedometers (SSTEP) study employed pedometers to increase the physical activities of South Asian taxi drivers in the US (Gany et al., 2014). The SSTEP intervention resulted in a small overall increase in physical activities among participants, with a more significant increase noted among certain subsets: the youngest (<39 years); the oldest age group (>59 years or older) ($p=0.005$) and among those with higher baseline glucose values. According to the study, married drivers (29%) physical activities were lower compared to those of drivers who were either separated, divorced, widowed, or single (71%) ($p=0.029$) (Gany et al., 2014).

Some of the reviewed studies looked at the relationship between taxi drivers' diet and CVD (Gany, Francesca M. et al., 2013; Ishimaru et al., 2016; Martin et al., 2016; Ramukumba Tendani, 2016). Gany et al., (2013) examined South Asian taxi drivers' perceptions, knowledge, attitudes, beliefs about health, CVD and ways to reduce CVD risk and found that South Asian taxi drivers in New York City believed their health to be at risk for CVD because of their poor diets. Nearly all drivers in the study reported eating unhealthy food, such as fast food, "$6 food platters from cars", soda, and heavy greasy food from restaurants. Another study found that, among Irish taxi drivers in Galway, poor diet was a lifestyle risk factor for CVD (Martin et al.,

2016). Ramukumba (2016) found a high prevalence of CVD risk factors such as obesity, with 81.16% of the taxi drivers in the study reporting eating from taxi vendors or other fast foods.

Two studies evaluated the effects of healthcare access on taxi drivers' CVD risk and general health status (Apantaku-Onayemi, F. et al., 2012; Gany, Francesca et al., 2016; Gany, F. M. et al., 2013). Apantaku-Onayemi et al., (2012) identified a low rate of insurance coverage among Chicago area taxi drivers as one of the reasons for the prevalence of CVD compared to the general population. Among the South Asian immigrant taxi drivers in New York City, lack of insurance was cited by half of the study participants as one of the reasons that makes them at risk for CVD (Gany, F. M. et al., 2013). An assessment of the CVD risk factors among New York City taxi drivers at John F. Kennedy International Airport found that only 46% of the participants had health insurance (Gany, Francesca et al., 2016). This barrier to healthcare access was found to have contributed to the high prevalence of unaddressed CVD risk factors among study participants (Gany, Francesca et al., 2016).

Two studies examined alcohol as one of taxi drivers' CVD risk factors (Bawa & Srivastav, 2013; Ishimaru et al., 2016). Bawa et al., (2013) found alcohol addiction as one of prevalent CVD risk factors taxi drivers in Mumbai India. A study of taxi drivers in Bangkok Thailand found that daily alcohol consumption was associated with increased hematocrit (HCT) levels that may predict CVD risk factors (Ishimaru et al., 2016).

Cardiovascular risk factors were most commonly measured by self-reports, although various measurements of CVD risk factors were also included in the review. All the studies assessed CVD risk factors. Cardiovascular risk factor measures comprised self-report questionnaires, anthropometric measurements, and health screenings. However, one study employed focus group settings to gain insight into the participant taxi drivers' knowledge, attitudes, and beliefs about CVD risks (Gany, F. M. et al., 2013).

Sample Description

Examinations of the demographics of the samples in the following studies show that most of study participants were males. Elshatarat et al. (2016) had 8 females out of 122 participants. Gany et al.(2016) had 1 female out of 413 participants. Wu et al.(2010) had 6 females out of 11 participants. Apantaku-Onayemi. et al.(2012), had 7 females out of 751 participants. Siu et al.(2012), had 249 females out of 3376 participants. Two other studies included female participants, however, the distribution number by gender was not provided (Chen et al., 2005; Hattori & Azami, 2001). The participants in five of the US studies comprised mainly immigrants (Apantaku-Onayemi, Funmi et al., 2012; Elshatarat, Rami Azmi & Burgel, Barbara J., 2016; Gany, F. et al., 2016; Gany et al., 2014; Gany, F. M. et al., 2013). The studies that included immigrants or foreign-born taxi drivers were all US and Canadian based studies. Participants' ages in the reviewed studies ranged between 18 years and 60 years, while their years of experience ranged between 3 months and 47 years.

Theoretical Framework

One of the 22 studies included in this review relied on a theoretical framework, the Glasgow Perceived Barriers Theory (Gany, Francesca M. et al., 2013). The other studies did not report using any specific theory; nevertheless, all the studies reported greater risk of cardiovascular diseases among taxi drivers.

Discussion

The discussion here will focus on (i) methodological issues, (ii) theoretical issues (iii) settings, and (iv) interventions. Additionally, the different CVD risk factors examined in the reviewed studies are addressed.

Methodological issues

The review shows that participants in the studies were predominantly males. However, with the entry of Uber and Lyft, it is feasible that the number of female drivers may increase.

Future studies should endeavor to recruit more females to assess if CVD risk factors differ based on gender.

Another issue that stands out is the lack of experimental investigations among the reviewed studies. As stated previously, convenience sample selections were mainly used to recruit participants to the studies, and the designs ranged from case controls, cross-sectional studies, panel studies, and focus groups. Experimental designs allow the researcher to establish causal relationship between the dependent and the independent variables. Future studies should use experimental designs to determine the causal nature of the relationship between taxi driving and CVD risk reduction as well as test effective interventions.

Also, there were no uniform validated and standardized measurement instruments specific to taxi drivers used across reviewed studies. A uniform standardized and validated instrument across studies will allow for easy capturing of relevant dimensions of CVD risk in this population and facilitate easy comparison of findings (Fitzpatrick, Davey, Buxton, & Jones, 1998). Future research is needed to develop or adapt a taxi driver CVD risk focused instrument.

Low survey response rates and high dropout rates were noted in some of the studies reviewed. This result is likely due to the nature of taxi driving business. Taxi drivers work long hours and are always on the move because of the need for immediate response to taxi ride requests. As a result, it is difficult to keep taxi drivers engaged for an hour without frequent interruptions. It is necessary for future studies in this area to find ways of encouraging more taxi drivers to enroll in and complete studies. This goal can be achieved by providing incentives that equal at least one-hour of income.

Confounding factors, such as the mixture of occupational groups, like taxi drivers, car service drivers, bus drivers and limousine drivers, concentration of participants in the cities, among other, were noted in the reviewed studies, thereby raising questions about the nature of the relationships claimed in the findings. The nature and work demands of drivers, for example, differ tremendously based on their occupational group. As a result, it is likely that their

occupational roles may affect their CVD risks differently, thereby affecting the estimated relationships of the respective studies. Future researchers should attempt to account for potential biases in their studies and provide evidence of their efforts aimed at minimizing the effects on the findings.

Inadequate description of samples was another issue noted in the reviewed studies. Some of the studies did not indicate the gender of participants, for example, making it difficult for their results to be generalizable. Not understanding the gender composition of the taxi drivers, for example, makes it difficult to determine the applicability of the findings to a wider population of drivers comprising males and females. Efforts should be made in future studies to provide detailed descriptions of sample composition.

Theoretical issues

Only one study had a theoretical framework (Gany, F. M. et al., 2013). Theoretical frameworks are needed in nursing research in order to advance knowledge beyond what is already known and generate new research questions (Lesham & Trafford, 2007; Sinclair, 2007). They are also an integral part of health science research necessary to guide intervention design and evaluation (Melnyk & Morrison-Beedy, 2012). One theory that will help in advancing our understanding of taxi drivers and CVD risk factors is the Health Behavior Model (HBM) (Becker & Maiman, 1975; Janz, 1988; Rosenstock, 1966). According to the HBM, health behaviors are dependent on a person's perception of four areas: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Glanz, Rimer, & Viswrath, 2008). Taxi drivers are likely to understand the seriousness of CVD and may be convinced of their susceptibility to CVD based on their occupation. As a result, when faced with the reality of CVD, some may prefer to take actions to prevent or minimize their CVD risks, while others may not perceive the benefits of specific changes in behaviors. However, they are likely to be faced with numerous structural barriers for initiating actions to prevent or minimize CVD risks. A more effective tailored intervention needs to address all four factors of the HBM.

Settings

As indicated in the results section, only five of the twenty-two studies were carried out in the US. The US spends a vast amount of money on CVD every year, and with need of people to move around with hired drivers growing, there is a need for future research on the CVD risk factors of occupational driving. Furthermore, the taxi driver population in the US belongs to minority immigrant populations unlike some other Western countries. As a result, further study is warranted to study the CVD risks of immigrant taxi drivers in the US.

Interventions

One intervention-based study was reviewed (Gany et al., 2014). Culturally appropriate and population specific interventions yield better outcomes. The SSTEP targeted South Asian taxi drivers in New York City to increase their physical activity. The recruitment was conducted mainly at taxi break sites, and questionnaires were administered in the driver's preferred language. The use of a pedometer minimized interruption to the working habits of the drivers. This intervention found an overall increase in physical activity among participants. Future CVD risk factor interventions among taxi drivers in the US are warranted.

Risk factors

The review examined different CVD risk factors among taxi drivers. The following CVD risk factors were explored: smoking, long work hours, lack of healthcare access, nighttime driving, alcohol use, physical inactivity, unhealthy diet, high-level stress, and pollution. Risks due to smoking, alcohol, diet, physical inactivity, long work hours, stress and pollution are mostly similar despite location of the respective studies and taxi drivers' demographics. However, the access to healthcare risk factor was mainly limited to US based studies. Further examination of these risk factors among US taxi drivers is warranted, especially to assess the impact of the Affordable Care Act on their current healthcare access.

Limitations

This review is limited to studies that examined both taxi drivers and cardiovascular diseases risk factors. Therefore, the number of studies specifically examining both was limited. The review does not include dissertations, abstracts, or studies from other databases. Because more than half of the studies were conducted outside the US, the findings might not be applicable in the US because of the different health care systems, population mix, and cultures of health. Another limitation is the small sample size in some of the studies, and the lack of any randomized control trial (RCT) in the review.

Future Implications/Conclusion

Only one of the 22 studies in this review explored the subjective opinions, attitudes, and perceptions of taxi drivers on cardiovascular risk factors associated with their occupation, indicating a need for more qualitative studies. The mixed methods combination of both quantitative and qualitative study designs is recommended for future research. A study that combines both designs will facilitate the capturing of both the objective cardiovascular risk factors as well the subjective views and perceptions of participants for better future intervention studies tailored to the lived experiences of taxi drivers. Furthermore, for a better capturing of drivers' CVD risks, comparison of findings, directing treatments and observing improvements, the development or adaptation of a taxi driver cardiovascular disease focused measurement instrument is needed. Also, more US-based studies are needed, since majority of the studies have been done internationally (Japan, Thailand, Ireland, France, South Africa, China, Sweden, Taiwan, South Korea, India, Iran, Hong Kong, Brazil). Additionally, larger sample sizes and more randomized controlled trials of interventions focused on modifiable behavioral risk factors are needed to demonstrate effectiveness.

This review provides a summary of the current state of research on taxi drivers and cardiovascular risk factors. Although there is a general renewed interest in studies involving

immigrants, especially women, there is a dearth of studies focused specifically on immigrant males who constitute one of the largest populations of taxi drivers in the US.

Further research on taxi drivers and cardiovascular risk factors has the potential to highlight their risk for cardiovascular diseases and facilitate the development and design of CVD risk interventions. Furthermore, future research could shed new light on potential facilitators and barriers to behavioral change in this specific population. Health providers may also use this review to adapt evidence-based care interventions that can reduce the risk of cardiovascular diseases in this population.

Cardiovascular diseases are one of the deadliest health conditions in the world, and taxi driving presents many cardiovascular risk factors. Studies that help link these two together will serve to bring this problem to the foreground of public health discourse and potentially help in the design and development of appropriate interventions leading to reduction in health disparities. More studies are needed to create culturally suited information about CVD risk factors and interventions for immigrant taxi drivers.

References

Apantaku-Onayemi, F., Baldyga, W., Amuwo, S., Adefuye, A., Mason, T., Mitchell, R., & Blumenthal, D. S. (2012). Driving to better health: cancer and cardiovascular risk assessment among taxi cab operators in Chicago. *Journal of Health Care for the Poor and Underserved, 23*(2), 768-780. doi:10.1353/hpu.2012.0066

Bawa, M., & Srivastav, M. (2013). Study the epidemiological profile of taxi drivers in the background of occupational environment,stress and personality characteristics. *Indian Journal of Occupational and Environmental Medicine, 17*(3), 10-113.

Becker, M. H., & Maiman, L. A. (1975). Sociobehavioral determinants of compliance with health and medical care recommendations. *Medical Care, 13*(1), 10-24.

Bigert, C., Gustavsson, P., Hallqvist, J., Hogstedt, C., Lewne, M., Plato, N., . . . Scheele, P. (2003). Myocardial infarction among professional drivers. *Epidemiology, 14*(3), 333-339.

Brucker, N., Moro, A., Charao, M., Bubols, G., Nascimento, S., Goethel, G., . . . Garcia, S. C. (2015). Relationship between blood metals and inflammation in taxi drivers. *Clinica Chimica Acta, 444*, 176-181. doi:10.1016/j.cca.2015.02.032

Chen, J. C., Chen, Y. J., Chang, W. P., & Christiani, D. C. (2005). Long driving time is associated with haematological markers of increased cardiovascular risk in taxi drivers. *Occupational and Environmental Medicine, 62*(12), 890-894. doi:10.1136/oem.2005.020354

Elshatarat, R. A., & Burgel, B. J. (2016). Cardiovascular Risk Factors of Taxi Drivers. *Journal of Urban Health, 93*(3), 589-606. doi:10.1007/s11524-016-0045-x

European Society of Cardiology. (2017). About cardiovascular disease in Europe: 2017 statistics. Retrieved from https://www.escardio.org/The-ESC/Press-Office/Fact-sheets/About-Cardiovascular-Disease-in-Europe

Fitzpatrick, R., Davey, C., Buxton, M. J., & Jones, D. R. (1998). Evaluating patient-based outcome measures for use in clinical trials. *Health Technology Assessments, 2*(14), i-iv, 1-74.

Gany, F., Bari, S., Gill, P., Ramirez, J., Ayash, C., Loeb, R., . . . Leng, J. (2016). Step On It! Workplace Cardiovascular Risk Assessment of New York City Yellow Taxi Drivers. *Journal of Immigrant and Minority Health, 18*(1), 118-134. doi:10.1007/s10903-015-0170-8

Gany, F., Gill, P., Baser, R., & Leng, J. (2014). Supporting South Asian Taxi Drivers to Exercise through Pedometers (SSTEP) to decrease cardiovascular disease risk. *Journal of Urban Health, 91*(3), 463-476. doi:10.1007/s11524-013-9858-z

Gany, F. M., Gill, P. P., Ahmed, A., Acharya, S., & Leng, J. (2013). "Every disease...man can get can start in this cab": focus groups to identify south Asian taxi drivers' knowledge, attitudes and beliefs about cardiovascular disease and its risks. *Journal of Immigrant and Minority Health, 15*(5), 986-992. doi:10.1007/s10903-012-9682-7

Glanz, K., Rimer, B., & Viswrath, K. (2008). *Health behavior and health education: Theory, research and practice* (4th ed.). San Francisco: Jossey-Bass.

Hattori, M., & Azami, Y. (2001). Searching for preventive measures of cardiovascular events in aged Japanese taxi drivers--the daily rhythm of cardiovascular risk factors during a night duty day. *Journal of Human Ergology (Tokyo), 30*(1-2), 321-326.

Ishimaru, T., Arphorn, S., & Jirapongsuwan, A. (2016). Hematocrit levels as cardiovascular risk among taxi drivers in Bangkok, Thailand. *Industrial Health, 54*(5), 433-438. doi:10.2486/indhealth.2015-0248

Janz, N. K. (1988). The Health Belief Model in understanding cardiovascular risk factor reduction behaviors. *Journal of Cardiovascular Nursing, 24*(6), 39-41.

Kobayashi, F., Tomita, T., & Okada, A. (2002). Blood pressure and heart rate variability in taxi drivers on long duty schedules. *Journal of Occupational Health, 44*, 214-220.

Kobayashi, F., Watanabe, T., Akamatsu, Y., Furui, H., Tomita, T., Ohashi, R., & Hayano, J. (2005). Acute effects of cigarette smoking on the heart rate variability of taxi drivers during work. *Scandinavian Journal Work, Environment & Health, 31*(5), 360-366.

Kurosaka, K., Daida, H., Muto, T., Watanabe, Y., Kawai, S., & Yamaguchi, H. (2000). Characteristics of coronary heart disease in Japanese taxi drivers as determined by coronary angiographic analyses. *Industrial Health, 38*(1), 15-23.

Lesham, S., & Trafford, V. (2007). Overlooking the conceptual framework. *Innovations in Education and Teaching International, 44*, 93-15.

Martin, W. P., Sharif, F., & Flaherty, G. (2016). Lifestyle risk factors for cardiovascular disease and diabetic risk in a sedentary occupational group: the Galway taxi driver study. *Irish Journal of Medical Science (1971 -), 185*(2), 403-412. doi:10.1007/s11845-016-1442-6

Melnyk, B. M., & Morrison-Beedy, D. (2012). *Intervention Research: Designing, Conducting, Analyzing, and Funding.* New York: Springer Publisher Company.

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Turner, M. B. (2016). Executive Summary: Heart Disease and Stroke Statistics--2016 Update: A Report From the American Heart Association. *Circulation, 133*(4), 447-454. doi:10.1161/cir.0000000000000366

Nasri, H., & Moazenzadeh, M. (2010). Coronary artery disease risk factors in drivers versus people in other occupations. *ARYA Atherosclerosis, 2*(2). Retrieved from http://www.arya.mui.ac.ir/index.php/arya/article/view/150

Navadeh, K., Moazenzadeh, M., & Mirzazadeh, A. (2008). Driving environment in Iran increases blood pressure even in healthy taxi drivers. *Journal of research in Medical Sciences, 13*(6), 287-293.

OCEBM Levels of Evidence Working Group. (2009). The Oxford 2009 Levels of Evidence. Retrieved from http://www.cebm.net/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/

Park, K., & Hwang, S. Y. (2015). 10-year risk for cardiovascular disease among male workers in small-sized industries. *Journal of Cardiovascular Nursing, 30*(3), 267-273. doi:10.1097/jcn.0000000000000146

Ramukumba Tendani, S. T. (2016). Health assessment of taxi drivers in the city of Tshwane. *Curationis, 39*(1), 1.

Rosenstock, I. M. (1966). Why people use health services. *Milbank Memorial Fund Quarterly, 44*(3), Suppl:94-127.

Sinclair, M. (2007). A guide to understanding theoretical and conceptual frameworks. *Evidence Based Midwifery, 5*(39).

Siu, S. C., Wong, K. W., Lee, K. F., Lo, Y. Y. C., Wong, C. K. H., Chan, A. K. L., & Fong, D. Y. T. (2012). Prevalence of undiagnosed diabetes mellitus and cardiovascular risk factors in Hong Kong professional drivers. *Diabetes Research and Clinical Practice, 96*(1), 60-67.

Skelly, A. C., Dettori, J. R., & Brodt, E. D. (2012). Assessing bias: the importance of considering confounding. *Evidence Based Spine Care Journal, 3*(1), 9-12. doi:10.1055/s-0031-1298595

Whittemore, R., & Knafl, K. (2005). The integrative review: updated methodology. *Journal of Advanced Nursing, 52*(5), 546-553. doi:10.1111/j.1365-2648.2005.03621.x

World Health Organization. (2017). Cardiovascular diseases (CVDs). Retrieved from http://www.who.int/mediacentre/factsheets/fs317/en/

Wu, S., Deng, F., Niu, J., Huang, Q., Liu, Y., & Guo, X. (2010). Association of heart rate variability in taxi drivers with marked changes in particulate air pollution in Beijing in 2008. *Environmental Health Perspectives, 118*(1), 87-91. doi:10.1289/ehp.0900818

Zagury, E., Le Moullec, Y., & Momas, I. (2000). Exposure of Paris taxi drivers to automobile air pollutants within their vehicles. *Occupational Environmental Medicine, 57*(6), 406-410.

Table 1. Matrix of Studies

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
Elshatarat et al (2016)	To identify the predictors of high CVD risk factors among taxi drivers	Cross sectional study	None	130 urban taxi drivers. Convenience sampling Male=122 (93.8%). USA born=58, foreign born=72; mean year as taxi driver=9.73 years, mean age=45.3 years. Mean hours worked per week=40.94 hours. San Francisco-USA	Working more than 10 years as taxi driver and reported higher stress level associated with CVD high-risk profile.	Study extended taxi drivers' CVD risk factor studies to urban taxi drivers in a major West Coast US city. Over sampling of Arabic speaking taxi drivers and under sampling of Asian drivers (not representative of the driver population of the driver population in San Francisco). Reliance on self-reports for information
Gany et al (2013)	To study South Asian taxi drivers' perceptions, knowledge, attitudes, beliefs about health, CVD and ways to reduce CVD risk.	Qualitative (focus group)	Glasgow Perceived Barriers theory	31 South Asian male taxi drivers (from: India, Pakistan, and Bangladesh). Languages spoken: Bengali=16%, Hindi=26%, Punjab=42%, and Urdu=25%. Yellow cab drivers=43%; Car Service=18%. Age: 18-40=26%; 41+=74% New York City-USA	South Asian taxi drivers in sample believed their health to be at risk for CVD and other related health issues based on (1) work related stress; physical inactivity; poor diet; poor healthcare access; infrequent urination.	Study devoted entirely to the study of immigrant drivers in a major US city. Perceptions of participants in focus groups may have been influenced by desire for common responses. Combination of taxi drivers and car service drivers in focus groups makes it difficult to ascertain each occupational group specific perceptions.

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
Gany et al (2016)	To assess CVD risk factors among New York City taxi drivers.	Survey	None	413 taxi drivers Males=412 Females=1 Years driving=<10 years 182; Age: 18-29=100; 40-59=209; >60=33. Place of Birth: South Asia=181 Africa=92 Caribbean=57 Latin America=13 Europe=11 Middle East=23 East Asia=4 United States=7 Years in the US: 0-10=64; >10=318 Education: HS grad or lower=173 Some college or higher=210 New York-USA	Compared to the general population, New York City taxi drivers have greater CVD risk factors: taxi drivers with greater than 10 years US residency have increased CVD risk factor. Poor BP control among drivers with prior hypertension diagnosis.	Participants' questionnaires and screenings had different levels of completeness. Potential sampling bias based on study design. Night taxi drivers not adequately represented in the sample.
Brucker et al (2015)	To examine relationship between toxic elemental pollution and cardiovascular diseases.	Case Control	None	69 nonsmoker men (42 taxi drivers; 27 non-taxi driver control group). Age= 44.15 (mean) for the drivers and 40.58 years for the control group. Number of years driving taxi=16.22	Taxi drivers showed higher levels of some toxic metals in blood and elevation of inflammatory biomarkers and higher level of renal damage compared to control group.	The cases represented a defined population with control drawn from individuals from the same city with both groups being non-smokers. Both control and cases study measures were identical and objective. Small sample makes it difficult for generalization.
Gany et al (2014)	To describe the results of a	Survey (pilot study)	None	47 male South Asian taxi drivers: India=47%;	The SSTEP intervention	Questionnaires administered in

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
	pedometer-based exercise intervention among South Asian taxi drivers because of their sedentary lifestyle.			Pakistan=38%; Bangladesh=15% Age: 47.9 (mean age). Years of taxi driving=10.6 (mean). US residency: >15 years=70% <2 years=2% Health insurance=51% PCP=67% U.S.A.	resulted in a small overall increase in step count among participants, with a more significant increase noted among certain subsets: the youngest; the oldest age group and among those with higher baseline glucose values and drivers who were either separated, divorced, widowed, or single.	participants own languages. Novel intervention study for Asian taxi drivers. Low response rate (out of 74 recruited, 24 refused and 5 were found ineligible), high participant dropout rate.
Kurosaka et al (2000)	To examine whether taxi driving is associated with severity of coronary heart disease.	Case Control	None	57 male taxi drivers; 49 with average 18.57 years taxi driving experience; 8 had no verifiable experience. 215 non-taxi drivers (control group) including 16.3% with technical jobs, 17.2% with managerial jobs, 27.05 with clerical jobs, 13.5% with sales jobs, and 26% other.	Taxi driving is associated with high prevalence of coronary risk factors. Higher BMI; hinger ratio of myocardial infarction; diabetes	Both control and cases study measures were identical and objective. The cases represented a defined population with control drawn from individuals from the same city with both groups' males. Potential for self-selecting bias since

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
				Japan	mellitus, and smoking.	participant drivers are patients with Ischemic heart diseases (IHD). Study results may not be replicable in other studies of taxi drivers without prior IHD.
Wu et al (2010)	To examine the effects of particulate matter (PM) air pollution on the cardiac autonomic function reflected in the change in Heart Rate Variability (HRV).	Panel Study	None	11 young non-smoking healthy taxi drivers. Male=5 Female=6 Age=27-41 Mean employment=6.0 years No prior history of CVD or smoking. Beijing-China	An association between traffic related particulate matter air pollution and altered cardiac function in taxi drivers that ultimately affects the cardiovascular system.	Potential variability in responses to PM exposure among participants. Compared same individuals at various time periods.
Ishimaru et al (2016)	To examine factors associated with Hematocrit levels in taxi drivers as a predictor for CVD risk factors.	Cross sectional	None	298 male taxi drivers Average age=49.0 years Work experience mean=10.7 years Average of work week=77.5 hours Bangkok-Thailand	Unhealthy working condition: obesity; daily alcohol consumption, smoking habits are associated with higher HCT levels that may predict increase CVD risk factors in taxi drivers.	Relative small sample size. Blood sample to measure HCT collected during working hours. Exclusion of female drivers.

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
					Working hours not directly associated with HCT levels, but unhealthy working styles may increase CVD risks for taxi drivers.	
Martin et al (2016)	To examine the lifestyle and medical CVD risk factors among Irish taxi drivers.	Cross sectional	None	41 male taxi drivers. Mean age=56.7 years (range 35-72), length of career as taxi drivers=0.3-43 years. 61% (25) work the nightshift, 39% (16) did not work nightshift. Average mean hours per week=50.2 (range 24-70). Number of immigrants=7 (3 from Nigeria, I each from Kenya, Pakistan, Switzerland, and the UK). Average length of stay of immigrant drivers=9.2-38 years. 5 drivers were normal weight, 22 were overweight, and 9 were obese class 1, and 4 were obese class 2. Galway-Ireland	Lifestyle risk factors for CVD sedentary behavior; poor diet; obesity; smoking habits appear to be prevalent among Irish taxi drivers. High risk for developing type 2 diabetes.	Small sample size; self-reporting of certain measures like hypertension and hypercholesterolemia may have affected accurate reporting. Exclusion of female drivers.
Bigert et al (2003)	To investigate potential causes of increased risk of myocardial	Case control	None	Cases: Males between 45-70 with first time history of myocardial infarction (1067 cases) selected from	Prevalence of CVD higher among occupational	Participants appear to have had at least a prior MI history. This may not be a true representation

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
	infarction among professional drivers (bus, taxi, and truck drivers.			hospital records and death certificates. Controls: randomly selected 1482 males between 65-70, taxi drivers: cases (N=44), controls (N=34). Stockholm-Sweden	drivers compared to other occupations like office or industrial workers because of both lifestyle and social factors (occupational factors).	of the driver population in Stockholm County. Use of control group randomly selected from the same population offered a good reference point.
Chen et al (2005)	To examine the relationship between driving time and hematological markers of CVD risks.	Cross sectional study	None	1157 taxi drivers. Females and males included (numbers not stated). Mean age=44.6 years. Greater than 10 years driving experience=52%, mean driving time per day=10 hours. 42% current smokers, 35% overweight, 24% obese, diabetic=12%, hypertensive=15% hypercholesterolemia=32%. Taipei-Taiwan	Number of hours driving per day/month associated with higher hematological markers for increased CVD risk like white blood cells count, hematocrit and platelets.	No causal relationship based on study design can be established. Se of White Blood Count (WBC) marker-a-non-specific hematological marker, could well have pointed to other stressors other than long time driving (inadequate accounting of confounding variable).
Apankatu-Onayemi et al (2012)	To examine the health status and promotion practices of Chicago taxi cab operators	Survey	None	751 taxi drivers; 99% male, (7 females); Median age of 37, 83% immigrants, 10% US born, 7% temporary US residents. Chicago-USA	Prevalence of CVD higher among taxi drivers compared to general population because of low rate of	Sampling was not randomized but participants' spread appears to mirror the population distribution of Chicago. Study conducted by a cancer research and advocacy group with

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
					insurance coverage and physical inactivity.	focus primarily on cancer risk factors.
Park et al (2015)	To examine general CVD risk of heart disease or stroke in a sample of male workers.	Cross sectional	None	12,933 male workers; 1,581 (12.2%) drivers, Mean age=42.1 (range 30-70 years). South Korea	Occupation a good predictor of CVD risk with drivers 1.38 times more likely than manufacturing workers to have a 10-year high risk for CVD.	Lifestyle risk factors obtained through self-reports. Study did not account for the relationships between other work-related variables (hours, shifts, stress level) and CVD risks. Sample limited to males.
Bawa et al (2013)	To examine the influences of work environment, personality characteristics, and stress on the health of taxi drivers.	Cross sectional	None	508 male taxi drivers. Age: mean age=36 (range 21-40). Mean years of service=13 years. Mean daily working hours=10.s hours. Shift: 68% nightshift Mumbai-India	Taxi drivers' health status affected by individual and combined factors of work environment, stress, socio-demographic and personality. CVD risk factors like alcohol, addiction, smoking, and tobacco chewing were prevalent.	Potential for recall bias as study relied entirely on self-reports.

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
Navadeh et al (2008)	To examine the effects of work (driving) environment on blood pressure of healthy taxi drivers.	Cross sectional study	None	31 male taxi drivers. Age: average age=42.1 years, mean BMI=26.9, Average years as taxi drivers=8.6 years, mean clinic BP (systolic=116.85, diastolic=74.44). Mean BP during driving (systolic=138.64, diastolic=95.70) Iran	Driving associated with systolic, diastolic, and mean arterial blood pressure increase by average of 20mmHg compared to baseline.	Small sample size.
Nasri et al (2006)	To determine whether bus and taxi drivers in Kernan, Iran are at increased risk of Coronary Artery Disease (CAD) and to identify factors responsible for the increased CAD risk.	Case control	None	135 male taxi drivers, 194 male bus drivers (Cases) 121 non-drivers (Control group) Greater than 5 years as bus or taxi driver Kerman, Iran	Higher prevalence of CAD risk factors (increased high blood pressure, elevated serum TG and cigarette) in drivers (taxi and bus) than other groups. Driving as an independent CVD risk factor.	Study limited to male drivers. Potential of findings being affected by unaccounted for cofounding factors, such as participants' drug abuse that may have affected BP.
Kobayashi et al (2005)	To examine the acute effects of cigarette smoking on cardiac autonomic nervous function	Cohort study	None	23 male taxi drivers. No prior CVD history. Age: mean age=49 (42-55 range). Mean taxi driving experience=16.7 years, Mean cigarettes	Smoking at night has more potent acute effect on the cardiac modulation of	Weakness: Small sample size. Variation in the smoking behaviors of participants. Potential cofounding factors like exercise, caffeine intake, were not

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
	among taxi drivers under ordinary work conditions.			smoked=35.7 per day. Mean smoking years=29.3 years. Japan	taxi drivers than during the day. Effects of long taxi driving and long work hours on cardiac autonomic modulation (balance) increased by nighttime smoking.	accounted for. Time of meal was self-reported.
Zagury et al (2000)	To examine exposure of taxi drivers in Paris to automobile air pollutants during work.	Cross sectional	None	29-day time randomly selected taxi drivers. Gender=not stated 96% with diesel cars and 53% with air conditioning. Paris=France	Paris taxi drivers are highly exposed to automobile pollutants like carbon monoxide (CO).	Randomized selection of participants. Study conducted with a small number of daytime participants (26) that limits extrapolation of findings. Limited description of sample gender missing.
Hattori et al (2001)	To examine the effect of night overtime taxi driving with little sleep on CVD risk factors/	Cross sectional study	None	Study I: 29 taxi drivers Gender not stated Drivers age=41-67. Work hours=8am-1am Study II: 46 taxi drivers Age=43-67 Work hours=8am-1am Japan	Night taxi driving increases CVD risks among taxi drivers.	Small sample size: self-report. Included nighttime driving. Limited sample description (gender missing)
Ramukumba (2016)	To examine the health status and wellness of Tshwane-South	Survey	None	69 male taxi drivers. Age=30-49 13 (18.84%) normal weight, 23 (33.3%)	Taxi drivers in the sample reported a high prevalence of	Small sample size and limited to male drivers.

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
	African taxi drivers in their working environment to identify health risk factors.			overweight, 31 (44.9%) Obese to morbid obese, 2 (2.9%) underweight. Tshwane-South Africa	CVD risk factors (obese, hypertensive, diabetes, unhealthy lifestyle).	
Siu et al (2012)	To examine the prevalence of undiagnosed diabetes mellitus (DM) and CVD risk factors among professional drivers in Hong Kong.	Survey	None	3,376 drivers with no history of DM. Male, 92.8% (3,327), female, 7.4% (249). Mean age=50.9. median working hours=60 hours, obese=51.2%. Taxi drivers=1,394 (58 females and 1,336 males). Hong Kong	High prevalence of CVD risk factors and metabolic syndrome compared to the general population. Female drivers had lower prevalence of undiagnosed DM (despite family history of obesity) and had fewer CVD risk factors except obesity.	Included female participants. Study combined all professional drivers like truck drivers in its findings.
Kobayashi et al (2002)	To examine the effects of taxi driving with long hours on blood pressure and heart rate variability in	Cross sectional	None	35 male taxi drivers. Mean age=49.5 years (range 40-56 years). Working hours=7am-7am Average work experience=>13 years. Japan	Long hours of taxi driving reported to be associated with blood pressure and increased CVD risk	Study only looked at healthy drivers with over 13 years' experience. Since no control group was involved, it is difficult to know whether finding is limited to taxi

Author	Purpose	Design	Theoretical Framework	Sample/Location	Findings	Strengths/Limitations
	order to understand the mechanisms of high CVD prevalence among taxi drivers.				among taxi drivers.	drivers or all with long work hours.

Manuscript 2

Cardiovascular Disease Risk Knowledge among African Immigrant Taxi Drivers in the Baltimore Washington DC area

Abstract

Background:

African immigrant taxi drivers in the US have a disproportionately high risk and prevalence of cardiovascular disease (CVD). However, research to assess their knowledge of CVD risk is sparse, as is research to guide and inform clinical practice, policies, programs and intervention mapping. The following aims guided this study: 1) examined bivariate relationships between personal or demographic factors among African immigrant taxi drivers and CVD knowledge, 2) examined multivariate relationships controlling for other factors.

Methods: Convenience sampling was used to recruit 121 African immigrant taxi drivers (AITD) in the Washington DC area. Data were collected using a modified Afro-Cardio Meta Study Survey. Participants' knowledge of CVD risk factors was measured using the Heart Disease Fact Questionnaire (HDFQ). Physical measurements for blood pressure, height, and weight were also taken. Descriptive, correlational, and multiple regression analysis were used to analyze the data and predict CVD knowledge score. `

Results: Several variables significantly correlated with CVD knowledge scores. In multiple linear regression analysis, avoiding eating fatty food, regularly sleeping for 7 – 8 hours a day, having immediate family with cardiovascular disease diagnosis in the past year, having problems managing household income, regular consumption of vegetables, and regularly exercising variables accounted for 24 % of variance in CVD knowledge scores.

Conclusions: Knowledge of CVD risk factors is high among African immigrant taxi drivers in the Baltimore-Washington area. Appropriate intervention mappings predicated on this knowledge are needed to prevent and reduce cardiovascular burden in this population.

Keywords: Cardiovascular disease, taxi drivers, African, immigrants.

Introduction

Approximately one of three deaths in the United States (US) results from cardiovascular disease (CVD) (Mozaffarian et al., 2016). Between 2011 and 2012, the US spent approximately $316.6 billion in both direct and indirect costs for CVD (Mozaffarian et al., 2016). There is a higher prevalence of CVD among taxi drivers compared to other occupations (Apantaku-Onayemi, F. et al., 2012; Bigert et al., 2003). Taxi drivers have a risk profile associated with major CVD risk factors, including lack of insurance coverage, long work hours, frequent shift changes, irregular meal times, sedentary lifestyle, and daily contact with exhaust fumes (Apantaku-Onayemi, F. et al., 2012). Moreover, the diet patterns and obesity level in sub-Saharan Africa show a growing trend for higher CVD risk factors in that region (National Research Council, 2014). Therefore, African immigrants in the US have a higher baseline prevalence of CVD risk factors compared to African Americans (Commodore-Mensah et al., 2016; Commodore-Mensah, Himmelfarb, Agyemang, & Sumner, 2015; Commodore-Mensah, Sampah, et al., 2015). The 1.8 million African immigrants in the US make up about 4% of the total US immigrant population (Anderson, 2015; Gambino, Trevelyan, & Fritzwater, 2014). The Washington DC metropolitan area has the second largest concentration of African–born immigrants after New York City (Chacko, 2016). In 2000, there were 230,000 taxicab and limousine drivers in the US, with 38% of them immigrants (Schaller Consulting, 2004). However, 6.3% of the total immigrant taxi and limo drivers in the US are Africans (Schaller Consulting, 2004), with majority of the 6,000 taxi cab drivers in Washington DC from Africa and the Middle East (International Brotherhood of Teamsters, 2013). Most African immigrant taxi drivers are men, an ethnic group that is usually not the focus of immigrant health clinical studies (Apantaku-Onayemi, Funmi et al., 2012). The African immigrant taxi driver population is unique because of CVD risks associated with their occupation in combination with the CVD risk prevalence among African immigrants in general. With African immigrants making up one of the fastest growing immigrant population in the US (Venters & Gany, 2011), there is need for an exploratory study

that examines the knowledge of the health risks associated with one of the common occupations of these immigrants in the US. Although a few US studies have investigated CVD risks among taxi drivers (Apantaku-Onayemi, F. et al., 2012; Elshatarat, R. A. & Burgel, B. J., 2016; Gany, Francesca et al., 2016; Gany, Francesca M. et al., 2013), only one survey study has examined CVD risks among African immigrant male taxi drivers (United African Organization, 2013). Therefore, more research is needed on African immigrant taxi drivers to learn their perspectives regarding CVD risk factors.

The purpose of this study was to determine personal or demographic factors that have a significant relationship with cardiovascular disease knowledge, and 2) to identify significant personal or demographic factors that, when combined, are predictive of CVD knowledge scores. We hypothesize that the following personal and demographic factors will correlate significantly with CVD knowledge: gender, age, education, marital status, time as a taxi driver, annual household income, problems managing household finances, weight, herbal supplements taken for blood pressure, immediate family diagnosis for cardiovascular disease, smoking, alcohol consumption, vegetable consumption, time spent sitting, avoiding eating too much fatty food, exercise, daily sleep, height, weight, and blood pressure status. We also hypothesize that there are personal and demographic factors that will significantly predict CVD knowledge score when combined. Finally, findings of the study will be used as a basis for future intervention mapping. The Institutional Review Board (IRB) at Medical University of South Carolina (MUSC) approved this study.

Methods

Sample

Participants targeted for the study were 126 taxi drivers. The sample size was calculated using G Power (Faul, Erdfelder, Lang, & Buchner, 2007) analysis for Mac. However, 121 African immigrant taxi drivers (AITD) were recruited in the Baltimore-Washington area through convenience sampling, an acceptable sample size for statistical equivalence. The

Baltimore-Washington area encompasses the following sections: The District of Columbia; the suburban Maryland counties of Howard, Montgomery, Prince Georges, and Anne Arundel; and the northern Virginia counties of Arlington, Fairfax, Loudoun, and Prince Williams. The inclusion criteria were (1) adults between 35 and 75 years, (2) residency in the Baltimore-Washington metropolitan area, (3) ability to read and understand English (score of 1 or 2 on the Single Item Literacy Screener (SILS-a single-item instrument used to determine health literacy ability of adults with printed health materials), (4) occupation as taxi driver, (5) immigrant from an African country and (6) at least 5 years US residency. Those criteria, excepting English proficiency, were ascertained through self-report. Exclusion criteria included (1) US born and (2) non-English proficient individuals (score of greater than 2 on the SILS).

Participants were recruited through direct approach at taxi stands, cab company office, word of mouth, and brochures left at taxi offices from the Baltimore and Washington DC airports (BWI Airport, Baltimore, Reagan National, Washington, DC, Dulles International, Virginia) train stations (BWI train station, Baltimore Penn station, Union station Washington, DC) taxicab unions, African cultural associations (Anambra State Association, Africans in DC, Cameroon America), restaurants (Ethiopian restaurants, Baltimore and DC, Nigerian Restaurant, Hyattsville) and churches and mosques (Redeemer Church, Igbo Catholic Church Baltimore) attended by African immigrants in the Baltimore-Washington metropolitan area. Individuals interested in the study either signed up on the spot with the Principal Investigator (PI) for a subsequent meeting, or they contacted the PI by phone or email indicated on the flyer. The PI and participants met on mutually agreed dates in a private room at one of the following locations in Washington, DC where the PI obtained consent, administered the surveys, and provided in-take health screening: Anambra State Association, Inc. (ASA) Cultural Association Office, Dial a Cab Office, Yellow Cab Company Office, and Fairway Cab Association Office. In-take health screenings were administered as follows: blood pressure using a OMRON model BP710N blood pressure monitor;

weight using WW 11 D Conair Corporation digital scale; and, height, weight, and hip measurements using a manual tape measure.

Measurement

The modified Afro-Cardio Meta Study survey (Commodore-Mensah et al., 2015) and the Heart Disease Fact Questionnaire (HDFQ) (Wagner, Lacey, Chyun, & Abbott, 2005) were used to collect demographic and health information data from participants. The instruments captured participants' awareness of chronic disease risks, use of health services by gender, diet, physical activity, health seeking behavior, age groups and length of US residency categories. The Afro-Cardio Meta Study survey is a modification of the World Health Organization (WHO) STEP wise approaches to chronic disease risk factor surveillance (STEPS) (World Health Organization, 2008), the National Health Interview Survey (NHIS) (National Center for Health Statistics, 2016) and the National Cancer Institute's Food Attitudes and Behaviors (FAB) Survey (National Cancer Institute, 2013). In addition to the demographic data, other validated standardized measures included in the Afro Cardio Meta Study Survey were used to assess study variables. Health history, diabetes, blood lipids, cardiovascular disease, and family history were assessed using a modified National Health Interview Survey (NHIS). The NHIS is the standardized instrument used by the National Center for Health Statistics (NCHS) to collect information on the health of the non-institutionalized civilian population of the US (National Center for Health Statistics, 2016). The NCHS was modified, for example, to assess pre- and postimmigration health status. For example, "Were you told you had high blood pressure or hypertension BEFORE or AFTER you moved to the United States?" "Were you diagnosed BEFORE or AFTER you moved to the United States?"

Health behaviors (tobacco use, alcohol consumption and physical activity) were assessed using a modified version of the World Health Organization (WHO) STEP wise approach to chronic disease risk factor surveillance (STEPS) (World Health Organization, 2008). The WHO STEPS is a standardized, but flexible questionnaire used for collecting data on chronic disease

factors in WHO countries (World Health Organization, 2008). STEPS involve three stages (1) the use of a questionnaire to assess study subjects' self-reported behavioral and lifestyle risk factors for chronic diseases, (2) the measurement of subjects' blood pressure and anthropometrical parameters, and (3) the collection and biochemical analysis of subjects' blood samples (World Health Organization, 2008). The modification of the WHO STEPS questionnaire was to reflect US residency of the African immigrants; e.g., "Zip code" was added to replace "Cluster/Center/Village" in the WHO questionnaire (Commodore-Mensa et al., 2015). The WHO STEPS framework provides flexibility for the modification of the instrument to accommodate different levels of risk-factor assessment by allowing for fewer or more details depending on availability of resources (Riley et al., 2016). It is estimated that some modified version of the WHO STEPS questionnaire with steps 1 and 2 has been used for risks-factor data collection in over 100 countries (Riley et al., 2016).

Dietary information related to fruit and vegetable (FV) consumption was assessed using a modified National Cancer Institute's Food Attitudes and Behaviors (FAB) 2-item SERVING FVS scale. The FAB standardized survey was developed by the National Cancer Institute (NCI) to assess the best correlates of fruit and vegetable (FV) intake among US adults (Yaroch et al., 2012). Validity for this scale was established through comparison with a reference instrument (24 hour-recalls) (r=0.27). The intra-class correlation coefficients (ICCs) for test-test reliability of the 2-item FVS scale were 0.70 (Subar et al., 2001).

Health seeking behavior was assessed using 13-item modified version (Maneze et al., 2016) of the original Health Seeking Behavior Scale (HSBS) (Bausell & Bausell, 1987). The 13-item scale measures the frequency of health seeking behaviors, with higher frequencies denoting positive health practices (Maneze, 2016). The Cronbach's alpha for this 13-item scale was 0.82.

Participants' knowledge of CVD risk factors was measured using the Heart Disease Fact Questionnaire (HDFQ) (Wagner et al., 2005). The HDFQ is a 25-item questionnaire that asks true

or false questions on CVD risk knowledge. The scores range from 0 to 25 with higher scores indicating higher level of CVD risks knowledge. Participants' scores on the 25-item surveys were added to determine their total CVD risk knowledge score. The HDFQ has shown both content and face validity with adequate internal consistency and Huder-Richardson-20 formula of 0.77 with good item-total correlation (Wagner et al., 2005). The Cronbach's alpha for this HDFQ scale was 0.63.

Participants' weight, height, waist circumference, hip circumference, and blood pressure were obtained in a private room at one of the following locations: Dial a Cab Office, Yellow Cab Company Office, and Fairway Cab Association Office in Washington, DC with validated devices according to standardized operational procedures (blood pressure using OMRON model BP710N Blood pressure Monitor; Weight using WW 11 D Conair Corporation digital scale; Height, weight, and hip measurements using manual tape measure). To account for variations in the English reading component of health literacy, and because the HDFQ requires an English reading facility, the SILS (Morris, MacLean, Chew, & Littenberg, 2006) was used to determine final enrollment. The SILS was used to assess the health literacy ability of potential participants with printed health materials to determine eligibility for enrollment in the study. The SILS asks, "How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?" Responses range from 1-Never, 2-Rarely, 3-Sometimes, 4-Often, to 5-Always. Scores greater than 2 are considered positive, signifying some difficulty with reading printed health materials (Morris, 2006).

Data Analysis

Statistical analyses were performed using IBM SPSS software application, version 24.0 (SPSS Inc., Chicago, IL). Data were analyzed in three steps. First, descriptive statistics were used to describe sample characteristics as frequencies with proportions and continuous factors as means and standard deviations. Second, a bivariate correlation analysis was performed to estimate crude correlation between variables and to identify variables that appear related to CVD

knowledge score, for potential inclusion of those personal and demographic factors as independent predictors of HDFQ scores in a regression model.

Finally, all variables originally considered in the correlation analysis were included to build a significantly predictive regression model. Several multiple regression models were run and through backward elimination strategy, reached a final model that included ten independent predictors of HDFQ scores. All assumptions associated with standard multiple regressions were tested, and none of the assumptions were violated. Those assumptions included normality, homoscedasticity, and multicollinearity. No significant outliers affected regression results. All statistical tests were performed at .05 level of significance.

Results

Table 1 provides participants' demographics. Almost all (97.5%, 118 out of 121) of the participants were males. Nigeria and Ethiopia accounted for more than 50% of participants' country of birth. Most participants (86.7%) mentioned living in a city prior to moving to the US, while 13.3% reported living in villages prior to moving to the US. Many participants (42.1%) indicated that education was the primary reason for moving to the US, followed by seeking job opportunities as reported by 29.8% of the participants, while 20.7% moved to the US as asylum seekers or refugees.

The age of taxi drivers ranged from 35 to 75 years with a mean age of M = 51.39 years (SD = 10.515). The number of years as a taxi driver ranged from 1 to 42 years with a mean experience of 13.656 years (SD = 9.914 years). For education, 47.1% of the participants had completed a college or university degree, 11.6% of them had completed a post-graduation degree, and 39.7% had completed high school. All participants had at least a high school or higher education level. Most of the participants (76.7%) were currently married, while 7.5% were never married, and 15.0% were either divorced or separated. Most participants (61.2%) indicated that the number of adult members of their household was two (including the participant), followed by 22.3% who indicated that they were living alone in the house, and 9.1% who reported the number

of adult household members was three. The majority (64.7%) did not know the estimated household annual income, while 11.8% reported income range of $ 15,000 to $ 29,999. The majority (76.0%) of participants mentioned some problems managing their household income in the last year. Only 8.3% indicated that they did not have any problem managing their household income last year.

Heart Disease Risk Knowledge – Response to Heart Disease Fact Questionnaire Items

The number of correct responses ranged from 15 to 25 with a mean of M = 21.9(SD = 1.77). The majority (81.8%, 109 out of 121) of participants gave correct responses of 20 or higher number of items out a total of 25. Three participants gave correct responses to all 25 items of the questionnaire. Table 2 presents breakdown of responses on the HDFQ survey.

Relationship between Personal and Demographic Factors and HDFQ Scores

Research question number one (RQ1) proposes to examine personal and demographic factors that have significant correlational relationships with CVD knowledge (HDFQ). We hypothesized that the following personal and demographic factors will be significantly correlated with HDFQ scores: gender, age, education, marital status, time as a taxi driver, annual household income, problems managing household finances, weight, herbal supplements taken for blood pressure, immediate family diagnosis for cardiovascular disease, smoking, alcohol consumption, vegetable consumption, time spent sitting, avoiding eating too much fat, exercise, daily sleep, height, weight, and blood pressure status.

To assess relationships, a bivariate correlation analysis was performed between demographic and personal factors (independent variables) and the CVD knowledge (dependent variable). The variables with significant and non- significant correlation are noted in Table 3 and 4 respectively. The significant variables are post graduate education, marital status, problems managing household income, weight without shoes, diagnosis of cardiovascular disease within the family, consumption of vegetables, avoidance of eating fatty food, and regular exercise. These

variables are likely predictors of HDFQ scores and were tested as such in the multiple regression analysis associated with RQ2.

Predictors of CVD Knowledge Scores

The second research question (RQ2) deals with factors identified as being significantly correlated with CVD knowledge in RQ1 and, thus, predictive of CVD Knowledge scores. We hypothesized that factors identified as significantly correlated with heart disease knowledge scores, when combined, are significantly predictive of CVD knowledge scores. A linear multiple regression analysis was performed to determine factors that, when combined, were significantly predictive of CVD knowledge scores.

To build a significantly predictive multiple regression model, all assumptions associated with standard multiple regression were tested, and none of the assumptions were violated. Those assumptions included normality, homoscedasticity, and multicollinearity, and there were no significant outliers that affected regression results. Several multiple regression models were run, and through backward elimination strategy, a final model that included ten independent predictors of HDFQ scores was selected.

A multiple regression was run to predict CVD knowledge score from avoiding eating fatty food, regular sleep of 7 – 8 hours, immediate family diagnosis of cardiovascular disease, body weight, blood pressure classification, endorsement of lots of problems managing household income, marital status, alcohol consumption, consumption of vegetables, and regular exercise. Their linearity was assessed using partial regression plots and a plot of standardized residuals against the predicted values. Consistent with the hypothesis, the multiple regression model statistically predicted CVD knowledge score $F (10, 92) = 4.125$, $p < .001$, adjusted $R^2 = .235$. Only five of the variables added statistically significance to the prediction, regular 7 – 8 hours of sleep ($\beta = - 0.293$, $p <. 01$), regular exercise ($\beta = - 0.228$, $p <. 05$), vegetable consumption ($\beta = .201$, $p <. 05$), immediate family diagnosis of cardiovascular disease ($\beta = 0.192$, $p <. 05$), and

alcohol consumption within the past 30 days ($\beta = 0.188$, $p < .05$) contributed significantly to the model. Regression coefficients and standard errors are presented in Table 5.

The result of the current study's multiple regression analysis determined that participants' regularly getting 7 – 8 hours of sleep, regular exercise, regularly consuming vegetable, with history of immediate family diagnosis of cardiovascular disease, and alcohol consumption within the past 30 days are likely predictors of high CVD knowledge scores in the study sample. These results suggest that respondents who are not regularly getting 7 – 8 hours of sleep and who are not regularly exercising score lower on the HDFQ knowledge; also, respondents who are regularly consuming vegetables or have an immediate family member with a cardiovascular disease diagnosis or have consumed alcohol in the past 30 days are likely to score higher on the HDFQ knowledge score.

Discussion

This study shows a high-level knowledge of CVD risk among African immigrant taxi drivers with participants (81.8%, 109 out of 121) providing correct responses to 20 or more items out of a total of 25 demographic variables. These results contrast with findings from other studies. A study of CVD knowledge among adults of Buea in the Southwest of Cameroon found over half (52.2%) of the participants with overall poor CVD knowledge (Aminde et al., 2017). Another study examining the CVD risk awareness among primary care physicians in South West Cameroon found a low level of awareness of CVD risks (Jingi & Noubiap, 2015). Among university workers in Ogbomosho, Nigeria, 49.0%(101 out of 206) of the participants had poor knowledge of CVD risk based on their score on the HDFQ 31.2% (64) had fair knowledge, and only 19.9%(41) were found to have good knowledge of CVD risk (Akintunde, Akintunde, & Opadijo, 2015). The results contrast with findings from a study examining knowledge and attitudes on stroke and stroke factors among residents of the urban and rural Mukuno district, central Uganda. That study found, among other things, overall poor stroke knowledge in both rural and urban Uganda, with rural participants likely to have extremely limited knowledge of

stroke risk factors (Kaddumukasa et al., 2015). The differences in results from the studies on CVD knowledge may be related to the different settings, populations, and methodologies (Aminde et al., 2017). In fact, a systematic review of studies examining level of knowledge and awareness of CVD and risk factors in Sub Saharan Africa found overall low level of CVD knowledge and awareness (Boateng et al., 2017). The finding of this study is distinctive, compared to the findings of other studies because it involved Africans living in the US, which may explain the difference in awareness of CVD risk.

Thus, this finding of a high level of CVD risk knowledge among AITD in the US has implications for policy makers, public health officials, and providers for developing strategies that address CVD within this population. The study also highlights personal and demographic factors with significant correlational relationships with CVD knowledge (HDFQ). The factors include post graduate education, marital status, problems managing household income, weight, diagnosis of CVD within the family, vegetables consumption, avoidance of fat eating, and regular exercise. The literature is split as to which of the above factors are significantly related to CVD knowledge. Although some studies demonstrated that age, gender and education are not associated with level of CVD knowledge (Akintunde et al., 2015; Donkor, Owolabi, Bampoh, Aspelund, & Gudnason, 2014; Uchenna, Ambakederemo, & Jesuorobo, 2012), other studies found that age and level of education were significantly related to the level of CVD knowledge: age (Cossi, Preux, Chabriat, Gobron, & Houinato, 2012; Obembe, Olaogun, Bamikole, Komolafe, & Odetunde, 2014; Wahab, Kayode, & Musa, 2015), and level of education (Ajayi & Ojo, 2007; Ansa, Oyo-Ita, & Essien, 2007; Cossi et al., 2012; Obembe et al., 2014; Oladapo, Salako, & Sadiq, 2013; Wahab et al., 2015).

The results from this study support the results in Aminde et al., (2017), which found that the combined factors of a high level of education, having family with CVD, being a former smoker, and being economically viable as likely predictors of high CVD knowledge. This study results also show modifiable and non-modifiable factors with significant correlational

relationships with CVD knowledge of AITD. The following modifiable factors significantly correlated with CVD knowledge: post graduate education, marital status, problems managing household income, weight without shoes, consumption of vegetables, avoidance of eating fatty food, and regular exercise. There were non-modifiable risk factors that significantly correlated with CVD knowledge of AITD, such as history of diagnosis of CVD within the family. For Aim 2, the same ten factors in Aim1, when combined, were significantly predictive of CVD knowledge scores. However, only five of the ten factors (regular 7 – 8 hours of sleep, regular exercise, frequent vegetable consumption, history of immediate family cardiovascular disease diagnosis, and alcohol consumption within the past 30 days contributed to the regression model and predicted that participants with these factors are likely to have higher CVD knowledge score.

Both CVD and related risk factors that necessitate behavioral changes and health outcomes are predicated on an overall high CVD knowledge (Al Hamarneh, Crealey, & McElnay, 2011). Therefore, overall high CVD knowledge scores from this study provide a solid foundation for researchers to map appropriate interventions to prevent or reduce the associated modifiable CVD risk factors. Intervention mapping provides the opportunity for researchers to focus on health promotion programs aimed at influencing behavioral and environmental outcomes of specific health issues (Eldredge, Markham, Ruiter, Kok, & Parcel, 2016). Effective interventions involving taxi drivers' health education will provide AITD the opportunity to translate knowledge of CVD risks into behavioral changes aimed at preventing or reducing CVD risks.

Limitations

Several limitations affected this study. First, more than 76 % of the participants recruited through convenience sampling were from three African countries (Nigeria, Ethiopia, Ghana), thus, findings cannot be generalized. There was a potential for sample selection bias, as participants with high knowledge of CVD may have been more willing to enroll in the study, thereby overestimating their CVD knowledge. Furthermore, only three female taxi drivers participated in the study, also preventing generalizing to all African taxi drivers.

Most responses on the survey were self-reported, making recall bias likely. It was difficult to enroll a sufficiently large number of overnight shift drivers because of the reluctance of drivers to speak to strangers at night. Future studies that include overnight shift drivers are needed to capture their CVD knowledge. Despite these limitations, the current study provides valuable new knowledge regarding CVD risk knowledge among African immigrants to the US.

Conclusion

This study captured the CVD knowledge levels of African immigrant taxi drivers in the Baltimore-Washington area and the relationships between that knowledge and personal and demographic factors. These factors could be assessed individually to establish direct relationships or in group model to capture inter-relationships likely to predict CVD knowledge. Furthermore, to design and develop appropriate interventions for CVD and associated risk factors prevalent in this population, an establishment of the CVD knowledge baseline is important since both CVD and related risk factors behavioral changes and health outcome are dependent on the level of CVD knowledge.

References

Ajayi, A. O., & Ojo, O. O. (2007). Knowledge and perception of stroke among at risk medical out-patients in a tertiary health institution in Nigeria. Annals of African Medicine, 6(2), 51-53.

Akintunde, A. A., Akintunde, T., & Opadijo, O. G. (2015). Knowledge of heart disease risk factors among workers in a Nigerian University: A call for concern. Nigerian Medical Journal, 56(2), 91-95. doi:10.4103/0300-1652.150688

Al Hamarneh, Y. N., Crealey, G. E., & McElnay, J. C. (2011). Coronary heart disease: health knowledge and behaviour. International Journal of Clinical Pharmacy, 33(1), 111-123. doi:10.1007/s11096-010-9467-9

Aminde, L. N., Takah, N., Ngwasiri, C., Noubiap, J. J., Tindong, M., Dzudie, A., & Veerman, J. L. (2017). Population awareness of cardiovascular disease and its risk factors in Buea, Cameroon. BMC Public Health, 17(1), 545. doi:10.1186/s12889-017-4477-3

Anderson, M. (2015). African immigrant populations in the US steadily climbs. Retrieved from http://www.pewresearch.org/fact-tank/2015/11/02/african-immigrant-population-in-u-s-steadily-climbs/

Ansa, V. O., Oyo-Ita, A., & Essien, O. E. (2007). Perception of ischaemic heart disease, knowledge of and attitude to reduction of its risk factors. East African Medical Journal, 84(7), 318-323.

Apantaku-Onayemi, F., Baldyga, W., Amuwo, S., Adefuye, A., Mason, T., Mitchell, R., & Blumenthal, D. S. (2012). Driving to Better Health: Cancer and Cardiovascular Risk Assessment among Taxi Cab Operators in Chicago. Journal of Health Care for the Poor and Underserved, 23(2), 768-780.

Bigert, C., Gustavsson, P., Hallqvist, J., Hogstedt, C., Lewne, M., Plato, N., . . . Scheele, P. (2003). Myocardial infarction among professional drivers. Epidemiology, 14(3), 333-339.

Boateng, D., Wekesah, F., Browne, J. L., Agyemang, C., Agyei-Baffour, P., Aikins, A. D., . . . Klipstein-Grobusch, K. (2017). Knowledge and awareness of and perception towards cardiovascular disease risk in sub-Saharan Africa: A systematic review. PLoS One, 12(12), e0189264. doi:10.1371/journal.pone.0189264

Chacko, E. (2016). Ethiopian taxicab drivers: forming an occupational niche in the US Capital. African and Black Diaspora: An International Journal, 9(2), 200-213. doi:10.1080/17528631.2015.1083177

Commodore-Mensah, Y., Hill, M., Allen, J., Cooper, L. A., Blumenthal, R., Agyemang, C., & Himmelfarb, C. D. (2016). Sex Differences in Cardiovascular Disease Risk of Ghanaian- and Nigerian-Born West African Immigrants in the United States: The Afro-Cardiac Study. Journal of the American Heart Association, 5(2). doi:10.1161/JAHA.115.002385

Commodore-Mensah, Y., Himmelfarb, C. D., Agyemang, C., & Sumner, A. E. (2015). Cardiometabolic Health in African Immigrants to the United States: A Call to Re-examine Research on African-descent populations. Ethnicity and Disease, 25(3), 373-380. doi:10.18865/ed.25.3.373

Commodore-Mensah, Y., Sampah, M., Berko, C., Cudjoe, J., Abu-Bonsrah, N., Obisesan, O., . . . Himmelfarb, C. D. (2015). The Afro-Cardiac Study: Cardiovascular Disease Risk and Acculturation in West African Immigrants in the United States: Rationale and Study Design. Journal of Immigrant and Minority Health. doi:10.1007/s10903-015-0291-0

Cossi, M. J., Preux, P. M., Chabriat, H., Gobron, C., & Houinato, D. (2012). Knowledge of stroke among an urban population in Cotonou (Benin). Neuroepidemiology, 38(3), 172-178. doi:10.1159/000336862

Donkor, E. S., Owolabi, M. O., Bampoh, P., Aspelund, T., & Gudnason, V. (2014). Community awareness of stroke in Accra, Ghana. BMC Public Health, 14, 196. doi:10.1186/1471-2458-14-196

Eldredge, L., Markham, C., Ruiter, R., Kok, G., & Parcel, G. (2016). Planning health promotion programs: An intervention mapping approach. Somerset, New Jersey: John Wiley & Sons

Elshatarat, R. A., & Burgel, B. J. (2016). Cardiovascular Risk Factors of Taxi Drivers. Journal of Urban Health, 93(3), 589-606. doi:10.1007/s11524-016-0045-x

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Reseearch Methods, 39(2), 175-191.

Gambino, C., Trevelyan, E., & Fritzwater, J. (2014). The foreign-born population from Africa: 2008-2012. Retrieved from http://www.immigrationresearch-info.org/report/us-census-department-commerce/foreign-born-population-africa-2008-2012

Gany, F., Bari, S., Gill, P., Ramirez, J., Ayash, C., Loeb, R., . . . Leng, J. (2016). Step On It! Workplace Cardiovascular Risk Assessment of New York City Yellow Taxi Drivers. Journal of Immigrant and Minority Health, 18(1), 118-134. doi:10.1007/s10903-015-0170-8

Gany, F. M., Gill, P. P., Ahmed, A., Acharya, S., & Leng, J. (2013). "Every disease…man can get can start in this cab": Focus Groups to Identify South Asian Taxi Drivers' Knowledge, Attitudes and Beliefs About Cardiovascular Disease and Its Risks. Journal of Immigrant and Minority Health, 15(5), 986-992. doi:10.1007/s10903-012-9682-7

International Brotherhood of Teamsters. (2013). Teamster taxi drivers call on D.C. Mayor to apologize for offensive comment [Press release]. Retrieved from http://dctaxidrivers.com/files/2013/11/11.07.13dctaxidrivers.pdf

Jingi, A. M., & Noubiap, J. J. (2015). Cardiovascular risk factors awareness and prevalence among primary care physicians: an insight from the West region Awareness Initiative Survey to fight cardiovascular disease (WAIT-CVD) in Cameroon. BMC Research Notes, 8, 762. doi:10.1186/s13104-015-1747-y

Kaddumukasa, M., Kayima, J., Kaddumukasa, M. N., Ddumba, E., Mugenyi, L., Pundik, S., . . . Katabira, E. (2015). Knowledge, attitudes and perceptions of stroke: a cross-sectional survey in rural and urban Uganda. BMC Research Notes, 8, 819. doi:10.1186/s13104-015-1820-6

Maneze, D., Salamonson, Y., Poudel, C., DiGiacomo, M., Everett, B., & Davidson, P. M. (2016). Health-Seeking Behaviors of Filipino Migrants in Australia: The Influence of Persisting Acculturative Stress and Depression. Journal of Immigrant and Minority Health, 18(4), 779-786. doi:10.1007/s10903-015-0233-x

Morris, N. S., MacLean, C. D., Chew, L. D., & Littenberg, B. (2006). The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. BMC Family Practice, 7, 21. doi:10.1186/1471-2296-7-21

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Turner, M. B. (2016). Executive Summary: Heart Disease and Stroke Statistics--2016 Update: A Report From the American Heart Association. Circulation, 133(4), 447-454. doi:10.1161/cir.0000000000000366

National Cancer Institute. (2013). Food attitudes and behaviors(FAB). Retrieved from https://cancercontrol.cancer.gov/brp/hbrb/fab/

National Center for Health Statistics. (2016). National Health Interview Survey: About the National Health Interview Survey. Retrieved from https://www.cdc.gov/nchs/nhis/about_nhis.htm

National Research Council. (2014). The Continuing Epidemiological Transition in sub-Saharan Africa: A Workshop Summary. Retrieved from https://www.nap.edu/download/13533

Obembe, A. O., Olaogun, M. O., Bamikole, A. A., Komolafe, M. A., & Odetunde, M. O. (2014). Awareness of risk factors and warning signs of stroke in a Nigeria university. Journal of Stroke and Cerebrovascular Diseases, 23(4), 749-758. doi:10.1016/j.jstrokecerebrovasdis.2013.06.036

Oladapo, O., Salako, L., & Sadiq, K. (2013). Knowledge of Hypertension and other risk factors for heart disease among yoruba rural southwestern Nigerian population. British Journal of Medicine and Medical Research, 3(4), 983-1003.

Riley, L., Guthold, R., Cowan, M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. (2016). The World Health Organization STEPwise Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities. American Journal of Public Health, 106(1), 74-78. doi:10.2105/ajph.2015.302962

Schaller Consulting. (2004). The changing face of taxi and limousine drivers: U.S., large states and metro areas and New York. Retrieved from Brooklyn, NY: http://www.schallerconsult.com/taxi/taxidriver.pdf

Subar, A. F., Thompson, F. E., Kipnis, V., Midthune, D., Hurwitz, P., McNutt, S., . . . Rosenfeld, S. (2001). Comparative validation of the Block, Willett, and National Cancer Institute food frequency questionnaires : the Eating at America's Table Study. American Journal of Epidemiology 154(12), 1089-1099.

Uchenna, D., Ambakederemo, T., & Jesuorobo, D. (2012). Awareness of heart disease prevention among patiients attending a specialist hospital in southern Nigeria. International Journal of Prevention and Treatment, 1(3), 40-43.

United African Organization. (2013). The health of the African taxicab driver in Chicago: Health survey report. Retrieved from http://uniteafricans.org/wp-content/uploads/2016/05/UAO-African-Taxicab-Driver-Health-Survey-Report.pdf

Venters, H., & Gany, F. (2011). African immigrant health. J Immigr Minor Health, 13(2), 333-344. doi:10.1007/s10903-009-9243-x

Wagner, J., Lacey, K., Chyun, D., & Abbott, G. (2005). Development of a questionnaire to measure heart disease risk knowledge in people with diabetes: the Heart Disease Fact Questionnaire. Patient Education and Counseling, 58(1), 82-87. doi:10.1016/j.pec.2004.07.004

Wahab, K. W., Kayode, O. O., & Musa, O. I. (2015). Knowledge of stroke risk factors among Nigerians at high risk. Journal of Stroke and Cerebrovascular Diseases, 24(1), 125-129. doi:10.1016/j.jstrokecerebrovasdis.2014.07.053

World Health Organization. (2008). WHO STEPS instrument (core and expanded): The WHO STEPwise approach to chronic disease risk factor surveillance (STEPS). Retrieved from http://www.who.int/chp/steps/STEPS_Instrument_v2.1.pdf

Yaroch, A. L., Tooze, J., Thompson, F. E., Blanck, H. M., Thompson, O. M., Colon-Ramos, U., . . . Nebeling, L. C. (2012). Evaluation of three short dietary instruments to assess fruit and vegetable intake: the National Cancer Institute's food attitudes and behaviors survey. Journal of the Academy of Nutrition and Diet, 112(10), 1570-1577. doi:10.1016/j.jand.2012.06.002

Table 1. Sample Description

Variable	Category	n	%	Mean	SD
Gender	Male	118	97.5		
	Female	3	2.5		
Country of Origin	Nigeria	41	33.9		
	Ethiopia	37	30.6		
	Ghana	15	12.4		
	Others	23	23.1		
Place of living in country of origin	City	105	86.7		
	Village	16	13.3		
Reason to move to USA	Education	51	42.1		
	Economic hardship	5	4.1		
	Join Family / Marriage	5	4.1		
	Asylum / Refugee	25	20.7		
	Job opportunities	36	29.8		
	Other reasons	13	10.7		
Education level	No formal schooling	0	0.0		
	Less than primary school	0	0.0		
	Secondary school completed	5	4.1		
	High school completed	48	39.7		
	College / University	57	47.1		
	Post-Graduation	14	11.6		
Marital status	Never married	9	7.5		
	Currently married	92	76.7		
	Separated	4	3.3		
	Divorced	14	11.7		
	Widowed	1	.8		
No. of people older than 18 years at home	1	27	22.3		
	2	74	61.2		
	3	11	9.1		

Variable	Category	n	%	Mean	SD
	4	5	4.1		
	5	1	.8		
	6	1	.8		
	7	1	.8		
Annual Household Income	Less than $15,000	3	2.5		
	More than $15,000 - $24,999	11	9.2		
	More than $25,000, - $34,999	14	11.8		
	More than $35,000- $49,999	10	8.4		
	More than $50,000	4	3.4		
	Don't Know	77	64.7		
Problems Managing Household Income	No problems but watched spending	10	8.3		
	Some problems	92	76.0		
	Lots of problems	4	3.3		
	No problems at all	10	8.3		
Age (years)				51.39	10.515
Duration working as driver (years)				13.656	9.914

Table 2 Frequency Table of Response to Hearth Decease Risk Knowledge Scale

	Response	n	%
A person always knows when they have heart disease	False	54	44.6
	True	67	55.4
If you have a family history of heart disease, you are at risk for developing heart disease	False	18	14.9
	True	103	85.1
The older a person is, the greater their risk of having heart disease	False	14	11.6
	True	107	88.4
Smoking is a risk factor for heart disease	False	1	0.8
	True	120	99.2
A person who stops smoking will lower their risk of developing heart disease	False	2	1.7
	True	119	98.3
High blood pressure is a risk factor for heart disease	False	0	0.0
	True	121	100.0
Keeping blood pressure under control will reduce a person's risk for developing heart disease	False	0	0.0
	True	121	100.0
High cholesterol is a risk factor for developing heart disease	False	2	1.7
	True	119	98.3
Eating fatty foods does not affect blood cholesterol levels	False	98	81.0
	True	23	19.0
If your 'good' cholesterol (HDL) is high you are at risk for heart disease	False	68	56.2
	True	53	43.2
If your 'bad' cholesterol (LDL) is high you are at risk for heart disease	False	8	6.6
	True	103	93.4
Being overweight increases a person's risk for heart disease	False	1	0.8
	True	119	99.2

	Response	n	%
Regular physical activity will lower a person's chance of getting heart disease	False	5	4.1
	True	115	95.9
Only exercising at a gym or in an exercise class will lower a person's chance of developing heart disease	False	111	91.7
	True	10	8.3
Walking and gardening are considered exercise that will help lower a person's chance of developing heart disease	False	4	3.3
	True	116	96.7
Diabetes is a risk factor for developing heart disease	False	2	1.7
	True	119	98.3
High blood sugar puts a strain on the heart	False	1	0.8
	True	120	99.2
If your blood sugar is high over several months, it can cause your cholesterol level to go up and increase your risk of heart disease	False	3	2.5
	True	117	97.5
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood sugar levels under control	False	2	1.7
	True	118	98.3
People with diabetes rarely have high cholesterol	False	68	56.2
	True	53	43.8
If a person has diabetes, keeping their cholesterol under control will help to lower their chance of developing heart disease	False	8	6.7
	True	112	93.3
People with diabetes tend to have low HDL (good) cholesterol	False	40	33.1
	True	81	66.9
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood pressure under control	False	3	2.5
	True	118	97.5
A person who has diabetes can reduce their risk of developing heart disease if they keep their weight under control	False	1	0.8
	True	119	99.2
Men with diabetes have a higher risk of heart disease than women with diabetes	False	70	59.3
	True	48	40.7

Table 3. Variables Significantly Correlating with HDFQ Scores

Variable	1	2	3	4	5	6	7	8	9	10
HDFQ Scores	-									
Post grad education	- .237**	-								
Marital Status	- .285**	.248**	-							
Problems managing HH Income	.189*	- .100	- .018	-						
Lots of problems managing HH Income	- .249**	.222*	.128	- .329**	_					
Weight w/o shoes	- .263**	- .040	.086	- .172	.481**	-				
Family Cardio Disease Diagnosis	.251**	- .067	- .048	.014	- .066	- .037	-			
Vegetable Consumption	.183*	.006	- .114	.047	.058	- .004	.143	-		
Avoid eating fat	- .233*	.159	.135	- .009	.217*	.146	- .065	- .085	-	
Regular Exercise	-.238**	.148	.069	- .206*	- .086	.038	- .127	- .05	.268**	-

* = p < .05, ** = p < .01

Table 4. Variables Non-Significantly Correlating with HDFQ Scores

Variable	1	2	3	4	5	6	7	8	9
HDFQ Scores	-								
Active Smoker	- .091	-							
Alcohol Consumed	.024	.001	-						
Time Sitting	.002	.169	- .046	-					
Sleep – 7 – 8 hours	- .126	.190*	.161	.002	-				
Height	- .123	- .007	- .093	- .005	.01	-			
Waist	.185	- .084	- .239	.028	.024	.444*	- .021	-	
Blood pressure classification	- .093	.082	- .073	.225*	- .047	- .022	- .142	- .084	-

* = p < .05, ** = p < .01

Table 5. Summary of Independent Variables Prediction of HDFQ Scores

Variable	B	Standard Error	β
Regular 7 – 8 Hours Sleep	-0.613	0.197	-0.293**
Regular Exercise	-0.485	0.199	-0.228*
Vegetable Consumption	0.219	0.101	0.201*
Family history Cardiovascular Disease Diagnosis	0.701	0.324	0.192*
Body Weight	-0.009	0.005	-0.167
Alcohol Consumption – Past 30 days	0.639	0.311	0.188*
Blood pressure classification	-0.234	0.147	-0.142
Lots of problems managing HH finance	-1.619	1.043	-0.141
Marital Status	-0.275	0.189	-0.136
Avoid eating too much fatty food	-0.238	0.204	-0.110

Note: Adjusted R^2 = 24%, F (10, 92) = 4.125, p < .001. ** = p < .01 * = p < .05
β = Standardized beta coefficient
B= Unstandardized B coefficient

Manuscript 3

Cardiovascular Disease Risk Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Qualitative Study

Abstract

Background
Taxi drivers face risks for cardiovascular diseases (CVD) associated with their occupation, such as sedentary lifestyle, irregular meals, long work hours, and exposure to exhaust fumes. These risk factors affect their health and general well -being. Many taxi drivers in large urban cities are disproportionately immigrants. In the Baltimore- Washington area, the majority of taxi drivers are African and Middle Eastern immigrants. Few published research studies in the US have explored the CVD risk perceptions and experiences of African immigrant taxi drivers. This qualitative grounded theory study addresses this gap.

Methods
Participants (N=19) were purposefully selected from a larger sample of 121 participants who were participating in a larger standardized survey study about their cardiovascular risk knowledge. Participant selection was based on completion of the Heart Disease Fact Questionnaire (HDFQ) survey with a minimum score of 20 points out of possible 25 points and willingness to participate in a follow up interview. All participants took part in a one on one interview that was audio recorded. The audio recordings were transcribed and coded based on the constructivist grounded theory method. The coding results were subsequently analyzed using Kleinman's Explanatory disease model framework.

Findings
Five themes were identified including, awareness of cardiovascular diseases risk factors, ethnic self-identification, behavior modifications, spiritual beliefs, and traditional/cultural approaches. The use of Kleinman's Explanatory disease model in analyzing their perspectives helped to show some underlying structural factors affecting their perspectives.

Conclusion
The African immigrant taxi drivers in this study identified five themes central to their understanding of the cardiovascular diseases risk factors associated with taxi driving. These themes touched on structural factors that affected their CVD risk within the description of each of these themes. Understanding their perspectives reflected in the five themes and the structural factors will help researchers design and develop appropriate interventions to reduce cardiovascular risk factors, through tailoring activities to occupational and cultural realities of the taxi drivers.

Introduction and Background

Taxi drivers have higher cardiovascular disease risk factors compared to workers in other occupations (Apantaku-Onayemi, F. et al., 2012; Bigert et al., 2003). Approximately 6.3% of the immigrant taxi and limo drivers in the US are Africans (Schaller Consulting, 2004), and a majority of the 6,000 taxi cab drivers in Washington DC are from Africa and the Middle East (International Brotherhood of Teamsters, 2013). Despite this high number of African immigrant taxi drivers, there is a dearth of research on their cardiovascular risk perspectives (Sewali et al., 2015). Many research studies on cardiovascular risk factors among African immigrants in the United States are concentrated among West African immigrants from Ghana, Cameroon, and Nigeria (O'Connor et al., 2014). The few studies that have looked at the cardiometabolic health of Africans in the US have consistently found that compared to African Americans, African immigrants have a low prevalence of obesity and smoking, but a higher prevalence of hypertension, diabetes, and pre-diabetes (O'Connor et al., 2014; Ukegbu et al., 2011; Yu et al., 2013).

Despite these findings of disproportionate cardiovascular risks among African immigrants, and the cardiovascular risks associated with taxi driving, few studies have addressed both issues. Most studies that have addressed these issues were conducted using survey instruments. We addressed this gap by conducting a qualitative study to explore and understand the cardiovascular risk experiences and perspectives of African immigrant taxi drivers in the Baltimore -Washington Metropolitan area. Understanding the CVD risk perceptions and experiences of this population will enable providers to tailor their care to meet their healthcare needs.

To capture participant perspectives in addition to meanings contained in the data, we chose open-ended, in–depth interviews and used Constructivist Grounded Theory (CGT) to guide data collection, coding and analysis. Data was transcribed, coded and analyzed immediately after interviews, which served to inform direction for further data collection. Unlike final theories that

emerge from classic Grounded Theory, final theories that emerge from the use of CGT reflect a combination of the cumulative experiences and interactions of the researcher and participants not limited to the information emerging from the data alone (Higginbottom & Lauridsen, 2014). The PI's background as an African immigrant may have helped in negotiating meanings with participants before and during interviews, leading to the emergence of themes in this study's context. The CGT method allows researchers to capture the complexities and realities of participants' lived experiences through their own subjective experiences and realities while interpreting emerging data (Charmaz, 2014). The open-ended interview format allowed participants to provide their perspectives and realities. This flexibility enhanced the understanding of collected data by allowing it to be shaped, reshaped, and refined to increase understanding of the study (Charmaz, 2014). After interviews were coded line by line, constant comparison was used to establish general categories, using gerunds or words ending in -ing that reflect actions or processes to make conceptual connections, consistent with CGT (Hoare, Mills, & Francis, 2012). Subsequently, the PI and second coder grouped the categories into themes. Finally, findings were adapted to Kleinman's explanatory models of disease to better understand how the taxi drivers' elicited health factors were influenced by socio-economic and cultural realities (Kleinman, Eisenberg, & Good, 1978).

According to Kleinman, Explanatory models (EMs) may include one or all of the following components of an illness: (a) etiology, (b) symptoms onset time, (c) pathophysiology, (d) course of sickness, and (e) treatment (Kleinman, 1980b). Explanatory models (EMs) of illness are personal beliefs that aid in the way we recognize, interpret, and react to a specific illness experience different from generalized health beliefs (Kleinman, 1980b). Healthcare outcomes of individuals within this health care system depend on how individuals with different EMs are able to negotiate transactions involved in healthcare encounters (Buchbinder, 2013). It is common for the EMs of patients and providers to vary because of their different social environments, ethnicity, subjective interpretation of past experiences, and knowledge (Kleinman, 1980a;

McSweeney, Allan, & Mayo, 1997). Health seeking activities and the choice of treatment interventions are both a result of one's perception of the cause of illness (Kleinman, 1980b). Therefore, individuals are expected to have conflicting EMs. However, the nature of patient encounters and outcomes depends on how individuals within the system are able to resolve conflicts between their EM and the daily realities they face (Buchbinder, 2013; Kleinman, 1980b). Kleinman advocated the use of open-ended questions in interviews to elicit individual EMs. He also suggested a set of eight questions (e.g. what do you fear most about your sickness?) that could be used to elicit personal EMs, if the open-ended questions do not yield desired results (Kleinman, 1980b).

This qualitative study was conducted to explore the cardiovascular risk perceptions and lived experiences of African immigrant taxi drivers in the DC metro area.

Methods

This qualitative grounded theory study with in-depth interviews was conducted in the Baltimore Washington Area with 19 African immigrant men and women who were participating in a larger standardized survey study about their cardiovascular risk knowledge. This study focused on their CVD risk perceptions and experiences. Grounded theory (GT) is a set of guidelines for collecting and analyzing qualitative data to generate theories 'grounded' in the collected data (Charmaz, 2014; Strauss & Corbin, 1994); the theory is not predetermined by any theoretical perspective (Mitchell, 2014). However, unlike traditional GT, Constructivist grounded theory (CGT) allows for researchers' subjectivity and active involvement in the collection and interpretation of data. Thus, theories emerge from data through the researchers lens. Theories are constructed through the researcher's "past and present involvements and interactions with people, perspectives, and research practices." (Charmaz, 2014).

This flexibility in data collection and analysis enhance the understanding of collected data by allowing for the co-construction of reality that entails research participants' "implicit meanings, experiential view- and researchers' finished grounded theories (Charmaz, 2014, pg.

17). The Medical University of South Carolina Institutional Review Board (IRB) approved the study.

Data collection

From 121 participants who participated in the quantitative phase of a mixed methods study, 19 participants were selected based on their completion of the Heart Fact Questionnaire (HDFQ) survey with at least a score of 20 points out of the possible 25 points and their willingness to participate in a follow up interview. Participants (n=19) were interviewed by Principal Investigator (PI) on a mutually agreed date in a private room at one of the following locations in Washington, DC: Anambra State Association, Inc. (ASA) Cultural Association Office, Dial a Cab Office, Yellow Cab Company Office, and Fairway Cab Association Office. The interviews occurred between April and August 2017.

The rapport established with the participants during quantitative data collection facilitated the one-on-one in depth interviews. The PI also disclosed his African origin and explained rationale for the interview, which further helped to create a relaxed atmosphere and opened the door for open and honest conversation between participants and the PI.

Participants

The inclusion criteria for this qualitative part of the mixed methods study include completion of the HDFQ survey phase with at least a score of 20 points out of the possible 25 points plus willingness to participate in the follow up interview. Each in-depth interview of the participants lasted between 20 and 60 minutes. All participants received a $5 Wal-Mart gift card for their participation. Participants (male=17, females n=2) were residents of the Baltimore Washington Metropolitan area (Virginia (n=1); Washington DC (n=1); Maryland (n=17), and from the following countries (Nigeria (n=10); Tunisia (n=1); Ethiopia (n=2); Ghana (n=5); Liberia (n=1). Participants' age ranged from 36 to 74 with length of years as taxi driver from 2 to 30 years.

Data Analysis

The transcribed interviews were coded based on the CGT methodology and analyzed immediately and constantly to inform additional ideas and questions. Coding was used to link data and emergent theories and involved (1) line-by-line coding, (2) focused coding, and (3) theoretical coding. The first coding process involved a line-by-line analysis of the transcript aimed at accurately capturing dimensions of the phenomena from each participant's perspective (Bowers, 1990; Charmaz, 2014; Glaser & Strauss, 1967). The codes from the initial coding process were subjected to a comparative focused coding that grouped codes into larger categories in order to organize and synthesize a large quantity of data (Charmaz, 2014). At this stage, a determination about the nature and conceptual strength of initially identified codes was made that supported thematic categories. Initial codes with wider theoretical reach and central to the study became the focus of the data analysis. Throughout this stage, we continually referred to the data to explore perspectives that may have been glossed over initially.

Next, we used a theoretical coding method was used to integrate related categories resulting from the focused coding into a meaningful and coherent theme (Glaser, 1978), which helps to theorize data and focused codes, thereby moving data analysis in a theoretical direction (Charmaz, 2014). In other words, categories developed earlier are integrated to show possible relationships. Memos aided in connecting the different dimensions and themes identified in the data. Data were considered saturated after the nineteenth interview, after which no new themes were noticed. Field notes taken before and after interviews were also used to analyze data in order to capture a " description of the situation, the interaction, the person's affect and the perceptions of how the interview went" (Charmaz, 1995b, p. 33).

Finally, Kleinman's Explanatory Disease model was used to re-examine the data in a second pass for triangulation in the generation of an explanatory model of CVD disease and risk factors. Similar to others who have used Kleinman's explanatory model of disease to examine

heart conditions (Clark et al., 2012), specific components of the theoretical framework allowed the PI to examine data using five components of the model:

- meaning of the illness
- participant perspectives (including attitude, fears, etc.)
- lived experiences with the illness and health services
- description of CVD related symptoms
- cultural significance of the illness.

In parallel with the analysis of data, some evaluative criteria were used to ensure accuracy and rigor of the study including use of adequate and appropriate sample size, negative case analysis, debriefing, standardized interview questions, clarifying researcher biases, and participant checking (Morse, 2015). Participants' who were interviewed represented different variations of the sample population, and the data collected represented their own lived experiences and the experiences of those they work with and know. The information collected, therefore, extends beyond the 19 study participants. Less commonly occurring participants' views were compared with the majority views to gain understanding of the differences for a better general understanding of the phenomenon. Following collection of the data, the PI presented preliminary findings at the 5th Annual Conference on African Immigrant Health in Washington, DC. Thus, PI was able to listen, receive feedback, and answer questions about the study. A standardized set of questions was used for the interviews, making it easier for coding and analysis. Because of the inherent researcher bias concerns in qualitative studies (Morse, 2015), the initial codes of each interview and at every step of the interviews, coding, and analysis, as well as the categories that emerged were discussed with a qualitative design expert committee member; the accuracy was assessed and verified by the same committee member to maintain credibility. Finally, participant checking was used during interviews to check data among

participants using cues like “some drivers told …”, “another driver told me xyz, how do you see it?”

Results

The data analysis resulted in five distinct categories/themes that captured salient lifestyle perceptions before and after immigration, as well as current health status, knowledge and attitudes about CVD and associated risks, and the socio-cultural approaches to health care decisions of 19 African immigrant taxi drivers in the Baltimore Washington area. The following themes/categories emerged (1) awareness of cardiovascular diseases risk factors, (2) ethnic self-identification, (3) behavior modifications, (4) spiritual beliefs, (5) traditional/cultural approaches. This section will present these themes using participants’ quotes to support categorizations.

Awareness of cardiovascular diseases

Participants’ awareness of CVD risk factors varied as reflected in their account of either their personal CVD risk factors or those of colleagues. This theme was supported by subcategories that include (1) sedentary lifestyle, (2) long work hours, (3) unhealthy diets, (4) physical inactivity, (5) stress.

Sedentary lifestyle/Physical inactivity

The predominant sub-theme among all interviewed taxi drivers demonstrated their understanding of risk factors. The participants’ believed that sitting down in their cars for long hours daily is responsible for all kinds of diseases. One participant believed that sedentary lifestyle is simply dangerous to the body…

> “*Any job you do sitting throughout you don’t get up is dangerous to the body. You don’t have free blood flow at all, that’s the problem.*” (P10)

Other participants were more pointed in their description of the link between sedentary lifestyle and CVD…

"I think they are mainly connected with the sitting down for a very long time, it is associated with a lot of diseases like diabetes and high blood pressure and other diseases that I don't know of." (P11)

Another attributed high blood pressure to sitting in the car for a long time…

"The high blood pressure is from lack of exercising and sitting in the car for long periods of time." (P17)

One participant explained that taxi drivers' health issues are compounded by lack of any physical activities after consuming junk foods.

When we eat all these food, you work 12 hours or more, you don't have time to exercise. You don't have time to burn it, to burn that fat. So, I mean, all that fat, all the cholesterol piles up together and compound the fact you are also sitting down all day for 12 hours. You're sitting down driving this thing; you rarely get out of your cab and walk around. All these compounds the medical problems that a lot of drivers have. (P2)

Another complained of his weight gain that he attributed to lack of physical activities.

The other thing is gaining weight because we sit a lot and we don't walk around. So, I'll say that I'm, you see yourself gaining weight, most specific around the tummy, you always sit and going around unless you sign out. (P7)

This participant went further to link his weight gain to CVD risk factors…

"Yeah, gaining weight brings diabetes, brings high blood pressure, and then makes you weak. You won't be agile. Overweight brings diabetes, it makes you diabetic, it makes you hypertensive." (P7)

According to another participant, exercising is central in preventing heart disease risk factors associated with taxi driving…

"If you eat healthy, you do your exercise every time; you can't have any heart disease." (P6)

These excerpts show individual EMs expressing etiological and CVD risk factors associated with taxi driving. The first participant viewed any job like taxi driving that involves continuous sitting down to be dangerous to the body. Therefore, not having free blood flow explains all taxi driving related diseases or risk factors. The second excerpt from participant 17 explains his personal EM that is somehow related but distinct from Participant 11 EM. Participant 17 explains high blood pressure in relation to physical inactivity and sedentary lifestyle. The explicit linking of physical inactivity and CVD provides points of intervention that health providers could use to propose development of Interactive Health Technology (IHT) to enhance behavior modifications (Ahern, Kreslake, & Phalen, 2006), consistent with the concept of User - centered Design (UCD) (Abras, Maloney-Krichmar, & Preece, 2004). Physical inactivity is a modifiable risk for CVD. It is important to learn taxi drivers' current understanding of their modifiable CVD risk factors to fashion appropriate strategies to reduce their CVD risk.

Long work hours

Most of the narratives show that the drivers spend long hours at work with an average of 10 to 11 hours daily. Many viewed long work hours without any breaks as responsible for ailments that affect them, especially CVD.

The biggest problem with cab drivers, I think, could be lack of knowledge or awareness; they sit in their cab for 12 hours, 14 hours. They don't get out to stretch their body or move their blood around. So, at the end of the day, they have some, some of them they make good money, but they lose their life because they can get any, I mean heart strokes at any point in time. (p17)

Another driver blamed business competition in the taxi industry for the long work hours…

"Because there is too much competition in the business and there is no money, so people try to stay long hours." (P16)

Both excerpts show an explanatory framework of CVD that embody their individual realities. As portrayed in the first excerpt, the EM of CVD hinged on lack of awareness or knowledge. On the other hand, participant 16's EM of the CVD risk factor, long work hours, was portrayed as an un-modifiable survival practice in today's cab business environment. These perspectives provide a point of intervention that has been used in a study of South Asian taxi drivers to use pedometers to increase physical activity in New York City (Gany et al., 2014). The likelihood of the success of similar intervention with this population is heightened because of their lived beliefs that lack of physical activity is a problem.

Unhealthy diets

Many of the taxi drivers in the interviews raised issues regarding their diets. Some of the key words that came up during the interviews include "junk food", "Popeyes", "McDonalds", fast food", "sodas". While some described their complete dependency on junk food for sustenance as taxi drivers, some explained their attempts at avoiding junk foods. Overall, the consensus among the interviewed drivers was that junk food is the food of choice for taxi drivers and is associated with their CVD risk factors.

This statement is supported by numerous narratives from the in-depth interviews. One participant explained it thus:

"Maybe the food we eat too. We eat all these food outside, burger and steak, and all these things, you know, all these high cholesterol food… so I mean, all the fat, all the cholesterol pile together". (P 2)

Another participant described his efforts at staying healthy in terms of how well he was able to avoid junk food…

"I care a lot about my health, so every single day I exercise, I avoid eating junk food, I mostly carry with me home made meals. So, by doing so I believe I'm in good shape." (P17)

Another driver describing common health problems with taxi drivers blamed lack of time during work hours for the consumption of junk food…

"I mean some of them get blood pressure and diabetes because they sit down a lot and they consume a lot of junk food." (P18)

For this participant, junk food meant the foods you eat because of the lack of time to consume normal full course meal…

"*You know, McDonalds, Burger King and all those things because it's like you don't have time to eat regular meal and stuff like that."* (P18).

Many participants explained diabetes and high blood pressure as direct consequences of drivers' unhealthy eating habits.

Yeah, because people as I told you, they have don't have enough time, like when they start working, they stop somewhere, and they eat like fast foods all the time. So, most cab drivers, I think, they have not the young ones, mostly the little bit older people who are driving taxis. They have like diabetes, as I told you, high cholesterol and high blood pressure, those kinds of diseases. (P19)

This participant went on to explain in detail what he considered the connection between eating junk food and CVD.

Which is true, like I told you earlier, heart disease is like because of high cholesterol, your blood vessels are closed because of junk foods you're eating, like those stuff. I don't want to mention the food, but like those junk foods, fast foods. If you're eating unhealthy

food all the time, it's going to close your vessels, and then you get heart disease. That's my feeling, that's my understanding. (P5)

Finally, one participant confessed that the only food he eats while driving is junk food because it affordable…

"Basically, I eat junk food when I'm on the road because I look for the cheapest food I can ever find. So, that's basically what it is." (P1)

The excerpts above show different EMs and how one's EM can influence decisions about how to modify behavior to prevent or minimize CVD risk factors. All the participants identified junk food as a CVD risk factor. The behavioral changes align with the EM identified. Participant 18 directed his behavior modifications of drinking less alcohol or quitting altogether; eating good food and a balanced diet align with his main CVD risk factors EM. The uniformity of the taxi drivers' awareness that current eating habits contribute to CVD provide a point of intervention for health providers and suggests the basis for a social marketing campaign to improve current eating practices.

Stress

Many of the participants believed that stress was a strong component of their CVD risk factors. One of the participants believed that stress was the number one issue associated with taxi driving. When asked what may have contributed to some of the health issues she has as a taxi driver, she named stress as the number one contributor to her health issues…

"*Well, it could be because of the job I do, because let me tell you, when you drive taxi you'll be having a lot of stress, stress is the number one thing that is affiliated with cab driving."* (P12)

Another driver explained that the stress level taxi drivers encounter each day is so pervasive that he attributed many health problems to stress alone.

I *think it's just the stressful nature of the job, the stressful nature of the job as described is such that the pace and the intensity and the desire and drive to make money. In the sense that you, before you actually get started in your day, you already committed to paying somebody a certain amount of money that doesn't even belong to you. So, you are in the red before you begin your work day*. (P8)

Another driver explained when asked what he thought was responsible for taxi cab drivers higher risk of heart disease named stress as the reason.

The stress of the job increases tenfold and I've never done anything else I don't know about any other profession. I really don't know about any other profession, but I can tell you that the stress of the job of driving a taxi for 12, 14 hours increases the risk of heart disease tenfold. (P8)

Another participant when asked whether there is anything that has to do with cab driving that is stressful responded with the example of how the weekly obligation of taxi rental fees can be a source of enormous stress on the drivers.

Oh! Yes, it's like you don't meet what you're supposed to every week. If you're not able to pay your bills, that keeps you on your toes, and it might stress you out and that will drive you to drive, putting more hours. (P9)

Finally, one participant argued that the stress resulting from the inability to meet set financial goals easily leads to CVD.

At the end of the day, the stress of not like meeting whatever target that you have probably is going to set your blood pressure and everything going up high because of expectations. I think that is that, coupled with if you have any heart issues or any questions. (P18)

Again, the excerpts above show participants' EMs of stress as a CVD risk factor. All view taxi driving as a stressful occupation that is responsible for various CVD risks. Psychosocial stress is a CVD risk factor that appears to contribute to mechanisms underlying CVD, such as plaque, rupture, ischemia, and arrhythmia (Bairey Merz et al., 2002). A better understanding of the taxi drivers' perspectives on the connection between stress and CVD will help healthcare providers to identify and formulate intervention strategies aimed at reducing stress in their daily lives, thereby reducing CVD morbidity and mortality in the taxi driver population.

Ethnic identification as Africans

Based on the narratives from the interviews, many of the participants self-identify as Africans instead of African Americans. In an answer to a question about his food habits and the things he eats, one participant prefixed his answers with statements denoting his ethnicity…

> "*Yeah, of things that we eat, for me, I'm African, so I'm not European, I'm not American, I'm from Africa."* (P3)

Another driver of 17 years when asked about his diet stated that he eats only Nigerian food.

> *I don't think I have problem with my food because even though I'm in America, but I'm eating all the food that I've been eating in Nigeria, at home. At home (Nigeria) all our food is natural, here (US) they are artificial type of food that they plant all their food with chemicals here.* (P10)

Another participant advocated for the establishment of an African Immigrant Center that will cater to the specific needs of African immigrants in the US. The excerpt below illustrates his clear identification as African.

> *I heard Congress always put money down for African Americans, why don't we also send a petition to Congress that we have a population of Africans. I mean not African*

Americans, Africans that have migrated into DC, Virginia, and Maryland metropolitan areas. (P19)

Inherent in this identification is also the preferred way of life, experiences and habits compared to those of African Americans.

An EM is affected by both environment and ethnicity. The identification with a particular ethnicity is important for the designing of culturally appropriate interventions. Since studies have suggested that African immigrants have worse cardiometabolic health status than African Americans, for example (O'Connor et al., 2014; Ukegbu et al., 2011; Yu et al., 2013), this self-identification as Africans may provide understanding of the cardiometabolic differences between them. It is not uncommon for studies to lump Africans and African Americans in the same category and for interventions designed for African Americans to be appropriated to Africans without consideration of the cultural differences.

Behavior modifications

A look at the interview narratives show that many taxi drivers made some life decisions to prevent or minimize their CVD risk factors.

One participant explained how the deaths of two African immigrant taxi drivers became a wake- up call for him to change his lifestyle.

"The food I eat, I stopped eating a lot of junk food. At first, I used to eat a lot of junk food. I eat well -prepared food, and I sleep because I was told that even lack of sleeping too causes high blood pressure. So, I make sure that after 12 or 16 hours I've enough time for 10 hours sleep." (P19)

An uninsured participant since becoming a taxi driver started going to the gym for exercises as an insurance against CVD risk factors…

"Now I don't have a doctor. But since I started this business, I go to the gym all the time. So, I make gym like my doctor, and I thank God I haven't gotten sick." (P4)

Another driver who had personal knowledge of three dead African immigrant drivers in the Baltimore Washington area and who is currently recovering from two recent strokes indicated that he is no longer in a hurry to do things as used to in the past…

"I'm on medication, and then I don't think too much about whatever goes on. I just relax and do whatever I can do." (P16)

Unlike generalized health belief models, EMs embody personal understanding of illness that are subject to change based on new knowledge, significant health events, or current health status (McSweeney et al., 1997). EM also represent a patient's perspectives, including attitudes towards and fears of an illness (Clark et al., 2012). Participant 16, for example, based on his experience dealing with two recent heart attacks, modified his behavior by…

"*not thinking much about whatever goes on*."

This modification is based on the EM of his prior heart attacks because of his stressful life as a taxi driver.

Therefore, health behavior changes sometimes align with individual EM about an illness or health status. Understanding the underlying behavioral change triggers of African taxi drivers will allow for proper understanding of their disease dealing process, as well as designing behavior modification interventions that align with their EMs. A drivers-educating-drivers' intervention strategy, for example, may be designed to have volunteer drivers educate other drivers on CVD risks.

Spiritual beliefs

This theme is manifested in the narratives of many participants. It portrays a general notion that God is an active player in the CVD risk factors of African immigrant taxi drivers.

One participant who is uninsured, without a primary care physician, and uses exercise to make up for not having a primary care physician was very grateful to God that he has not gotten sick…

"But since I started this business, I go to the gym all the time. So, I make gym like my doctor, and I thank God I haven't gotten sick." (P4)

Another participant seemed to suggest that God was responsible for his current good health.

Well, I'm grateful to God, I don't have any serious medical problems. Recently, I went to the doctor even did, what do you call it? Colonoscopy and my doctor was surprised that, you know, he had never seen somebody with such a very good health like me. So, I'm grateful to God for what the Lord is doing for me in that area. (P2)

Understanding the role God plays in the life of an average African as demonstrated from these excerpts provides an additional context to understanding participant EMs CVD risk factors. Our study presents people of African descent who have fundamental health related behaviors predicated on spirituality that affect quality of life, as a previous review reports (Como, 2007). These health related spiritual beliefs enable some people of African descent to discard personal accountability in promotion or maintenance of health (Marshall & Archibald, 2015). This approach to health promotion or maintenance serves as an impediment to conventional healthcare because individuals tend to perceive church-going as an alternative for the healthcare system (Marshall & Archibald, 2015). An understanding of this perspective will help health providers design and implement CVD risk interventions such as health education that incorporates biblical ideas and their religious beliefs (Marshall & Archibald, 2015).

Traditional/cultural values

The interviews show that many of the participants' values are more aligned to their African cultures and traditions. One participant argued that the reason for the long working hours of Nigerian and maybe other African immigrant taxi drivers boils down to their insatiable quest for material wealth.

"I don't think it is applicable to Americans; it is peculiar to immigrants particularly to Nigerians. Let me just say, let me be specific, you know, to Nigerians and probably

maybe Africans. But let me talk specifically about Nigerians. We want to acquire so much, we want to satisfy those back home, as well as satisfying our own here. Then we just pack and pack and just work and work and don't give the body rest. So, that's the way I see it". (P2)

A high deductible insured participant who had not been to the doctor for the past two years explained that cost was the biggest issue preventing her from seeking care. To her, such simple health issues like ear infection can be treated with traditional medicine.

I mean if a kid has ear infection and then you go and you end up paying $300 or $400 after you have paid your co-pay, then it's like, you could just get over the counter or just get traditional medicine just to take care of it. (P18)

Another participant with 10 years of cab driving experience believed that every African practices Voodoo at some level…

"Yeah, I think every African has a little bit under the bed. I'll put it that way, no matter being a Christian or whatever." (P16)

Explanatory models are the products of our socio-cultural environments (McSweeney et al., 1997). The cultural beliefs and values intrinsic to the participants help shape their views and understanding of their health status. Participant 16's statement that every African no matter how highly placed practices voodoo will affect his views on CVD risk factors and ultimately his response to health behavior modification and or treatment. Personal understanding of health and illness is influenced by the health perceptions and practices of a given culture (Airhihenbuwa, Ford, & Iwelunmor, 2014). Therefore, identifying the appropriate health interventions for this population will require a cultural centered approach that recognizes the health issues, beliefs, and practices important to this population (Dutta, 2007).

Discussion

Using interview data provided by the 19 African immigrant taxi drivers from the Baltimore Washington metropolitan area, the PI identified five themes that capture participants' perspectives of CVD risk factors associated with their occupation. Based on the interviews, their main concerns are the effects of their occupation on their health, especially as it relates to CVD. The identification of these themes provides focus points for future health interventions. These findings serve as preliminary data that can be used to tailor health behavior change interventions to involve the beliefs, attitudes, and preferred practices of African immigrant taxi drivers. The five dominant themes/categories are (1) awareness of cardiovascular diseases risk factors, (2) ethnic self-identification, (3) behavior modifications, (4) spiritual beliefs, (5) traditional/cultural approaches. The themes tend to highlight individual identity and the taxi drivers repeatedly referred to structural factors that affect their CVD risks within the description of each of these themes. Thus, our findings target these structural factors: health care access, occupational factors, and cultural identity as the focal issues that can be addressed to reduce CVD risks among African Immigrant taxi drivers.

Health care access includes issues with health insurance and cost of care. This finding supports results from previous studies that linked lack of health insurance and cost of care as major barriers to healthcare access for immigrants in the US (Adekeye, Adesuyi, & Takon, 2018; Adu-Boahene, Laws, & Dapaah-Afriyie, 2017; Cruz, Chen, Salazar, Karloopia, & LeGeros, 2010; Harcourt et al., 2014). In a study that examined health care barriers of African immigrants in Georgia, US, for example, 45.2% of the participants identified cost of medical care as a major barrier to healthcare access (Adekeye et al., 2018). Lack of health insurance is associated with lower likelihood of adequate treatment of CVD risk factors (Ayanian, Zaslavsky, Weissman, Schneider, & Ginsburg, 2003) and increased risk of CVD related conditions and death (Fowler-Brown, Corbie-Smith, Garrett, & Lurie, 2007).

Therefore, health care access is important for the reduction and management of CVD risks. In our study, lack of health insurance and high cost of medical care, both determinants of healthcare access, led to taxi drivers' resorting to alternative traditional African medicine, foregoing primary care visits, and substitution of medical care with gym visits. Therefore, we postulate that tackling these structural issues will help to prevent, reduce, and manage CVD risks among African immigrant drivers in the Washington DC area. Based on the connection between health care access and CVD risk, it is essential to involve African communities in educating and helping taxi drivers enroll in the appropriate health programs based on need and circumstance. Furthermore, it is necessary to involve the community in locating local clinics for the uninsured for their health care needs.

Illnesses, diseases, and the resources to prevent and manage them are not randomly distributed in societies. As a result, socioeconomic status (SES) affects how individuals prevent and manage illnesses and diseases (Havranek et al., 2015). Some studies have linked low SES with higher prevalence of CVD risk factors and higher rate of incidence and death resulting from CVD (de Mestral & Stringhini, 2017; Havranek et al., 2015; Valero-Elizondo et al., 2017). A study of the trends in prevalence of CVD risk factors among US adult by SES from 2002-2013, found that cardiovascular risk profile (CRF) of people of lower income SES were 36% higher when compared with the risk profiles of people with higher income SES (Valero-Elizondo et al., 2017). Our findings show that the SES of taxi drivers makes them susceptible to CVD risks. They work long hours to make ends meet, barely have time to eat, are sedentary for most of the day, are stressed, with some lacking health insurance or simply cannot afford the cost of care. Therefore, to be effective, intervention design and development must consider these socioeconomic factors. Furthermore, it is essential to involve lay African immigrants as community health workers to help educate the taxi drivers on CVD risks. The Institute of Medicine (IOM), recommended the use of Community Health Workers (CHW) to improve healthcare delivery, assist with secondary preventive strategies, and enhance risk reduction (IOM, 2003).

A recent systematic review of the effectiveness of CHW in CVD prevention in low-and middle-income countries found that, through interaction with target CVD at risk populations, CHWs were effective in helping decrease blood pressure and fasting blood sugar, increase smoking quit rates, modify diet, and increase physical activities (Khetan et al., 2017).

People's understanding and perceptions of health are based on their interactions within a culture that defines their identities and affects health outcomes. This understanding allows for the identification of both positive and negative factors that can affect health outcomes (Iwelunmor, Newsome, & Airhihenbuwa, 2014). Our findings illustrate that many of the African immigrant taxi drivers self-identify as Africans, maintain strong ties to their countries of origin, prefer an African diet, support their family in countries of origin, and identify as religious. Predicating interventions on these positive aspects of their identities can be very effective in promoting health behaviors that will lead to better health outcomes (Iwelunmor et al., 2014).

Therefore, health interventions for health concerns should focus on the cultural context that affects individual health behavior (Airhihenbuwa, 1990), such as designing dietary interventions to include the family unit as opposed to the individual alone or involving the African community in organizing health seminars focused on CVD risk.

The study findings highlight the importance of EMs in understanding participants' personal perspectives of their CVD risk factors. Furthermore, the findings show the correlation between participants' EMs and health behavior modifications or treatments. Participants' EMs highlighted throughout the interview show responses that reflect Kleiman's components of illness including etiology, symptoms onset, pathophysiology, course of sickness, and treatment.

Implications to Policy and Practice

Although the need to prevent and reduce CVD risk has been given adequate coverage as a public health issue, the structural factors implicated in this study are important to both practice and policy. The Affordable Care Act reduced the number of uninsured in the country, improved access to primary care, made medications affordable and improved health outcomes (Sommers,

Gunja, Finegold, & Musco, 2015). However, recent changes to the Affordable Care Act are likely to result in an increase in the uninsured population in the country. As independent contractors, taxi drivers receive health coverage either through Medicaid eligibility or private insurance purchased in the open market, or from either the State or Federal Exchange. However, with the recent Medicaid 'work requirements' changes by some states (Musumeci, Garfield, & Rudowitz, 2018), it is likely that many taxi drivers' income may be too high to qualify for Medicaid income eligibility requirements, but not high enough to afford private insurance coverage. Therefore, policy makers should continue to find ways to make health insurance coverage affordable to those not eligible to be covered under Medicaid, but not able to afford private health insurance coverage.

African immigrants are one of the fastest growing segments of the US population, yet policy makers continue to place all people of African descent into the "Black/African American/ racial category. This categorization affects the health care and outcomes of African immigrants because of their idiosyncratic cultural, socioeconomic, and health characteristics (Commodore-Mensah, Himmelfarb, et al., 2015). It is therefore important that policy makers and health providers lead the way in collecting census data and health survey data that recognize African immigrants as a distinct ethnic group.

Limitations

Some limitations impacted this study. The 19 participants who volunteered to participate were not representative of all African countries. Of those participants, 16 are from West Africa, one is from North Africa, and the other two are from the horn of Africa. Because of the lack of geographical spread of the countries of origin, the findings cannot be generalized as representative of the CVD risk perceptions of African immigrant taxi drivers. Additionally, because participation in the study was limited to African immigrants in the Washington DC metropolitan area, their views may not represent the views of African immigrant taxi drivers in other areas of the US. Future studies are needed to capture a more representative perspective.

Conclusion

Although many studies have looked at the CVD risk factors of taxi drivers, for example, sedentary lifestyle, physical inactivity, and unhealthy diets, this study sought to understand the CVD risk perspectives and attitudes of African immigrant taxi drivers from their point of view. Our findings not only aligned with findings from prior studies, our results also highlighted some structural issues that affect taxi drivers' CVD risk factors like health care access, occupation, and cultural identity. Future studies are necessary to better understand how these factors affect taxi drivers' CVD risk perspectives and attitudes toward behavior change. Finally, to reduce and minimize CVD risk in other parts of the U.S. and the world, as well as the DC-Baltimore area among our study population, further research is required for the design and development of appropriate interventions tailored to the occupational and cultural realities of the taxi drivers

References

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-Centered Design. In W. Bainbridge (Ed.), *Encyclopedia of Human-Computer Interaction*. Thousand Oaks: Sage.

Adekeye, O. A., Adesuyi, B. F., & Takon, J. G. (2018). Barriers to Healthcare among African Immigrants in Georgia, USA. *Journal of Immigrant and Minority Health, 20*(1), 188-193. doi:10.1007/s10903-017-0549-9

Adu-Boahene, A. B., Laws, M. B., & Dapaah-Afriyie, K. (2017). Health-Needs Assessment for West African Immigrants in Greater Providence, RI. *Rhode Island Medical Journal (2013), 100*(1), 47-50.

Ahern, D. K., Kreslake, J. M., & Phalen, J. M. (2006). What is eHealth (6): perspectives on the evolution of eHealth research. *J Med Internet Res, 8*(1), e4. doi:10.2196/jmir.8.1.e4

Airhihenbuwa, C. O. (1990). A conceptual model for culturally appropriate health education programs in developing countries. *Int Quarterly of Community Health Education, 11*(1), 53-62. doi:10.2190/lpkh-pmpj-dbw9-fp6x

Airhihenbuwa, C. O., Ford, C. L., & Iwelunmor, J. I. (2014). Why culture matters in health interventions: lessons from HIV/AIDS stigma and NCDs. *Health Education & Behavior, 41*(1), 78-84. doi:10.1177/1090198113487199

Ajayi, A. O., & Ojo, O. O. (2007). Knowledge and perception of stroke among at risk medical out-patients in a tertiary health institution in Nigeria. *Annals of African Medicine, 6*(2), 51-53.

Akintunde, A. A., Akintunde, T., & Opadijo, O. G. (2015). Knowledge of heart disease risk factors among workers in a Nigerian University: A call for concern. *Nigerian Medical Journal, 56*(2), 91-95. doi:10.4103/0300-1652.150688

Al Hamarneh, Y. N., Crealey, G. E., & McElnay, J. C. (2011). Coronary heart disease: health knowledge and behaviour. *International Journal of Clinical Pharmacy, 33*(1), 111-123. doi:10.1007/s11096-010-9467-9

American Heart Association. (2017). Heart disease and stroke statistics 2017 at- a-glance. Retrieved from https://healthmetrics.heart.org/wp-content/uploads/2017/06/Heart-Disease-and-Stroke-Statistics-2017-ucm_491265.pdf

Aminde, L. N., Takah, N., Ngwasiri, C., Noubiap, J. J., Tindong, M., Dzudie, A., & Veerman, J. L. (2017). Population awareness of cardiovascular disease and its risk

factors in Buea, Cameroon. *BMC Public Health, 17*(1), 545. doi:10.1186/s12889-017-4477-3

Anderson, M. (2015). African immigrant populations in the US steadily climbs. Retrieved from http://www.pewresearch.org/fact-tank/2015/11/02/african-immigrant-population-in-u-s-steadily-climbs/

Ansa, V. O., Oyo-Ita, A., & Essien, O. E. (2007). Perception of ischaemic heart disease, knowledge of and attitude to reduction of its risk factors. *East African Medical Journal, 84*(7), 318-323.

Apantaku-Onayemi, F., Baldyga, W., Amuwo, S., Adefuye, A., Mason, T., Mitchell, R., & Blumenthal, D. S. (2012). Driving to better health: cancer and cardiovascular risk assessment among taxi cab operators in Chicago. *Journal of Health Care for the Poor and Underserved, 23*(2), 768-780. doi:10.1353/hpu.2012.0066

Apantaku-Onayemi, F., Baldyga, W., Amuwo, S., Adefuye, A., Mason, T., Mitchell, R., & Blumenthal, D. S. (2012). Driving to Better Health: Cancer and Cardiovascular Risk Assessment among Taxi Cab Operators in Chicago. *Journal of Health Care for the Poor and Underserved, 23*(2), 768-780.

Ayanian, J. Z., Zaslavsky, A. M., Weissman, J. S., Schneider, E. C., & Ginsburg, J. A. (2003). Undiagnosed hypertension and hypercholesterolemia among uninsured and insured adults in the Third National Health and Nutrition Examination Survey. *American Journal of Public Health, 93*(12), 2051-2054.

Bairey Merz, C. N., Dwyer, J., Nordstrom, C. K., Walton, K. G., Salerno, J. W., & Schneider, R. H. (2002). Psychosocial stress and cardiovascular disease: pathophysiological links. *Behavioral Medicine, 27*(4), 141-147. doi:10.1080/08964280209596039

Bawa, M., & Srivastav, M. (2013). Study the epidemiological profile of taxi drivers in the background of occupational environment,stress and personality characteristics. *Indian Journal of Occupational and Environmental Medicine, 17*(3), 10-113.

Becker, M. H., & Maiman, L. A. (1975). Sociobehavioral determinants of compliance with health and medical care recommendations. *Medical Care, 13*(1), 10-24.

Bigert, C., Gustavsson, P., Hallqvist, J., Hogstedt, C., Lewne, M., Plato, N., . . . Scheele, P. (2003). Myocardial infarction among professional drivers. *epidemiology, 14*(3), 333-339.

Boateng, D., Wekesah, F., Browne, J. L., Agyemang, C., Agyei-Baffour, P., Aikins, A. D., . . . Klipstein-Grobusch, K. (2017). Knowledge and awareness of and perception towards cardiovascular disease risk in sub-Saharan Africa: A

systematic review. *PLoS One, 12*(12), e0189264. doi:10.1371/journal.pone.0189264

Bowers, B. (1990). Grounded theory. In B. Sarter (Ed.), *Paths to knowledge*. New York: National League for Nursing Press.

Brucker, N., Moro, A., Charao, M., Bubols, G., Nascimento, S., Goethel, G., . . . Garcia, S. C. (2015). Relationship between blood metals and inflammation in taxi drivers. *Clinica Chimica Acta, 444*, 176-181. doi:10.1016/j.cca.2015.02.032

Buchbinder, M. (2013). THE CANON - 5. Patients and healers in the context of culture: an explorationof the borderland between anthropology, medicine, and psychiatry, by Arthur Kleinman. *Anthropology & Medicine, 20*(1), 109-111. doi:10.1080/13648470.2012.762337

Chacko, E. (2016). Ethiopian taxicab drivers: forming an occupational niche in the US Capital. *African and Black Diaspora: An International Journal, 9*(2), 200-213. doi:10.1080/17528631.2015.1083177

Charmaz, K. (1995b). Grounded theory. In J. Smith, Harre R., & Langehove L. (Eds.), *Rethinking methods in psychology* (pp. 27-65). London: Sage.

Charmaz, K. (2014). *Constructing Grounded Theory* (2nd ed.). Washington DC: SAGE.

Chen, J. C., Chen, Y. J., Chang, W. P., & Christiani, D. C. (2005). Long driving time is associated with haematological markers of increased cardiovascular risk in taxi drivers. *Occupational Environmental Medicine, 62*(12), 890-894. doi:10.1136/oem.2005.020354

Clark, A. P., McDougall, G. J., Jr., Joiner-Rogers, G., Innerarity, S., Delville, C., Meraviglia, M., & Davila, A. (2012). Explanatory models of heart failure etiology. *Dimensions of Critical Care Nursing, 31*(1), 46-52. doi:10.1097/DCC.0b013e31823a561c

Commodore-Mensah, Y., Hill, M., Allen, J., Cooper, L. A., Blumenthal, R., Agyemang, C., & Himmelfarb, C. D. (2016). Sex Differences in Cardiovascular Disease Risk of Ghanaian- and Nigerian-Born West African Immigrants in the United States: The Afro-Cardiac Study. *J Am Heart Assoc, 5*(2). doi:10.1161/JAHA.115.002385

Commodore-Mensah, Y., Himmelfarb, C. D., Agyemang, C., & Sumner, A. E. (2015). Cardiometabolic Health in African Immigrants to the United States: A Call to Re-examine Research on African-descent populations. *Ethn Dis, 25*(3), 373-380. doi:10.18865/ed.25.3.373

Commodore-Mensah, Y., Sampah, M., Berko, C., Cudjoe, J., Abu-Bonsrah, N., Obisesan, O., . . . Himmelfarb, C. D. (2015). The Afro-Cardiac Study: Cardiovascular

Disease Risk and Acculturation in West African Immigrants in the United States: Rationale and Study Design. *Journal of Immigrant and Minority Health*. doi:10.1007/s10903-015-0291-0

Como, J. M. (2007). Spiritual practice: a literature review related to spiritual health and health outcomes. *Holistic Nursing Practice, 21*(5), 224-236. doi:10.1097/01.hnp.0000287986.17344.02

Cossi, M. J., Preux, P. M., Chabriat, H., Gobron, C., & Houinato, D. (2012). Knowledge of stroke among an urban population in Cotonou (Benin). *Neuroepidemiology, 38*(3), 172-178. doi:10.1159/000336862

Cruz, G. D., Chen, Y., Salazar, C. R., Karloopia, R., & LeGeros, R. Z. (2010). Determinants of oral health care utilization among diverse groups of immigrants in New York City. *Journal of American Dental Association, 141*(7), 871-878.

de Mestral, C., & Stringhini, S. (2017). Socioeconomic Status and Cardiovascular Disease: an Update. *Current Cardiology Reports, 19*(11), 115. doi:10.1007/s11886-017-0917-z

Donkor, E. S., Owolabi, M. O., Bampoh, P., Aspelund, T., & Gudnason, V. (2014). Community awareness of stroke in Accra, Ghana. *BMC Public Health, 14*, 196. doi:10.1186/1471-2458-14-196

Dutta, M. J. (2007). Communicating about culture and health: Theorizing culture-centerd cultural sensitivity approaches. *Communication Theory, 17*, 304-328.

Eldredge, L., Markham, C., Ruiter, R., Kok, G., & Parcel, G. (2016). *Planning health promotion programs: An intervention mapping approach*. Somerset, New Jersey: John Wiley & Sons,.

Elshatarat, R. A., & Burgel, B. J. (2016). Cardiovascular Risk Factors of Taxi Drivers. *Journal of Urban Health, 93*(3), 589-606. doi:10.1007/s11524-016-0045-x

European Society of Cardiology. (2017). About cardiovascular disease in Europe: 2017 statistics. Retrieved from https://www.escardio.org/The-ESC/Press-Office/Fact-sheets/About-Cardiovascular-Disease-in-Europe

Facey, M. E. (2003). The health effects of taxi driving: the case of visible minority drivers in Toronto. *Canadian Journal of Public Health, 94*(4), 254-257.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Fitzpatrick, R., Davey, C., Buxton, M. J., & Jones, D. R. (1998). Evaluating patient-based outcome measures for use in clinical trials. *Health Technology Assessment, 2*(14), i-iv, 1-74.

Fowler-Brown, A., Corbie-Smith, G., Garrett, J., & Lurie, N. (2007). Risk of cardiovascular events and death--does insurance matter? *Journal of General Internal Medicine, 22*(4), 502-507. doi:10.1007/s11606-007-0127-2

Gambino, C., Trevelyan, E., & Fritzwater, J. (2014). The foreign-born population from Africa: 2008-2012. Retrieved from http://www.immigrationresearch-info.org/report/us-census-department-commerce/foreign-born-population-africa-2008-2012

Gany, F., Bari, S., Gill, P., Ramirez, J., Ayash, C., Loeb, R., . . . Leng, J. (2016). Step On It! Workplace Cardiovascular Risk Assessment of New York City Yellow Taxi Drivers. *Journal of Immigrant and Minority Health, 18*(1), 118-134. doi:10.1007/s10903-015-0170-8

Gany, F., Gill, P., Baser, R., & Leng, J. (2014). Supporting South Asian Taxi Drivers to Exercise through Pedometers (SSTEP) to decrease cardiovascular disease risk. *Journal of Urban Health, 91*(3), 463-476. doi:10.1007/s11524-013-9858-z

Gany, F. M., Gill, P. P., Ahmed, A., Acharya, S., & Leng, J. (2013). "Every disease...man can get can start in this cab": focus groups to identify south Asian taxi drivers' knowledge, attitudes and beliefs about cardiovascular disease and its risks. *Journal of Immigrant and Minority Health, 15*(5), 986-992. doi:10.1007/s10903-012-9682-7

Glanz, K., Rimer, B., & Viswrath, K. (2008). *Health behavior and health education: Theory, research and practice* (4th ed.). San Francisco: Jossey-Bass.

Glaser, B. G. (1978). *Theoretical sensitivity*. Mill Valley, CA: Sociology Press.

Glaser, B. G., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.

Harcourt, N., Ghebre, R. G., Whembolua, G. L., Zhang, Y., Warfa Osman, S., & Okuyemi, K. S. (2014). Factors associated with breast and cervical cancer screening behavior among African immigrant women in Minnesota. *Journal of Immigrant and Minority Health, 16*(3), 450-456. doi:10.1007/s10903-012-9766-4

Hattori, M., & Azami, Y. (2001). Searching for preventive measures of cardiovascular events in aged Japanese taxi drivers--the daily rhythm of cardiovascular risk factors during a night duty day. *Journal of Human Ergology (Tokyo), 30*(1-2), 321-326.

Havranek, E. P., Mujahid, M. S., Barr, D. A., Blair, I. V., Cohen, M. S., Cruz-Flores, S., . . . Yancy, C. W. (2015). Social Determinants of Risk and Outcomes for Cardiovascular Disease: A Scientific Statement From the American Heart Association. *Circulation, 132*(9), 873-898. doi:10.1161/cir.0000000000000228

Higginbottom, G., & Lauridsen, E. I. (2014). The roots and development of constructivist grounded theory. *Nurse Researcher, 21*(5), 8-13. doi:10.7748/nr.21.5.8.e1208

Hoare, K. J., Mills, J., & Francis, K. (2012). Sifting, sorting and saturating data in a grounded theory study of information use by practice nurses: a worked example. International Journal of Nursing Practice, 18(6), 582-588. doi:10.1111/ijn.12007

International Brotherhood of Teamsters. (2013). Teamster taxi drivers call on D.C. Mayor to apologize for offensive comment [Press release]. Retrieved from http://dctaxidrivers.com/files/2013/11/11.07.13dctaxidrivers.pdf

Ishimaru, T., Arphorn, S., & Jirapongsuwan, A. (2016). Hematocrit levels as cardiovascular risk among taxi drivers in Bangkok, Thailand. *Industrial Health, 54*(5), 433-438. doi:10.2486/indhealth.2015-0248

Iwelunmor, J., Newsome, V., & Airhihenbuwa, C. O. (2014). Framing the impact of culture on health: a systematic review of the PEN-3 cultural model and its application in public health research and interventions. *Ethnicity & Health, 19*(1), 20-46. doi:10.1080/13557858.2013.857768

Janz, N. K. (1988). The Health Belief Model in understanding cardiovascular risk factor reduction behaviors. Journal of *Cardiovascular Nursing, 24*(6), 39-41.

Jingi, A. M., & Noubiap, J. J. (2015). Cardiovascular risk factors awareness and prevalence among primary care physicians: an insight from the West region Awareness Initiative Survey to fight cardiovascular disease (WAIT-CVD) in Cameroon. *BMC Research Notes, 8*, 762. doi:10.1186/s13104-015-1747-y

Kaddumukasa, M., Kayima, J., Kaddumukasa, M. N., Ddumba, E., Mugenyi, L., Pundik, S., . . . Katabira, E. (2015). Knowledge, attitudes and perceptions of stroke: a cross-sectional survey in rural and urban Uganda. *BMC Research Notes, 8*, 819. doi:10.1186/s13104-015-1820-6

Khetan, A. K., Purushothaman, R., Chami, T., Hejjaji, V., Madan Mohan, S. K., Josephson, R. A., & Webel, A. R. (2017). The Effectiveness of Community Health Workers for CVD Prevention in LMIC. *Global Heart, 12*(3), 233-243.e236. doi:10.1016/j.gheart.2016.07.001

Kleinman, A. (1980a). *Patients and healers in the context of culture*. Berkeley, CA: University of California Press.

Kleinman, A. (1980b). *Patients healers in the context of culture: an exploration of the borderland between athropology, medicine, and psychiatry*. Berkeley, CA: University of California Press.

Kleinman, A., Eisenberg, L., & Good, B. (1978). Culture, illness, and care: clinical lessons from anthropologic and cross-cultural research. *Annals of Internal Medicine, 88*(2), 251-258.

Kobayashi, F., Tomita, T., & Okada, A. (2002). Blood pressure and heart rate variability in taxi drivers on long duty schedules. *Journal of Occupational Health, 44*, 214-220.

Kobayashi, F., Watanabe, T., Akamatsu, Y., Furui, H., Tomita, T., Ohashi, R., & Hayano, J. (2005). Acute effects of cigarette smoking on the heart rate variability of taxi drivers during work. *Scandinavian Journal of Work, Environment & Health, 31*(5), 360-366.

Kurosaka, K., Daida, H., Muto, T., Watanabe, Y., Kawai, S., & Yamaguchi, H. (2000). Characteristics of coronary heart disease in Japanese taxi drivers as determined by coronary angiographic analyses. *Industrial Health, 38*(1), 15-23.

Lesham, S., & Trafford, V. (2007). Overlooking the conceptual framework. . *Innovations in Education and Teaching International, 44*, 93-15.

Maneze, D., Salamonson, Y., Poudel, C., DiGiacomo, M., Everett, B., & Davidson, P. M. (2016). Health-Seeking Behaviors of Filipino Migrants in Australia: The Influence of Persisting Acculturative Stress and Depression. *Journal of Immigrant and Minority Health, 18*(4), 779-786. doi:10.1007/s10903-015-0233-x

Marshall, J., & Archibald, C. (2015). The Influence of Spirituality on Health Behaviors in an Afro-Caribbean Population. *Abnf j, 26*(3), 57-62.

Martin, W. P., Sharif, F., & Flaherty, G. (2016). Lifestyle risk factors for cardiovascular disease and diabetic risk in a sedentary occupational group: the Galway taxi driver study. *Irish Journal of Medical Science (1971 -), 185*(2), 403-412. doi:10.1007/s11845-016-1442-6

McSweeney, J. C., Allan, J. D., & Mayo, K. (1997). Exploring the use of explanatory models in nursing research and practice. *Image-The Journal of Nursing Scholarship, 29*(3), 243-248.

Melnyk, B. M., & Morrison-Beedy, D. (2012). *Intervention Research: Designing, Conducting, Analyzing, and Funding*. New York: Springer Publisher Company.

Mitchell, D. (2014). Advancing grounded theory: Using theoretical frameworks within grounded theory studies. *The Qualitative Report, 19*(36), 1-11.

Morris, N. S., MacLean, C. D., Chew, L. D., & Littenberg, B. (2006). The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. *BMC Family Practice, 7*, 21. doi:10.1186/1471-2296-7-21

Morse, J. M. (2015). Critical Analysis of Strategies for Determining Rigor in Qualitative Inquiry. *Qualitative Health Research, 25*(9), 1212-1222. doi:10.1177/1049732315588501

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Turner, M. B. (2016). Executive Summary: Heart Disease and Stroke Statistics--2016 Update: A Report From the American Heart Association. *Circulation, 133*(4), 447-454. doi:10.1161/cir.0000000000000366

Musumeci, M., Garfield, R., & Rudowitz, R. (2018). Medicaid and work requirements: New guidance, state waiver details and key issues. Retrieved from https://www.kff.org/medicaid/issue-brief/medicaid-and-work-requirements-new-guidance-state-waiver-details-and-key-issues/

Nasri, H., & Moazenzadeh, M. (2010). Coronary artery disease risk factors in drivers versus people in other occupations. *ARYA Atheroscler, 2*(2). Retrieved from http://www.arya.mui.ac.ir/index.php/arya/article/view/150

National Cancer Institute. (2013). Food attitudes and behaviors(FAB). Retrieved from https://cancercontrol.cancer.gov/brp/hbrb/fab/

National Center for Health Statistics. (2016). National Health Interview Survey: About the National Health Interview Survey. Retrieved from https://www.cdc.gov/nchs/nhis/about_nhis.htm

National Research Council. (2014). *The Continuing Epidemiological Transition in sub-Saharan Africa: A Workshop Summary*. Retrieved from https://www.nap.edu/download/13533

Navadeh, K., Moazenzadeh, M., & Mirzazadeh, A. (2008). Driving environment in Iran increases blood pressure even in healthy taxi drivers. *Journal of research in Medical Sciences, 13*(6), 287-293.

O'Connor, M. Y., Thoreson, C. K., Ricks, M., Courville, A. B., Thomas, F., Yao, J., . . . Sumner, A. E. (2014). Worse cardiometabolic health in African immigrant men than African American men: reconsideration of the healthy immigrant effect. *Metab Syndr Relat Disord, 12*(6), 347-353. doi:10.1089/met.2014.0026

Obembe, A. O., Olaogun, M. O., Bamikole, A. A., Komolafe, M. A., & Odetunde, M. O. (2014). Awareness of risk factors and warning signs of stroke in a Nigeria university. *Journal of Stroke and Cerebrovascular Diseases, 23*(4), 749-758. doi:10.1016/j.jstrokecerebrovasdis.2013.06.036

OCEBM Levels of Evidence Working Group. (2009). The Oxford 2009 Levels of Evidence. Retrieved from http://www.cebm.net/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/

Oladapo, O., Salako, L., & Sadiq, K. (2013). Knowledge of Hypertension and other risk factors for heart disease among yoruba rural southwestern Nigerian population. *British Journal of Medicine and Medical Research, 3*(4), 983-1003.

Osei, K., & Schuster, D. P. (1995). Metabolic characteristics of African descendants: a comparative study of African-Americans and Ghanaian immigrants using minimal model analysis. *Diabetologia, 38*(9), 1103-1109.

Park, K., & Hwang, S. Y. (2015). 10-year risk for cardiovascular disease among male workers in small-sized industries. *Journal of Cardiovasc Nursing, 30*(3), 267-273. doi:10.1097/jcn.0000000000000146

Ramukumba Tendani, S. T. (2016). Health assessment of taxi drivers in the city of Tshwane. *Curationis, 39*(1), 1.

Riley, L., Guthold, R., Cowan, M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. (2016). The World Health Organization STEPwise Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities. *American Journal of Public Health, 106*(1), 74-78. doi:10.2105/ajph.2015.302962

Rosenstock, I. M. (1966). Why people use health services. *Milbank Memorial Fund Quaterly, 44*(3), Suppl:94-127.

Schaller Consulting. (2004). *The changing face of taxi and limousine drivers: U.S., large states and metro areas and New York*. Retrieved from Brooklyn, NY: http://www.schallerconsult.com/taxi/taxidriver.pdf

Sewali, B., Harcourt, N., Everson-Rose, S. A., Leduc, R. E., Osman, S., Allen, M. L., & Okuyemi, K. S. (2015). Prevalence of cardiovascular risk factors across six African Immigrant Groups in Minnesota. *BMC Public Health, 15*(1), 411. doi:10.1186/s12889-015-1740-3

Sinclair, M. (2007). A guide to understanding theoretical and conceptual frameworks. *Evidence Based Midwifery, 5*(39).

Siu, S. C., Wong, K. W., Lee, K. F., Lo, Y. Y. C., Wong, C. K. H., Chan, A. K. L., & Fong, D. Y. T. (2012). Prevalence of undiagnosed diabetes mellitus and cardiovascular risk factors in Hong Kong professional drivers. *Diabetes Research and Clinical Practice, 96*(1), 60-67.

Sommers, B. D., Gunja, M. Z., Finegold, K., & Musco, T. (2015). Changes in Self-reported Insurance Coverage, Access to Care, and Health Under the Affordable Care Act. *Jama, 314*(4), 366-374. doi:10.1001/jama.2015.8421

Strauss, A., & Corbin, J. (1994). Grounded Theory Methodology. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research*. Thousand Oaks: Sage Publications.

Subar, A. F., Thompson, F. E., Kipnis, V., Midthune, D., Hurwitz, P., McNutt, S., . . . Rosenfeld, S. (2001). Comparative validation of the Block, Willett, and National Cancer Institute food frequency questionnaires : the Eating at America's Table Study. *American Journal of Epidemiology, 154*(12), 1089-1099.

Uchenna, D., Ambakederemo, T., & Jesuorobo, D. (2012). Awareness of heart disease prevention among patiients attending a specialist hospital in southern Nigeria. *International Journal of Prevention and Treatment, 1*(3), 40-43.

Ukegbu, U. J., Castillo, D. C., Knight, M. G., Ricks, M., Miller, B. V., 3rd, Onumah, B. M., & Sumner, A. E. (2011). Metabolic syndrome does not detect metabolic risk in African men living in the U.S. *Diabetes Care, 34*(10), 2297-2299. doi:10.2337/dc11-1055

United African Organization. (2013). The health of the African taxicab driver in Chicago: Health survey report. Retrieved from http://uniteafricans.org/wp-content/uploads/2016/05/UAO-African-Taxicab-Driver-Health-Survey-Report.pdf

Valero-Elizondo, J., Hong, J. C., Spatz, E. S., Salami, J. A., Desai, N. R., Rana, J. S., . . . Nasir, K. (2017). Persistent socioeconomic disparities in cardiovascular risk factors and health in the United States: Medical Expenditure Panel Survey 2002-2013. *Atherosclerosis*. doi:10.1016/j.atherosclerosis.2017.12.014

Venters, H., & Gany, F. (2011). African immigrant health. *Journal of Immigrant and Minority Health, 13*(2), 333-344. doi:10.1007/s10903-009-9243-x

Wagner, J., Lacey, K., Chyun, D., & Abbott, G. (2005). Development of a questionnaire to measure heart disease risk knowledge in people with diabetes: the Heart Disease Fact Questionnaire. *Patient Education and Counseling, 58*(1), 82-87. doi:10.1016/j.pec.2004.07.004

Wahab, K. W., Kayode, O. O., & Musa, O. I. (2015). Knowledge of stroke risk factors among Nigerians at high risk. *Journal of Stroke & Cerebrovascular Diseases, 24*(1), 125-129. doi:10.1016/j.jstrokecerebrovasdis.2014.07.053

Whittemore, R., & Knafl, K. (2005). The integrative review: updated methodology. *Jouranl of Advanced Nursing, 52*(5), 546-553. doi:10.1111/j.1365-2648.2005.03621.x

World Health Organization. (2008). WHO STEPS instrument (core and expanded): The WHO STEPwise approach to chronic disease risk factor surveillance (STEPS). Retrieved from http://www.who.int/chp/steps/STEPS_Instrument_v2.1.pdf

World Health Organization. (2017). Cardiovascular diseases (CVDs). Retrieved from http://www.who.int/mediacentre/factsheets/fs317/en/

World Heart Federation. (2018). Cardiovascular risk factors. Retrieved from https://www.world-heart-federation.org/resources/risk-factors/

Wu, S., Deng, F., Niu, J., Huang, Q., Liu, Y., & Guo, X. (2010). Association of heart rate variability in taxi drivers with marked changes in particulate air pollution in Beijing in 2008. *Environmental Health Perspectives, 118*(1), 87-91. doi:10.1289/ehp.0900818

Yaroch, A. L., Tooze, J., Thompson, F. E., Blanck, H. M., Thompson, O. M., Colon-Ramos, U., . . . Nebeling, L. C. (2012). Evaluation of three short dietary instruments to assess fruit and vegetable intake: the National Cancer Institute's food attitudes and behaviors survey. *Journal of the Academy of Nutrition and Dietetics, 112*(10), 1570-1577. doi:10.1016/j.jand.2012.06.002

Yu, S. S., Ramsey, N. L., Castillo, D. C., Ricks, M., & Sumner, A. E. (2013). Triglyceride-based screening tests fail to recognize cardiometabolic disease in African immigrant and African-American men. *Metabolic Syndrome and Related Disorders, 11*(1), 15-20. doi:10.1089/met.2012.0114

Zagury, E., Le Moullec, Y., & Momas, I. (2000). Exposure of Paris taxi drivers to automobile air pollutants within their vehicles. *Occupational Environmental Medicine, 57*(6), 406-410.

Table 1. Kleiman's Explanatory Models of Health

KLEIMAN"S 8 QUESTIONS	KLEIMAN'S EXPLANATORY MODEL THEORY (parts of illness).
What do you call your problem? What name does it have?	
What do you think has caused your problem?	Etiology
Why do you think started when it did?	Time of onset
What does your illness do to you? How does it work?	Pathophysiology
How severe is it? Will it have a short or long illness?	Course
What are the chief problems your illness has caused for you?	
What kind of treatment do you think you should receive? What are the most important results you hope to receive from the treatment?	Treatment

Table 2. Interview Guide During Participant Interviews.

1. What health problems do you think are connected with being a taxi driver?
2. What do you call your health problems?
3. What do you think may have caused your health problems?
4. How do you make decisions about getting health care?

   Secondary prompt: Where do you go for health care?
5. What do you fear most about your health as a taxicab driver?
6. Some people think taxicab drivers have higher risks of heart disease. What do you think causes this type of problem?
7. What could be done to reduce your risk of diseases?
8. What is the difference in your health and health care before and after you immigrated to the US?
9. What else would you like to tell me about improving the health of taxicab drivers?

Summary and Conclusions

The three manuscripts presented in this dissertation address concerns related to cardiovascular disease among taxi drivers. The first manuscript, "Cardiovascular Risk Factors and Taxi Drivers: An Integrative Review", critically examined studies that have assessed the cardiovascular disease risks of taxi drivers. Findings from the review indicate that taxi drivers have an increased prevalence of CVD risk factors compared to the general population, yet have been under-investigated in the US with few tested interventions. A better understanding of the CVD risks, knowledge, and perceptions of taxi drivers can contribute to the development of a tailored intervention specific to the CVD risk of this population.

The second manuscript, "Cardiovascular Disease Risk Knowledge among African Immigrant Taxi Drivers in the Baltimore Washington DC area" examined the CVD risk knowledge of African immigrant taxi drivers in the area using the using the Heart Disease Fact Questionnaire (HDFQ) (Wagner et al., 2005). The findings from this quantitative designed study show that post-graduate education, marital status, problems managing household income, weight without shoes, diagnosis of cardiovascular disease within the family, consumption of vegetables, avoidance of eating fatty food, and regular exercise significantly correlated with CVD knowledge scores. The multiple regression analysis shows that the following significantly predicted CVD knowledge scores: Avoiding eating fatty foods, regularly sleeping for 7 – 8 hours a day, having an immediate family with cardiovascular disease diagnosis in the past year, having substantial problems managing household income, regular consumption of vegetables, and regular exercise. Appropriate intervention mapping predicated on this knowledge is needed to prevent and reduce cardiovascular burden in this population.

The third manuscript, "Cardiovascular Disease Risk Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Qualitative Study," explored the cardiovascular risk experiences and perspectives of African immigrant taxi drivers in the Baltimore-Washington Metropolitan area using constructivist grounded theory to guide data

collection, coding, and analysis. Kleinman's Explanatory Disease Model was used to analyze participants' perspectives and to detect underlying structural factors affecting their perspectives. The results showed that participants identified five themes central to their understanding of the cardiovascular diseases risk factors associated with taxi driving including, awareness of cardiovascular diseases risk factors, ethnic self-identification, behavior modifications, spiritual beliefs, and traditional/cultural approaches. These themes touched on structural factors that affected their CVD risk within the description of each of these themes. Understanding their perspectives reflected in the five themes and the structural factors will help researchers design and develop appropriate interventions to reduce cardiovascular risk factors, through tailoring activities to the occupational and cultural realities of the taxi drivers.

The three studies in this compendium have several limitations. The first manuscript review is limited to studies that examined both taxi drivers and cardiovascular diseases risk factors. Therefore, the number of studies specifically examining both was limited. (n=22). More than half of the studies were conducted outside the US. Therefore, those findings might not be applicable in the US due to this nation's different health care systems, population mix, and cultures of health. Another limitation is the small sample size in some studies, and the lack of any randomized control trial (RCT) in the review.

The second manuscript has various limitations. More than 76 % of the participants recruited through convenience sampling were from three African countries (Nigeria, Ethiopia, Ghana); thus, findings cannot be generalized. There was a potential for sample selection bias, as participants with high knowledge of CVD may have been more willing to enroll in the study, thereby overestimating their CVD knowledge. Furthermore, only three female taxi drivers participated in the study, also preventing generalizing to all African taxi drivers.

Most responses on the survey were self-reported, making recall bias likely. It was difficult to enroll a sufficiently large number of overnight shift drivers because of the reluctance of drivers to speak to strangers at night. Future studies that include overnight shift drivers are

needed to capture their CVD knowledge. Despite these limitations, the current study provides valuable new knowledge regarding CVD risk knowledge among African immigrants to the US.

Also, several limitations are associated with the third Manuscript. The 19 participants who volunteered to participate were not representative of all African countries. Of those participants, 16 are from West Africa, one is from North Africa, and the other two are from East Africa. Because of the lack of geographical spread of the countries of origin, the findings cannot be generalized as representative of the CVD risk perceptions of African immigrant taxi drivers in the US. Additionally, because participation in the study was limited to African immigrants in the Washington DC metropolitan area, their views may not represent the views of African immigrant taxi drivers in other areas of the nation. Future studies are needed to capture a more representative perspective. Despite these limitations, in the dissertation studies, they provide valuable new knowledge regarding CVD risk awareness among African immigrants to the US.

Implications for Future Research (Next Steps)

Although there is a general renewed interest in studies involving immigrants, there is a dearth of studies focused specifically on immigrant taxi drivers who constitute one of the largest populations of taxi drivers in the US. There is also a need for policy makers, health care providers, and researchers to review the findings from this dissertation in order tackle the CVD risks of this population.

Policy makers should continue to find ways to make health insurance coverage affordable to those taxi drivers too rich to be covered under Medicaid, but not rich enough to afford private health insurance coverage. Also, it is important that policy makers and health providers lead the way in collecting census data and health survey data that recognize African immigrants as a distinct ethnic group. This categorization will help account for the health characteristics of African immigrants and improve their health outcomes and generate more abundant data from this population for future empirical analysis.

Since cardiovascular diseases are one of the deadliest health conditions in the world, and taxi driving presents many cardiovascular risk factors, researchers should undertake further research in this area to keep this problem in the foreground of public health discourse and potentially help in the design and development of appropriate interventions leading to reduction in health disparities. More studies are needed to create culturally suited information about CVD risk factors and interventions for immigrant taxi drivers.

Finally, healthcare providers may use findings from this dissertation and future studies in this area to adapt evidence-based care interventions that can reduce the risk of cardiovascular disease in this population. Understanding the CVD risk perspectives and attitudes of this population will enable healthcare providers to tailor their interventions specifically to taxi drivers' occupational, cultural and educational needs.

Appendix A. The IRB Approval Letter

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal Pro00063762 entitled:
Cardio Vascular Disease Risks Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Mixed Methods Study

submitted by: **Camillus Ezeike**
Department: **Medical University of South Carolina**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of the individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this study, except to provide information as requested by the IRB.

Original Approval Date: **4/6/2017**
Approval Expiration: **4/5/2018**

Type: **Expedited**

Chair, **IRB-I - Medical University of South Carolina**
Mark Hamner*

Statement of Principal Investigator:

As previously signed and certified, I understand that approval of this research involving human subjects is contingent upon my agreement:

1. To report to the Institutional Review Board for Human Research (IRB) any adverse events or research related injuries which might occur in relation to the human research. I have read and will comply with IRB reporting requirements for adverse events.
2. To submit in writing for prior IRB approval any alterations to the plan of human research.
3. To submit timely continuing review reports of this research as requested by the IRB.
4. To maintain copies of all pertinent information related to the research activities in this project, including copies of informed consent agreements obtained from all participants.
5. To notify the IRB immediately upon the termination of this project, and/or the departure of the principal investigator from this Institution and the project.

**Electronic Signature*: *This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Appendix B. Recruitment Flyer for Studies

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

A Doctoral Dissertation research study at MEDICAL UNIVERSITY OF SOUTH CAROLINA

To understand Cardiovascular risk perceptions among African Immigrant Taxicab drivers

WE need African Immigrant taxicab drivers (men &women).

Who can participate?

- African Immigrant women & men
- Taxicab drivers
- Living in the Baltimore-
- Washington Metropolitan Area
- At least 5 years US residency
- Between 35 & 75 years

(other criteria apply)

What does the study involve?

- Questionnaire completion (approximately 1 hour).
- Measurement of blood pressure, weight, hip, waist and height
- Opportunity to be selected for a follow-up interview with additional incentives.

You should also know:

- All information is kept confidential.

Payment for participation will be provided.

For more information please call (410) 412-6970
or email
taxicabstudy@gmail.com

MUSC
IRB Number: Pro00063762
Date Approved 4/6/2017

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

Appendix C. HIPAA Authorization

Authorization to Use or Disclose (Release) Health Information that Identifies You for a Research Study

If you sign this document, you give permission to the Medical University of South Carolina (MUSC) to use or disclose (release) your health information that identifies you for the research study described here:

Cardio Vascular Disease Risks Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Mixed Methods Study.
The purpose of this study is to examine cardio vascular disease(CVD) risk factors among taxicab drivers because of their occupational lifestyle.

The health information MUSC may use or disclose (release) for this research study includes information in your medical record, results of physical exams, medical history, lab tests or certain health information indicating or relating to your condition.

The health information listed above may be used by and/or disclosed (released) to the following, as applicable:

- The sponsor of the study including its agents such as data repositories or contract research organizations monitoring the study;
- Other institutions and investigators participating in the study;
- Data Safety Monitoring Boards;
- Accrediting agencies;
- Clinical staff not involved in the study whom may become involved if it is relevant;
- Health insurer or payer in order to secure payment for covered treatment;
- Parents of minor children if less than 16 years old. Parents of children 16 years old or older require authorization from the child; or
- Federal and state agencies and MUSC committees having authority over the study such as:
    - The Institutional Review Board (IRB) overseeing this study;
    - Committees with quality improvement responsibilities;
    - Office of Human Research Protections;
    - Food and Drug Administration;
    - National Institutes of Health; or
    - Other governmental offices, such as a public health agency or as required by law.

MUSC is required by law to protect your health information. By signing this document, you authorize MUSC to use and/or disclose (release) your health information for this research. Those persons who receive your health information may not be required by Federal privacy laws (such as the Privacy Rule) to protect it and may share your information with others without your permission, if permitted by laws governing them.

You do not have to sign this authorization. If you choose not to sign, it will not affect your treatment, payment or enrollment in any health plan or affect your eligibility for benefits. However, you will not be allowed to be a participant in this research study.

You may change your mind and revoke (take back) this Authorization at any time. Even if you revoke this Authorization, MUSC may still use or disclose (release) health information already obtained about you as necessary to maintain the integrity or reliability of the research study. If you revoke this Authorization, you may no longer be allowed to participate in this research study. To revoke this Authorization, you must write to:

Camillus Ezeike, MUSC College of Nursing, 99 Jonathan Lucas St, Charleston, SC 29425

You will not be allowed to see or copy the information described on this Authorization as long as the research study is in progress. When the study is complete, you have a right to see and obtain a copy of the information.

Your health information will be used or disclosed when required by law. Your health information may be shared with a public health authority that is authorized by law to collect or receive such information for the purpose of preventing or controlling disease, injury or disability and for conducting public health surveillance, investigations or interventions. No publication or public presentation about the research study will reveal your identity without another signed authorization from you.

You will be given a copy of this Authorization. This Authorization will expire at the end of the research study. If you have questions or concerns about this Authorization or your privacy rights, please contact MUSC's Privacy Officer at 843-792-8740.

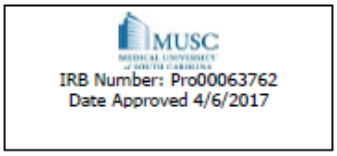
Regulations require that you be given a copy of the MUSC Notice of Privacy Practices (NPP) describing the practices of MUSC regarding your health information. One can be found at the end of this form.

[SIGNATURE PAGE TO FOLLOW]

MUSC
IRB Number: Pro00063762
Date Approved 4/6/2017

Signature of Research Participant ages 16 & above* Date

Printed Name of Research Participant



MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

NOTICE OF PRIVACY PRACTICES

MUSC Organized Health Care Arrangement (OHCA)

THIS NOTICE DESCRIBES HOW MEDICAL INFORMATION ABOUT YOU MAY BE USED AND DISCLOSED AND HOW YOU CAN GET ACCESSS TO THIS INFORMATION. PLEASE REVIEW IT CAREFULLY.

The Medical University of South Carolina and its affiliates (including but not limited to the Medical University Hospital Authority, MUSC Physicians, and MUSC Physicians Primary Care) participate in a clinically integrated health care setting. As a result of this clinical integration, these organizations function as an Organized Health Care Arrangement (OHCA) as defined by the Health Insurance Portability and Accountability Act (HIPAA). For purposes of this notice, the members of the MUSC OHCA are collectively referred to in this document as "MUSC." **We collect or receive this information about your past, present or future health condition to provide health care to you, to receive payment for this health care, or to operate the hospital and/or clinics.**

HOW WE MAY USE AND RELEASE YOUR PROTECTED HEALTH INFORMATION (PHI)

A. The following uses do NOT require your authorization, except where required by SC law:

1. For treatment. Your PHI may be discussed by caregivers to determine your plan of care. For example, the physicians, nurses, medical students and other health care personnel may share PHI in order to coordinate the services you may need.

2. To obtain payment. We may use and disclose PHI to obtain payment for our services from you, an insurance company or a third party. For example, we may use the information to send a claim to your insurance company.

3. For health care operations. We may use and disclose PHI for hospital and/or clinic operations. For example, we may use the information to review our treatment and services and to evaluate the performance of our staff in caring for you.

4. For public health activities. We report to public health authorities, as required by law, information regarding births, deaths, various diseases, reactions to medications and medical products.

5. Victims of abuse, neglect, domestic violence. Your PHI may be released, as required by law, to the South Carolina Department of Social Services when cases of abuse and neglect are suspected.

6. Health oversight activities. We will release information for federal or state audits, civil, administrative or criminal investigations, inspections, licensure or disciplinary actions, as required by law.

7. Judicial and administrative proceedings. Your PHI may be released in response to a subpoena or court order.

8. Law enforcement or national security purposes. Your PHI may be released as part of an investigation by law enforcement.

9. Uses and disclosures about patients who have died. We provide coroners, medical examiners and funeral directors necessary information related to an individual's death.

10. For purposes of organ donation. As required by law, we will notify organ procurement organizations to assist them in organ, eye or tissue donation and transplants.

11. Research. We may use your PHI if the Institutional Review Board (IRB) for research reviews, approves and establishes safeguards to ensure privacy.

MUSC
IRB Number: Pro00063762
Date Approved 4/6/2017

12. To avoid harm. In order to avoid a serious threat to the health or safety of a person or the public, we may release limited information to law enforcement personnel or persons able to prevent or lessen such harm.

13. For workers compensation purposes. We may release your PHI to comply with workers compensation laws.

14. Marketing. We may send you information on the latest treatment, support groups and other resources affecting your health.

15. Fundraising activities. We may use your PHI to communicate with you to raise funds to support health care services and educational programs we provide to the community. You have the right to opt out of receiving fundraising communications with each solicitation.

16. Appointment reminders and health-related benefits and services. We may contact you with a reminder that you have an appointment.

B. You may object to the following uses of PHI:

1. Hospital directories. Unless you object, we may include your name, location, general condition and religious affiliation in our patient directory for use by clergy and visitors who ask for you by name.

2. Information shared with family, friends or others. Unless you object, we may release your PHI to a family member, friend, or other person involved with your care or the payment for your care.

3. **Health plan.** You have the right to request that we not disclose certain PHI to your health plan for health services or items when you pay for those services or items in full.

C. Your prior written authorization is required (to release your PHI) in the following situations:

You may revoke your authorization by submitting a written notice to the privacy contact identified below. If we have a written authorization to release your PHI, it may occur before we receive your revocation

1. Any uses or disclosures beyond treatment, payment or healthcare operations and not specified in parts A & B above.

2. Psychotherapy notes.

3. Any circumstance where we seek to sell your information.

WHAT RIGHTS YOU HAVE REGARDING YOUR PHI

Although your health record is the physical property of MUSC, the information belongs to you, and you have the following rights with respect to your PHI:

A. The Right to Request Limits on How We Use and Release Your PHI. You have the right to ask that we limit how we use and release your PHI. We will consider your request, but we are not always legally required to accept it. If we accept your request, we will put any limits in writing and abide by them except in emergency situations. Your request must be in writing and state (1) the information you want to limit; (2) whether you want to limit our use, disclosure or both; (3) to whom you want the limits to apply, for example, disclosures to your spouse; and (4) an expiration date.

B. The Right to Choose How We Communicate PHI with You. You have the right to request that we communicate with you about PHI in a certain way or at a certain location (for example, sending information to your work address rather than your home address). You must make your request in writing and specify how and where you wish to be contacted. We will accommodate reasonable requests.

C. The Right to See and Get Copies of Your PHI. You have the right to inspect and receive a copy of your PHI (including an electronic copy), which is contained in a designated record set that may be used to make decisions about your care. You must submit your request in writing. If you request a copy of this information, we may charge a fee for copying, mailing or other costs associated with your request. We may deny your request to inspect and receive a copy in

certain very limited circumstances. If you are denied access to PHI, you may request that the denial be reviewed.

D. The Right to Get a List of Instances of When and to Whom We Have Disclosed Your PHI. This list may not include uses such as those made for treatment, payment, or health care operations, directly to you, to your family, or in our facility directory as described above in this Notice of Privacy Practices. This list also may not include uses for which a signed authorization has been received or disclosures made more than six years prior to the date of your request.

E. The Right to Amend Your PHI. If you believe there is a mistake in your PHI or that a piece of important information is missing, you have the right to request that we amend the existing information or add the missing information. You must provide the request and your reason for the request in writing. We may deny your request in writing if the PHI is correct and complete or if it originated in another facility's record.

F. The Right to Receive a Paper or Electronic Copy of This Notice: You may ask us to give you a copy of this Notice at any time. For the above requests (and to receive forms) please contact: Health Information Services (Medical Records), Attention: Release of Information / 169 Ashley Avenue / MSC 369 / Charleston, SC 29425. The phone number is (843) 792-3881.

G. The Right to Revoke an Authorization. If you choose to sign an authorization to release your PHI, you can later revoke that authorization in writing. This revocation will stop any future release of your health information except as allowed or required by law.

H. The Right to be Notified of a Breach. If there is a breach of your unsecured PHI, we will notify you of the breach in writing.

HEALTH INFORMATION EXCHANGES

MUSC, along with other health care providers belongs to health information exchanges. These information exchanges are used in the diagnosis and treatment of patients. As a member of these exchanges, MUSC shares certain patient health information with other health care providers. Should you require treatment at another location that is a part of one of these exchanges, that provider may gather historical health information to assist with your treatment. You have the option of saying that this cannot be done. If you choose not to take part in these alliances, please contact the MUSC Privacy Office at 792-4037.

HOW TO COMPLAIN ABOUT OUR PRIVACY PRACTICES

If you think your privacy rights may have been violated, or you disagree with a decision we made about access to your PHI, you may file a complaint with the office listed in the next section of this Notice. **Please be assured that you will not be penalized and there will be no retaliation for voicing a concern or filing a complaint. We are committed to the delivery of quality health care in a confidential and private environment.**

PERSON TO CONTACT FOR INFORMATION ABOUT THIS NOTICE OR TO COMPLAIN ABOUT OUR PRIVACY PRACTICES

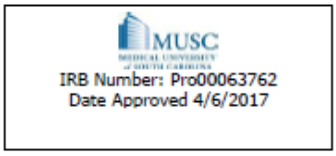
If you have any questions about this Notice or any complaints about our privacy practices please call the Privacy Officer (843) 792-4037, the Privacy Hotline (800) 296-0269, or contact in writing: HIPAA Privacy Officer / 169 Ashley Avenue / MSC 332 / Charleston SC 29425. You also may send a written complaint to the Office of Civil Rights. The address will be provided at your request.

CHANGES TO THIS NOTCE

We reserve the right to change the terms of this Notice at any time. We also reserve the right to make the revised or changed Notice effective for existing as well as future PHI. This Notice will always contain the effective date. You may view this notice and any revisions to it at: http://www.musc.edu/privacy.

EFFECTIVE DATE OF THIS NOTICE

This Notice went into effect on April 14, 2003.
Revised September 2013.



Confidential

Afro CardioMeta Study Survey

Please complete the survey below.

Thank you!

1) Zip code (Your home) _____

Demographic Information

2) What is your sex?
- ◯ 1. Male
- ◯ 2. Female

3) What is your date of birth? _____

4) How old are you? _____

5) In what African country were you born? _____

6) Did you live in a city or village prior to moving to the United States?
- ◯ 1. City
- ◯ 2. Village

7) What year did you come to live in the US? _____

8) Why did you move to the US?
- ☐ 1.Education
- ☐ 2.Economic hardship
- ☐ 3.To join your family/Marriage
- ☐ 4. Asylum/Refugee
- ☐ 5. Job opportunities
- ☐ 6. Other

9) What is the highest level of education you have completed?
- ☐ No formal schooling
- ☐ Less than primary school
- ☐ Primary school completed
- ☐ Secondary school completed
- ☐ High school completed
- ☐ College/University completed
- ☐ Post graduate degree

10) What is your marital status?
- ◯ Never married
- ◯ Currently married
- ◯ Separated
- ◯ Divorced
- ◯ Widowed
- ◯ Cohabitating

11) How long have you worked as a taxi driver? _____

12) How many people older than 18 years, including yourself, live in your household? _____

13) Can you give an estimate of the annual household income?
- ◯ Less than $15,000
- ◯ More than $15,000 - $24,999
- ◯ More than $25,000, - $34,999
- ◯ More than $35,000-$49,999
- ◯ More than $50,000
- ◯ Don't Know

14) During the past year, did you have problems managing your household income?
- ☐ No problems but I have to watch what I spend
- ☐ Yes some problems
- ☐ Yes lots of problems
- ☐ No no problems at all

15) Do you currently have any kind of health care coverage, including private health insurance, ACA (Obamacare),prepaid plans such as HMOs,or government plans such as Medicare/Medicaid?
- ◯ Yes
- ◯ No

(If 'NO' disregard the next question)

16) What kind of health insurance do you currently have?
- ☐ Private health insurance
- ☐ Government-sponsored insurance(Medicare, Medi-Gap, Medicaid, SCHIP, Tri-Care)
- ☐ State-sponsored health plan
- ☐ No coverage of any type
- ☐ I prefer not to answer
- ☐ Don't know

17) Did you have health insurance before the Affordable Care Act(Obamacare)was passed?
- ☐ Yes
- ☐ No
- ☐ I don't know

18) Have you looked into purchasing health insurance coverage through Healthcare.gov or the Health Insurance Marketplace/Health Insurance Marketplace?
- ☐ No
- ☐ Yes
- ☐ I don't know

19) Is there a place that you USUALLY go to when you are sick or need advice about your health?
- ☐ Yes
- ☐ There is NO place
- ☐ There is MORE THAN ONE place
- ☐ I prefer not to answer
- ☐ Don't know

20) What kind of place do you USUALLY go to when you need routine or preventive care, such as a physical examination or check-up?
- ☐ Don't get preventive care anywhere
- ☐ Clinic or health center
- ☐ Doctor's office or HMO
- ☐ Hospital emergency room
- ☐ Hospital outpatient department
- ☐ Some other place
- ☐ Don't go to one place most often
- ☐ I prefer not to answer
- ☐ Don't know

21) How tall are you without shoes? (height)

_____
(In feet)

22) How much do you weigh NOW without shoes? (weight)

_____
(In pounds)

23) How much did you weigh BEFORE you came to the United States? (Approximately)

_____
(In pounds)

24) What do you think of your body weight?
- ☐ I'm much too heavy
- ☐ I'm a little too heavy
- ☐ I'm just about right
- ☐ I'm a little too thin
- ☐ I'm much too thin

25) Are you trying to do something about your weight right now?
- ☐ No nothing
- ☐ Yes I'm trying to lose weight
- ☐ Yes I'm trying to stay the same weight
- ☐ Yes I'm trying to gain weight

26) DURING THE PAST 12 MONTHS, have you had your'blood pressure checked by a doctor, nurse, or other health professional?
- ☐ Yes
- ☐ No
- ☐ I don't know

27) Have you EVER been told by a doctor or other health professional that you had Hypertension, also called high blood pressure?
- ☐ Yes
- ☐ No
- ☐ I don't know

(If 'NO' skip to question 10)

28) Were you told on two or more DIFFERENT visits that you had hypertension, also called high blood pressure?
- ☐ Yes
- ☐ No
- ☐ I don't know

(If 'NO' skip to next applicable question)

29) DURING THE PAST 12 MONTHS, have you had hypertension, also called high blood pressure?
- ☐ Yes
- ☐ No
- ☐ I don't know

(If 'NO' skip to next applicable question)

30) How long have you been diagnosed with high blood pressure or hypertension?

_____

(If less than 1 year write 1)

31) Were you told you had high blood pressure or hypertension BEFORE or AFTER you moved to the United States?
- ○ Before
- ○ After

32) Was any medicine EVER prescribed by a doctor for your high blood pressure or hypertension?
- ○ Yes
- ○ No
- ○ I don't know

33) Are you NOW taking any medicine prescribed by a doctor for your high blood pressure?
- ○ Yes
- ○ No
- ○ I don't know

34) Are you currently taking herbal supplements for your high blood pressure or hypertension?
- ○ Yes
- ○ No
- ○ I don't know

35) Is there anyone in your family (parents,siblings or children) who has high blood pressure or hypertension?
- ○ Yes
- ○ No
- ○ I don't know

36) Have you had a fasting test for high blood sugar or diabetes DURING THE PAST 12 MONTHS?
- ○ Yes
- ○ No
- ○ I don't know

37) Have you EYER been told by a doctor or other health professional that you have diabetes or sugar diabetes?
- ○ Yes
- ○ No
- ○ I don't know

38) If you are a female, were you diagnosed with diabetes during pregnancy?
- ○ Yes
- ○ No
- ○ I don't know

39) Have you EYER been told by a doctor or other health professional that you have any of the following: prediabetes,impaired fasting glucose, impaired glucose tolerance, borderline diabetes, or high blood sugar?
- ◯ Yes
- ◯ No
- ◯ I don't know

(If 'NO' skip to next section)

40) How old were you when a doctor or other health professional FIRST told you that you had diabetes or sugar diabetes?

_____

41) Were you diagnosed BEFORE or AFTER you moved to the United States?
- ◯ Before
- ◯ After

42) Are you now taking Insulin or diabetic pills to lower your blood sugar? These are sometimes called oral agents or oral hypoglycemic agents.
- ◯ Yes
- ◯ No
- ◯ I don't know

43) Are you currently taking herbal supplements for your diabetes or high blood sugar?
- ◯ Yes
- ◯ No
- ◯ I don't know

44) DURING THE PAST 12 MONTHS, have you had your blood cholesterol checked by a doctor, nurse, or other health professional?
- ◯ Yes
- ◯ No
- ◯ I don't know

45) Have you EVER been told by a doctor or other health professional that you had high cholesterol?
- ◯ Yes
- ◯ No
- ◯ I don't know

46) DURING THE PAST 12 MONTHS, have you had high cholesterol?
- ◯ Yes
- ◯ No
- ◯ I don't know

47) Was any medication EVER prescribed by a doctor to help lower your cholesterol?
- ◯ Yes
- ◯ No
- ◯ I don't know

48) Are you NOW taking any medicine prescribed by a doctor to help lower your cholesterol?
- ◯ Yes
- ◯ No
- ◯ I don't know

49) Have you EVER been told by a doctor or other health professional that you had Coronary heart disease?
- ◯ Yes
- ◯ No
- ◯ I don't know

50) Have you EVER been told by a doctor or other health professional that you had Angina, also called angina pectoris/chest pain?
- ◯ Yes
- ◯ No
- ◯ I don't know

51) Have you EVER been told by a doctor or other health professional that you had a heart attack (also called myocardial infarction)
- ◯ Yes
- ◯ No
- ◯ I don't know

52) Have you EVER been told by a doctor or other health professional that you had stroke?
- ◯ Yes
- ◯ No
- ◯ I don't know

53) Have you EVER been told by a doctor or other health professional that you had any kind of heart condition or heart disease(other than the ones above)?
- ◯ Yes
- ◯ No
- ◯ I don't know

54) Has a doctor or other health professional EVER told you to take a low-dose aspirin each day to prevent or control heart disease?
- ◯ Yes
- ◯ No
- ◯ I don't know

(If Age>=40)

55) Has anyone in your immediate family (your parents, brothers, sisters, or children) ever been diagnosed with cardiovascular disease when they were 60 years old or younger?
- ◯ Yes
- ◯ No
- ◯ I don't know

(If 'NO' or 'I don't know' skip next question)

56) Please indicate family member(s), and how old when first diagnosed with cardiovascular disease.

_____

(You can give more than one answer. Pleae estimate age , if not sure)

57) Has anyone in your immediate family(your parents, brothers, sisters, or children) ever suddenly died when they were 60 years or younger with no clear cause of death?
- ◯ Yes
- ◯ No
- ◯ I don't know

(If 'NO' or 'I don't know' skip next section)

58) Could you please indicate the family member(s) and how old they were when they died suddenly?

_____

(You can give more than one answer. Pleae estimate age , if not sure)

59) Do you currently smoke any tobacco products, such as cigarettes, cigars or pipes?
- ◯ Yes
- ◯ No

(If 'NO' skip to next section)

60) Do you currently smoke tobacco products daily?
- ◯ Yes
- ◯ No

61) Have you ever consumed an alcoholic drink such as beer, wine, spirits, fermented cider or [akpeteshi. ogogoro,poyo palm wine]?
- ◯ Yes
- ◯ No

(If 'NO' skip to next section)

62) Have you consumed an alcoholic drink within the past 30 days?
- ◯ Yes
- ◯ No

(If 'NO' skip to next section)

63) During the past 30 days, how frequently have you had at least one alcoholic drink?
- ◯ Daily
- ◯ 5-6 days per week
- ◯ 1-4 days per week
- ◯ 1-3 days per month
- ◯ Less than once a month

64) How many servings of FRUIT do you usually eat or drink each day? Think of a serving as being about I medium piece, or 1h cup of fruit, or 3/i of cup of fruit juice."

_____

(servings)

65) How many servings of VEGETABLES do you usually eat or drink each day? Think of a serving as being about I cup of raw leafy vegetables, 1h cup of other cooked or raw vegetables, or% cup of vegetable juice".

_____

(servings)

66) On average, how many meals per week do you eat that were not prepared at a home? By meaL we mean breakfast, lunch and dinner

_____

67) The next questions are about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not think you are a physically active person. In the following questions 'vigo:rous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

68) During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?
_____
(If 'N/A' skip next question)

69) How much time did you usually spend doing vigorous physical activities on one of those days?
_____
(In minutes/ hours per day)

70) During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
_____
(If 'N/A' disregard the next question)

71) How much time did you usually spend doing moderate physical activities on one of those days?
_____
(In minutes/ hours per day)

72) How much time do you usually spend sitting or reclining on a typical day?
_____
(In minutes/ hours per day)

73) How often do you have your blood pressure checked by a health professional?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

74) How often do you go to the dentist for treatment or check-up
- ◯ Never
- ◯ Hardly never
- ◯ Sometimes
- ◯ Often
- ◯ Very often

75) Do you avoid eating too much salt or sodium?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

76) Do you avoid eating too much fat?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

77) Do you eat enough fiber from whole grains, cereals, fruits, and vegetables?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

78) Do you avoid eating high saturated fat foods, such as butter, chips or French fries, fatty meat?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

79) Do you avoid eating too much sugar and sweet food?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

80) Do you exercise regularly (i.e. vigorous exercise for recreation, sport or health- fitness purposes) for at least 5 times per week?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

81) Do you consciously take steps to control or reduce the stress in your life?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

82) Do you consciously take steps to maintain a healthy body weight?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

83) Do you ensure that you consume enough vitamins and minerals in food or food supplements?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

84) Do you sleep for 7-8 hours each 24-hour day in total?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

85) Do you consume more than 2 standard drinks per day alcoholic beverages (e.g. beer, wine, brandy, etc)?
- ◯ Never
- ◯ Hardly ever
- ◯ Sometimes
- ◯ Often
- ◯ Very often

86) Do you have a usual place to go when you are sick?
- ◯ Yes
- ◯ No

87) Do you experience a delay in obtaining healthcare?
- ◯ Yes
- ◯ No

88) Do you experience a delay in receiving a prescription drug?
- ◯ Yes
- ◯ No

89) Have you had at least one physician visit during the previous year?
- ◯ Yes
- ◯ No

90) Have you had at least one emergency department(ED) visit during the previous year?
- ◯ Yes
- ◯ No

91) Are you interested in participating in a follow up face to face interview in about a month's time?
- ◯ Yes
- ◯ No

HEART DISEASE FACT QUESTIONNAIRE (HDFQ).

A person always knows when they have heart disease	○ True ○ False
If you have a family history of heart disease, you are at risk for developing heart disease	○ True ○ False
The older a person is, the greater their risk of having heart disease	○ True ○ False
Smoking is a risk factor for heart disease	○ True ○ False
A person who stops smoking will lower their risk of developing heart disease	○ True ○ False
High blood pressure is a risk factor for heart disease	○ True ○ False
Keeping blood pressure under control will reduce a person's risk for developing heart disease	○ True ○ False
High cholesterol is a risk factor for developing heart disease	○ True ○ False
Eating fatty foods does not affect blood cholesterol levels	○ True ○ False
If your 'good' cholesterol (HDL) is high you are at risk for heart disease	○ True ○ False
If your 'bad' cholesterol (LDL) is high you are at risk for heart disease	○ True ○ False
Being overweight increases a person's risk for heart disease	○ True ○ False
Regular physical activity will lower a person's chance of getting heart disease	○ True ○ False
Only exercising at a gym or in an exercise class will lower a person's chance of developing heart disease	○ True ○ False
Walking and gardening are considered exercise that will help lower a person's chance of developing heart disease	○ True ○ False
Diabetes is a risk factor for developing heart disease	○ True ○ False
High blood sugar puts a strain on the heart	○ True ○ False
If your blood sugar is high over several months it can cause your cholesterol level to go up and increase your risk of heart disease	○ True ○ False
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood sugar levels under control	○ True ○ False

People with diabetes rarely have high cholesterol	◯ True ◯ False
If a person has diabetes, keeping their cholesterol under control will help to lower their chance of developing heart disease	◯ True ◯ False
People with diabetes tend to have low HDL (good) cholesterol	◯ True ◯ False
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood pressure under control	◯ True ◯ False
A person who has diabetes can reduce their risk of developing heart disease if they keep their weight under control	◯ True ◯ False
Men with diabetes have a higher risk of heart disease than women with diabetes	◯ True ◯ False

Physical Measurements

Height	_____ (In Centimeters)
Weight	_____ (In pounds. If too large for scale 666.6)
Hip	_____ (In Centimeters)
Waist	_____ (In Centimeters)
Blood Pressure Cuff size	◯ Small ◯ Medium ◯ Large
Blood Pressure 1(sitting)	_____ (mmHg)
Blood pressure 2 (standing)	_____ (mmHg)
During the past two weeks, have you been treated for raised blood pressure with drugs (medication) prescribed by a doctor or other health worker?	◯ Yes ◯ No ◯ N/A (If 'Yes' go to next section)
Have you taken your BP medication today?	◯ Yes ◯ No

Appendix E. Qualitative Interview Questions (Manuscript 3)

The PI will ask the participant the following open-ended questions:

1. What health problems do you think are connected with being a taxi driver?
2. What do you call your health problems?
3. What do you think may have caused your health problems?
4. How do you make decisions about getting health care?

   Secondary prompt: Where do you go for health care?
5. What do you fear most about your health as a taxicab driver?
6. Some people think taxicab drivers have higher risks of heart disease. What do you think causes this type of problem?
7. What could be done to reduce your risk of diseases?
8. What is the difference in your health and health care before and after you immigrated to the US?
9. What else would you like to tell me about improving the health of taxicab drivers?

Thank you so much for the information you have shared

Appendix F. Research Support Documents
(Cab Companies & ASA, Inc.)

FAIRWAY SERVICES, INC.
T/A FAIRWAY CAB ASS'N
2405 22ND STREET N.E.
WASHINGTON, D.C.
PHONE: 202-832-4662
FAX: 202-832-7640

May 13, 2017

To Whom It May Concern

This is to certify that Mr. Camillus Ezeike was permitted to conduct research study at Fairway Cab Company Drivers.

If any question, please call the above number.

Thank You.

Amjid Qureshi
Manager

YELLOW CAB COMPANY OF DC INC.

EXPERIENCE – SERVICE – RELIABILITY – COMMITMENT

May 05, 2017

To whom is may concern:

Camillus Ezeike was giving permission to continue study efforts for his research here at Yellow Cab Company of D.C. If you have any questions please free to contact me anytime at 202-546-7900.

Dominic Lewis

Dominic Lewis

1636 Bladensburg Road N.E. Washington D.C. 20002

Tel. No. 202-546 7900 / Fax No. 202-546 0999

www.dcyellowcab.com

Dial cab co

2838 Bladensburg Rd NE, Washington, DC 20018

Tel (202)832-4444 - Fax (202)832-4040

May 6, 2017

To Whom It May Concern

This is to inform you that, Mr. *Camillus Ezeike* is permitted to conduct research study at Dial Cab Co about African Immigrant Cab Drivers .

For further details please contact the company.

Rateb Thahir

President

UNITY AND PROGRESS

Anambra State (Nigeria) Association in the Americas, Inc. (ASA, Inc.)
2901 18th Street, Northwest, Suite 103, Washington, DC 20009

url:http://anambrast.org *Tax ID: 52-1485620* *Email: ASA-DC@yahoogroups.com*

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PUBLIC RELATION OFFICER
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(240) 422-7074

CULTURAL DIRECTOR
Mrs. Ngozi Igwe
(202) 716-6067

PROVOST
Mrs. Joy Jideani
(202) 745-2921

Date: February 12, 2017

Reference: Research Study – African Immigrants Taxicab Drivers

To Whom It May Concern

This is to inform you that the members of Anambra State Association in the Americas, Inc. (ASA, Inc.) are aware of Attorney Camillus Ezeike's research study on African Immigrants Taxicab Drivers in the Washington DC metropolitan area.

Additionally, we authorized him to use a room in our office to interview those study participants.

Sincerely,

/s/ B.O Ezeosim
Sir Boniface O. Ezeosim
General Secretary.

Appendix G. Off Campus Study Site

PI Name: Camillus Ezeike

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

Office of Research Integrity
19 Hagood Ave, Suite 601
(843) 792-4148
Fax (843) 792-7457

Off Campus Study Site Form

PRO/HR # 00063762

STUDY TITLE: **Cardio Vascular Disease Risks Perceptions and Experiences of African Immigrant Taxicab Drivers in the DC Metro Area: A Mixed Methods Study**

PRINCIPAL INVESTIGATOR: Camillus Ezeike

ADDRESS OF OFF-SITE FACILITY: (1)2901 18th Street, Northwest, Suite 103, Washington, DC 20009 (2) 2838 Bladensburg Rd NE, Washington, DC 20018, (3) 2405 22nd Street N.E. Washington, DC, (4) 1636 Bladensburg Road N.E. Washington, DC 20002

NAME OF NON-MUSC INVESTIGATOR/ INSTITUTIONAL OFFICIAL: Sir Boniface Ezeosim

SECTION I.

A. Is the off-campus site "engaged" in human subject's research pertaining to this study?

To make this determination you will need to consult the OHRP website to assist in determining if the off campus site's role in this study makes the site "engaged." In general, an institution is considered *engaged* in a particular non-exempt human subjects research project when its employees or agents for the purposes of the research project obtain: (1) data about the subjects of the research through intervention or interaction with them; (2) identifiable private information about the subjects of the research; or (3) the informed consent of human subjects for the research. See the following link for categories and guidance:
http://www.hhs.gov/ohrp/policy/engage08.html

1. Check either A or B below: (Completion of A or B is required)

☐ (A) Activities at the off-campus site are consistent with examples under Category A; the site is engaged in human subjects research

If you checked this section, please identify the specific type of activity or activities to be done at this off site campus by providing the number of the example from the OHRP website. For example: A1, A2, A3, etc.

☒ (B) Activities at the off-campus site are consistent with examples under category B; the site is not engaged in human subjects' research

If you checked this section, please identify the specific type of activity or activities to be done at this off site campus by providing the number of the example from the OHRP website. For example: B1, B2, B3, etc.

Principal Investigator will use a private room in this office suite to meet with prospective participants to (1) obtain informed consent (2) administer research survey (3) obtain measurements (hip, waist, weight, blood pressure), and finally conduct face to face interview with 20 participants selected for the qualitative phase of the study. The OHRP example is B5: "Institutions (e.g., schools, nursing homes, businesses) that permit use of their facilities for intervention or interaction with subjects by investigators from another institution. Examples would be a school that permits investigators from another institution to conduct or distribute a research survey in the classroom; or a business that permits investigators from another institution to recruit research subjects or to draw a blood sample at the work site for research purposes."

2. Does the off-campus site have a Federal Wide Assurance (FWA)?

☐ Yes If yes, what is their FWA:
☒ No

3. Does the off-campus site have an Institutional Review Board for Human Research?

☐ Yes ☒ No

If Yes, the individual or site must contact that IRB and provide MUSC with documentation on whether IRB approval is required.

Please provide the name, address and phone number of the IRB:

If Yes, has the off-campus site's IRB approved this study?

☐ Yes ☐ No

If the off-campus site's IRB has not approved this study, will review by that IRB be required?

☐ Yes ☐ No

If no, please explain.

SECTION II. *(Complete this section if you selected Section I.A(1)(A)).*

A. List all community individuals that will be engaged in the study.

Individuals are "engaged" if they will: (1) obtain data about research participants through intervention or interaction with them; or (2) obtain identifiable private information or identifiable specimens about the participants of the research – even if they do not directly interact with them or (3) the informed consent of human subjects for the research. More information pertaining to what constitutes engagement can be found in the OHRP guidance on engagement at: http://www.hhs.gov/ohrp/policy/engage08.html

Individual's Name *Use full legal name*	**Individual's Credentials and/or Position** *(e.g., M.D., Executive Director., recruitment specialist)*	**Individual's Role on the study** *(e.g. ,consent, deliver interventions, data analysis)*

To expand table, move to the end of the last row and press the tab key.
***Any community individual "engaged" in research will need to complete the CITI MIAMI training course and be listed on the eIRB personnel list.*

** If any community individual member of a facility is considered "engaged" in research, the site is then considered "engaged in research under section I(A)(1) of this form.

B. For each individual listed above who will be involved in the informed consent process, please complete the information below.

Name:
Current Position/Role at the Facility:
Human Subjects Education/Training:

You may copy and paste this box as many times as needed. Box expands.

***For those individuals and/or sites that do not have their own IRB, MUSC may consider taking on the role of IRB of Record. Please review the guidance provided by SCTR (pg2) on how to apply for a Federal Wide Assurance (FWA) / Institutional Authorization Agreement (IAA). Contact your MUSC IRB administrator if you have questions.

**MUSC may assume IRB responsibilities for non-affiliated institutions and investigators only under certain conditions (i.e., such as when an approved IRB Authorization Agreement exists designating the MUSC IRB to serve as the IRB of Record and the facility applies for and receives and FWA from OHRP).

**If the MUSC IRB takes on the role of IRB of Record, individuals must complete an IRB approved education program (CITI MIAMI) for the protection of human research participants prior to conducting this, or any other, research involving human participants.

Appendix H. Single Item Literacy Screener

Single Item Literacy Screener (SILS) (Morris, MacLean, Chew, & Littenberg, 2006).

"How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?"

1- Never

2- Rarely

3- Sometimes

4- Often

5- Always

Morris, N. S., MacLean, C. D., Chew, L. D., & Littenberg, B. (2006). The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. BMC Family Practice, 7, 21. doi:10.1186/1471-2296-7-21