INFLUENCE OF THE DEMOGRAPHIC FACTORS AND CLINICAL VARIATION ON THE LOW-DENSITY LIPOPROTEIN LEVEL AMONG LOW INCOME PATIENTS WITH CARDIOVASCULAR CONDITIONS IN SAN DIEGO COUNTY

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Master of Public Health
with a Concentration in
Health Management & Policy

by
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Summer 2014
SAN DIEGO STATE UNIVERSITY

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Influence of the Demographic Factors and Clinical Variation on the Low-Density Lipoprotein Level among Low Income Patients with Cardiovascular Conditions in San Diego County

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ABSTRACT OF THE THESIS

Influence of the Demographic Factors and Clinical Variation on the Low-Density Lipoprotein Level among Low Income Patients with Cardiovascular Conditions in San Diego County

by

Abdinasir K. Ali

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San Diego State University, 2014

Background: The San Diego Low Income Health Program (LIHP) uses one of the nine defined Healthcare Effectiveness Data and Information Set (HEDIS) measures to determine the clinical effectiveness of cholesterol management for patients with cardiovascular conditions. The percent compliance rate for the measure has been very low since the program was first implemented in July 2011.

Study Questions: To determine whether all patients with cardiovascular conditions have been screened for lipids during the four quarters (Jul 2012-Jun 2013) analyzed in the study, and identify which demographic and clinical factors that were associated with Low-Density Lipoprotein, LDL>100 mg/dL.

Methods: Using LIHP claims data from July 1, 2012-June 30, 2013; all enrollees with cardiovascular conditions were identified by International Classification of Diseases, ICD-9 and Current Procedural Terminology, CPT codes. The LIHP claims data were merged with the LDL data set that is collected separately from the LIHP claims data. Percent test rates for all providers and patient demographic characteristics such gender, race/ethnicity, and age were used as the independent variables to test the association between LDL and those demographic and clinical characteristics.

Results: Not all the patients with cardiovascular conditions were screened during the four quarters analyzed for the study. Results from multiple logistic regression showed that percent LDL test was significantly associated with LDL above 100 mg/dL. For the gender variable, females showed 2.5 times more likelihood for LDL above 100 mg/dL. In race/ethnicity, non-white racial group showed 1.88 times as likely than white to have a bad LDL above 100 mg/dL. No significant association was found for the age variable.

Conclusion: The majority of LIHP patients were found to have had a cardiovascular condition have not been screened for lipids during the four quarters analyzed. Clinical variations such as percent test rate and demographic factors such as gender, and race/ethnicity were found to be some of the factors that determined whether LDL was above 100 mg/dL for the San Diego county LIHP patients with cardiovascular conditions.
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<table>
<thead>
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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>LIHP:</td>
<td>Low Income Health Program</td>
</tr>
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<td>LDL:</td>
<td>Low-Density Lipoprotein</td>
</tr>
<tr>
<td>ASO:</td>
<td>Administrative Service Organization</td>
</tr>
<tr>
<td>HCPA:</td>
<td>Health Care Policy Administration</td>
</tr>
<tr>
<td>AHA:</td>
<td>American Heart Association</td>
</tr>
<tr>
<td>HEDIS:</td>
<td>Healthcare Effectiveness Data and Information Set</td>
</tr>
<tr>
<td>CVC-LDL:</td>
<td>Cardiovascular Conditions-Low-Density Lipoprotein</td>
</tr>
<tr>
<td>EMS:</td>
<td>Emergency Medical Services</td>
</tr>
<tr>
<td>ICD:</td>
<td>International Classification of Diseases</td>
</tr>
<tr>
<td>AHRQ:</td>
<td>Agency for Healthcare Research and Quality</td>
</tr>
<tr>
<td>NCEP:</td>
<td>National Cholesterol Education Program</td>
</tr>
<tr>
<td>CHD:</td>
<td>Coronary Heart Disease</td>
</tr>
<tr>
<td>STC:</td>
<td>Special Terms and Conditions</td>
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CHAPTER 1

INTRODUCTION

The Low Income Health Program, popularly known as LIHP, was a program for eligible adults that provided both medical and mental health coverage. The program was implemented by the state of California after California’s Department of Health Care Services (DHCS), in coordination with Medicare and Medicaid services (CMS), received approval of the section 1115 Medicaid demonstration, also known as “California’s Bridge to Reform,” effective November 1, 2010, through October 31, 2015 (California’s Department of Health Care Services [DHCS], 2014a). A Section 1115 waiver allowed DHCS to receive $10 billion in federal funds to invest in its health care delivery system in preparation for health care reform (DHCS, 2014b). The LIHP program was optional and administered at the local county level with a 50:50 matching revenue from the state and federal governments.

The “California Bridge to Reform” (DHCS, 2014b) consisted of two parts: the Medicaid Coverage Expansion, also known as MCE, and the Health Care Coverage Initiative, also known as HCCI. The MCE portion of the LIHP covers individuals who are at or below 133% of the federal poverty level (though the number varies depending on the participating county jurisdiction in California). The HCCI portion of the LIHP is for those individuals who are uninsured, but have family incomes of that is between 133% and 200% of the federal poverty level. Section 1115 Medicaid demonstration requires all the participating counties in the state to provide health care for the estimated 500,000 low income, uninsured people in California (DHCS, 2014b). The implementation also requires gradual improvements in the public hospital system in order to provide a good infrastructure for the anticipated health care reform, which is expected to be completed in 2017 (DHCS, 2014b).

San Diego County Low Income Health Program, LIHP began on July 1, 2011 and ended on December 31, 2013. When the program ended, all the enrollees were transitioned to the state Medi-Cal program because of the Medicaid expansion provision in the Patient Protection and Affordable Care Act (PPACA) legislation passed in Congress on March 23,
2010. The San Diego County LIHP offered new enrollment to only the MCE portion of LIHP, but retained those individuals that are already enrolled in HCCI portion, and continued to meet the eligibility criteria for the LIHP program (County of San Diego, 2014). The County of San Diego Health and Human Services Agency (HHSA) administered the LIHP program. HHSA contracted with UnitedHealth Administrative Service Organization (ASO) to provide and manage the daily operations of LIHP (County of San Diego, 2014). The County of San Diego is unique because it does not own or operate any health care facilities in the county, except for the San Diego County Psychiatric Hospital (San Diego County Psychiatric Hospital, 2014). Most other counties in California own and operate their own county hospitals, and have infrastructure to serve their population. San Diego County LIHP therefore used a set of Community Health Centers, CHCs, private physicians, and private hospitals in order to provide services to LIHP enrollees.

Eligible County of San Diego residents applied for LIHP through the family resources centers or online at Calwin portal (County of San Diego, 2014). The other minimum eligibility criteria included: enrollees must have been 19 through 64 years of age when they applied, a San Diego County resident, a U.S citizen or a legal alien with 5 years residency, and must meet LIHP financial eligibility requirements (County of San Diego, 2014). Once approved, enrollees received coverage for a period of twelve months with subsequent recertification requirements. LIHP enrollees are required to choose one of the Community Health Centers as their primary health care provider in order to continue receiving care.

In addition to medical coverage, LIHP also provided limited mental health coverage (County of San Diego, 2014). Mental health services included ten days per year of acute inpatient hospitalization in an acute care hospital, and twelve outpatient visits per year (County of San Diego, 2014). Some of the services covered by LIHP included primary care services, emergency room care, emergency medical transportation, acute inpatient hospital services, radiology, laboratory, and transportation services. There were some services that needed prior approval such as physical therapy, surgical and diagnostic procedures, optometry exams and supplies, limited home health services, scheduled inpatient hospital admissions and services, prosthetic and orthotic appliances and devices, and podiatry. Some of the services that were not covered by LIHP: bariatric surgery, pregnancy and all prenatal services, pediatrics, family planning and sterilization procedures, infertility related services,
drug and alcohol treatment, organ and bone transplants, bone marrow transplants, experimental procedures, cosmetic procedures, work examinations, completion of medical certificates, routine or preventive dental services, orthodontia, non-FDA-approved medications, medical or clinical trials, electroconvulsive therapy, transcranial magnetic stimulation, vagal nerve stimulation, observation status for admissions less than twenty-four hours, and chiropractic services.

As part of Special Terms and Conditions (STCs), the county was mandated to write a quarterly Quality Improvement (QI) report detailing the status of the QI initiatives for each quarter of the program. The report detailed utilization measures, and clinical performances based on defined nine Healthcare Effectiveness Data and Information Set (HEDIS) measures. HEDIS is a tool used to measure performance on important dimensions of health care and service (County of San Diego, 2013). The nine HEDIS measures used in the LIHP program are agreed upon by consensus within a subcommittee of the Low Income Health Program, LIHP quality improvement committee led by the senior program manager of the office of Health Care Policy Administration (County of San Diego, 2013). Some of the criteria used to select the nine quality improvement indicators are based on reporting boards across the country, funding entities, and “other quality improvement networks” (County of San Diego, 2013). The quality improvement committee targeted some of the clinical HEDIS measures that could be measured, and that they can see possibilities for “efficient data collection” in the community clinics. This was because of the requirement by the national HEDIS, Medicaid and ALL HEART benchmarks (County of San Diego, 2013).

The County introduced a Pay-for-Performance program (P4P) in quarter 3 of the LIHP program, and the first P4P rate adjustments, depending partly on HEDIS performance measures were received by the Community Health Centers, CHCs in Quarter five of the LIHP program (County of San Diego, 2013). The intention of the P4P program was to incentivize Community Health Centers, CHCs to improve their clinical outcomes. The LIHP program was trying to lay the groundwork for the implementation of the Affordable Care Act, and therefore the County was looking towards health management and patients-centered care as the solution to those with chronic diseases.

This study will focus on one of the HEDIS measures, which is cholesterol management for patients with cardiovascular conditions including heart attack and stroke that
are the leading causes of death among Americans (Greenlund, Keenan, Clayton, Pandey, & Yuling Hong, 2012). It also takes a greater portion of national health expenditure with estimated direct cost of $273 billion annually (Heidenreich et al. 2011).

The proportion of LIHP enrollees with cardiovascular conditions, and who have lower level of low-density lipoprotein (LDL) below 100 mg/dL, meaning those who were compliant for the HEDIS measure, had been consistently low since the beginning of the LIHP program. The percent LDL complaint for quarter five was 26.40%, quarter six was 32.49%, quarter seven was 35.34%, and quarter eight was 34.06%. These low percentages clearly show that the number of enrollees have been consistently lower than the 70% benchmark required for the LIHP program. The Table 1 shows the percentages of LIHP patients who were compliant for the four quarters as published in the quality improvement report published quarterly by the Low Income Health program.

**Table 1. Number of Patients Who Were Compliant for Quarters 5-8 from the ASO**

<table>
<thead>
<tr>
<th>Parent Organizations</th>
<th>Quarter 5</th>
<th>Quarter 6</th>
<th>Quarter 7</th>
<th>Quarter 8</th>
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<tr>
<td>Benchmark</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Total</td>
<td>26.40%</td>
<td>32.49%</td>
<td>35.34%</td>
<td>34.06%</td>
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<tr>
<td></td>
<td>(80/303)</td>
<td>(77/237)</td>
<td>(94/266)</td>
<td>(110/323)</td>
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The percent LDL compliant for quarter five was 26.40% (80/303), quarter six was 32.49% (94/266), quarter seven was 35.34% (110/323), and quarter eight was 34.06%. These low percentages clearly show that the number of enrollees have been consistently lower than the 70% benchmark required for the LIHP program.

All the LIHP patients had an assigned primary care medical home (MH), which was a specific clinic site within a Community Health Center (County of San Diego, 2013). The age ranges for the enrollees was 19-64, and 99.9 percent of them fell below 133 percent of the Federal Poverty Level (FPL), while the 0.1 percent remaining patients have been retained in the LIHP from the previous Health Care Coverage Initiative Program (County of San Diego, 2012).
According to the Quality Improvement Report (County of San Diego, 2012), the goal for the LIHP Program was to have 70% of the enrollees’ blood cholesterol compliant, meaning below 100 mg/dL (Milligrams per deciliter of blood). Given the lower compliance rates for the LDL test among cardiovascular patients in LIHP program, it is important to know how cardiovascular patients in the LIHP program were screened and what are associated with LDL noncompliance (>100). Investigating LDL screening and LDL compliance among cardiovascular patients is also important. According to the CDC, 1 in every 4 people, about 600,000 people die annually of cardiovascular conditions in the United States (United States Department of Health and Human Services [HHS], 1996). Furthermore, heart diseases are the leading causes of death for both men and women, and more than half the deaths among men in 2009 were due to heart diseases (HHS, 2010). Since LIHP is a county program, it is also important for taxpayers to know where their dollars are going and how the state and local county governments prioritize those dollars. The LIHP program was partly funded by the state of California through the local tax revenue that was collected, and so it is in the interest of taxpayers to know whether the program has been effective, and that the program’s effectiveness is commensurate with the resources allocated to it. To my knowledge, the county of San Diego or the state has never conducted a cost-benefit or cost-effectiveness analysis for the LIHP program to determine whether health outcomes for enrollees improved over the long run given the amount of resources spent on this program. However, the program produced a quarterly Quality Improvement report to summarize primary care and emergency utilization, and other HEDIS compliance requirements.

LDL or “bad cholesterol” testing should be given to patients screened with cardiovascular conditions because numerous previous studies have found a link between the levels of LDL and cardiovascular conditions (Brautbar & Ballantyne, 2011). Over the past decades a large, longitudinal study (among 304,460 individuals) has shown that LDL cholesterol levels is a significant indicator for the occurrence of cardiovascular conditions. The study found that all the individuals did not have any known cardiovascular conditions at baseline, but after the follow-up period, they reported hazard ratios for Coronary heart disease (CHD) of 1.38 for each 1 standard deviation increase in directly measured LDL (Di Angelantonio et al., 2009), indicating an association between high LDL levels and onset of cardiovascular conditions. There are also other more recent studies that have linked elevated
LDL levels with incidences of cardiovascular conditions such as coronary heart diseases in all the populations studied. More importantly, the same studies also found clear benefits such as reduced risk for cardiovascular conditions when LDL was lowered through interventions such as statins, or medications for cholesterol management (LIPID Study Group, 1998). The US National Cholesterol Education Program (NCEP) working with the American Heart Association (AHA), introduced a new, more aggressive guideline for LDL level with a goal of <70 mg/dL for those patients that have a high risk for cardiovascular conditions (Grundy et al., 2004). NCEP and the AHA considered blood LDL optimal when the value is less 100 mg/dL. For this study, an LDL of over 100 mg/dL was considered non-compliant, and was coded as 1 in SPSS. Those who were below 100 mg/dL were coded as 0 in SPSS. The recoded LDL was then used for the multiple regression as the dependent variable.

This aggressive guideline is meant to reduce the risk for cardiovascular conditions because an LDL level lower than 70mg/dL was associated with reduced risk (Grundy et al., 2004). Other similar guidelines have also been put in place in Europe and in other parts of the world in order to target those patients who have a high risk for cardiovascular conditions (Rydén et al., 2007). These measures have resulted in clinicians adapting protocols for drawing LDL and prescribing medications or statins for those with high LDL values in order to lower their LDL values to the recommended level (Sirtori & Fumagalli, 2006).

Study questions:
1. Are all the LHIP enrollees with cardiovascular conditions screened for lipids during quarters five, six, seven, and eight?
   a. What are the characteristics of patients that drew lipids vs. those that did not (for all CVD enrollees)?
2. In the subgroup that had lipids drawn, what factors determine whether LDL>100?
   a. A large percentage of those with lipid testing had LDL>100. Of those individuals, what percentage was retested?

Hypothesis:
1. What is the influence of demographic factors on cardiovascular conditions among indigent population in the County of San Diego?
   a. White population shows lower likelihood of LDL above 100 mg/dL when compared to other racial groups.
   b. Women show lower likelihood of LDL above 100 mg/dL when compared to men.
c. Young adults show lower likelihood of LDL above 100 mg/dL when compared to older adults.
CHAPTER 2

LITERATURE REVIEW

There are numerous studies that have shown an association between gender, age, race/ethnicity, and other socioeconomic factors with cardiovascular conditions. The literature review below focuses on demographic factors including age, gender, and racial/ethnic characteristics that have an effect on cardiovascular conditions.

CARDIOVASCULAR CONDITIONS AND GENDER

It has been shown that gender plays a significant role for people with cardiovascular conditions especially for older women (White, Darley-Usmar, & Oparil, 1997). Cardiovascular conditions rarely affect women in premenopausal years. In fact, for younger women, the rate of cardiovascular conditions is very low when compared to men of similar age groups, but after menopause, the incidences of cardiovascular conditions among women rises sharply (White et al., 1997).

Recent studies have shown that cardiovascular conditions are the leading cause of death among women in U.S., accounting for 200,000 deaths annually (Agency for Healthcare Research and Quality, 2009). Heart diseases are generally associated with men because of the societal factors such as work-related stress, poor diet, and smoking. Furthermore, cardiovascular conditions were once considered “a man’s disease” for many years because of the symptoms associated with the disease. There is increasing evidence to suggest that this is partly due to the differences in how heart disease symptoms are seen in men and women. McSweeney et al. (2003) found that women’s symptoms were milder, and harder to detect when compared to men. Some of the symptoms found in women with heart diseases were shortness of breath, fatigue, and sleep disturbance, which is different from the common symptoms of heart attack among male, which are chest pain, chest discomfort, and chest pressure. This has contributed, partially, to the reasons why many women do not to seek early treatment that could have saved their lives and prevent early death (McSweeney et al., 2003). It is believed that many women did not seek early treatment because they might have
associated those symptoms with other diseases such as seasonal influenza (flu), or common cold (McSweeney et al., 2003).

Recent statistics from a survey conducted by American Heart Association found that 57% of women did not know that cardiovascular conditions were the third leading cause of death for women between 25-44, and second leading cause of death for women 45-64 (Rosamond et al, 2008). This lack of awareness among women about the prevalence of cardiovascular conditions may have contributed to higher number of women dying of heart diseases (Rosamond et al., 2008). It is generally accepted that the risk factors for cardiovascular conditions are nearly the same for both men and women, but the impact they have on men and women are significantly different (Lee & Foody, 2008). There are some cardiovascular conditions that are more common in one gender, and others common in the other gender. For example, coronary artery disease (CAD) is common among women because of their increased risk factors when compared to men (Lee & Foody, 2008). Women tend to have higher prevalence of all the traditional risk factors for cardiovascular conditions with the exception of smoking when compared to men (Lee & Foody, 2008).

The most common risk factor for cardiovascular condition in women is hypertension. Up to 85% of all women in the United States become hypertensive by the time they reach 75 years (Lee & Foody, 2008). It is rare for women to develop hypertension before menopause, but if they do, it is mostly associated with secondary causes of hypertension such as renal artery stenosis, oral contraceptive use, and pregnancy (Lee & Foody, 2008). In the Study on Hypertension Prevalence in Menopause in the Italian Population (SIMONA), which was a large cross-sectional study on 18,326 women of age ranges 46-59 years seen by 302 practitioners in Italy, found that systolic blood pressure (SBP) and diastolic blood pressure (DBP) were significantly higher in postmenopausal than premenopausal and perimenopausal women. That association was consistently significant even when the confounding effects of age, BMI, smoking, and contraceptive or replacement therapies were controlled by analysis of covariance, indicating that menopause was significantly and positively associated with SBP and DBP (Zanchetti et al., 2005). Thus, it is believed that the mechanism for the development of hypertension in menopausal women is linked to the lack of estrogen that results in vasoconstriction from both renin-angiotensin-aldosterone-sensitive pathways (Schulman & Raij, 2006).
In a similar population-based survey that used data from Framingham study, researchers assessed sex-specific coronary heart diseases over a period of 26 years. The participants’ ages ranged from 35 to 84 years. The researchers found that men had about twice the total incidence of morbidity and mortality than women (Leaner & Kannel, 1986). Furthermore, the study found that the gender difference in morbidity declined after women reached 45 years, and even surpassed men’s morbidity rate after menopause. The link between morbidity due to cardiovascular conditions and menopause in women indicates that ovarian hormones play a significant role in preventing women from cardiovascular conditions when they are in childbearing age (Learner & Kannel, 1986).

In other parts of the world, the situation is not much different. In Europe, the rate of cardiovascular conditions among women is very high. A study indicated that about 55% of all deaths in women is attributed to cardiovascular conditions, especially coronary heart disease and stroke (Stramba-Badiale et al., 2006). The study came to conclusion similar to the numerous studies carried out in the U.S regarding the correlation of cardiovascular conditions and that female gender was associated with cardiovascular conditions after menopause. The prevalence and the incidence of cardiovascular conditions increased with age (Bello & Mosca 2004), but the proportion of women with cardiovascular conditions rises while the proportion of men with cardiovascular conditions declines because of a decrease associated with myocardial infarction incidence in men and an increase in myocardial infarction incidence associated with women (Tunstall-Pedoe et al., 1999).

One of the biggest barriers to the reduction of cardiovascular conditions in women is the lack of information and the general misconception about the prevalence of cardiovascular conditions in women that majority of women do not believe that cardiovascular conditions exists as the greatest threat to women’s health when compared to breast cancer (Mosca, Ferris, Fabunmi, & Robertson, 2004). This is partly due to the false narrative created by the media regarding breast cancer, which is falsely identified as the leading cause of morbidity and mortality in women (Stramba-Badiale et al., 2006).

Heart failure shows an important distinction between men and women. Already, heart failure is the most common cause of hospitalization in both men and women (Stramba-Badiale et al., 2006), but putting this into perspective, the prevalence of heart failure is similar for both men and women when you consider the overall population. However, some
important differences emerge as the two genders age. Heart failure seems to be common among older women who are over 75 years when compared to their male counterpart (Ho, Pinsky, Kannel, & Levy, 1993).

In summary, the review of existing literature about the correlation between gender and cardiovascular condition found that females show higher likelihood of having cardiovascular conditions after menopause when compared to males. This is because of the ovarian hormones that protect women during their pre-menopause years. Once they hit menopause, the risk for cardiovascular conditions surpasses that of men.

**CARDIOVASCULAR CONDITIONS AND RACE/ETHNICITY**

Studies have shown that race/ethnicity is associated with LDL level among patients with cardiovascular conditions. Among African-American men and women, the mortality rate due to cardiovascular conditions accounted for 44.6% and 46.9% in 2006 (Lloyd-Jones et al., 2010). African-Americans also have a high prevalence of cardiovascular risk factors such as obesity, diabetes mellitus, hypertension, and physical inactivity (Lloyd-Jones et al., 2010).

This trend is clearly explained by the Cooper Center Longitudinal Study (CCLS), which used a large cohort of men and women in Cooper Clinic, Dallas, Texas from May 1970 to July 2010 (Frierson, Howard, DeFina, Powell-Wiley, & Willis, 2013). Based on 762 self-identified African-Americans of whom 61% were men, and 40,051 Caucasians of whom 68% were men CCLS showed that African-Americans had a greater chance of developing prevalent hypertension and diabetes mellitus, which are risk factors for cardiovascular conditions (Frierson et al. 2013). Also it revealed the existence of sex-specific disparities between African-Americans and Caucasians; African-American women had a higher prevalence for hypertension and diabetes mellitus. Upon summarizing the study as whole, the researchers found out that African-Americans had a greater prevalence of multiple risk factors, while Caucasians had a greater prevalence of being free from risk factors (Frierson et al., 2013). The study also found that African-Americans had “a unique medical implication” (Frierson et al., 2013) that should be taken into account. The researchers attributed this to negative psychosocial factors in their environment such as stress, mistreatment, and
discrimination experienced over their lifetimes that contributed to their overall health experiences.

Another aspect of the cardiovascular condition prevalence was how the modifiable risk factors for cardiovascular conditions differed by race/ethnicity. Some of the important risk factors for cardiovascular morbidity and mortality are: diabetes, obesity, smoking, hypercholesterolemia, hypertension, and lack of adequate exercise. For people with diabetes, the risk for cardiovascular conditions is twice or even three times greater when compared to people without diabetes (Kurian & Cardarelli, 2007). Regular exercise was seen to reduce the risk of cardiovascular conditions (Powell et al., 1987). Minorities tend to live in areas where access to recreational facilities are limited, and may not be able to get adequate exercise as opposed to people who live in areas where there are adequate facilities. It was also noted that there is enough evidence to show that other important risk factors for cardiovascular morbidity and mortality such as hypercholesterolemia, hypertension, and obesity could be lowered with adequate exercise (HHS, 1996).

Race/ethnicity was associated with hypertension in the Begalusa Heart Study in order to assess the differences in CVD risk factors among black and white adults by geographic area. The study found that black men had higher blood pressure than white men, and family history of hypertension also played a crucial role in determining whether the person had a higher blood pressure; Family history of hypertension was higher in blacks than whites (Greenlund et al. 1998). According to a study about the Cardiovascular diseases risk factors among older black, Mexican American, and white women, black women and men were significantly more likely to have approximately a two-fold higher prevalence of hypertension than white men and women (Sundquist, Winkleby, & Pudaric, 2001).

Black and Mexican American women had significantly higher prevalence of type 2 diabetes than white women after adjusting for their demographic differences (Sundquist et al., 2001). In another San Antonio heart study, the relative risk of cardiovascular conditions mortality for diabetes in Mexican Americans was significantly different from non-Hispanic whites who did not achieve significance (Wei, Mitchell, Haffner, & Stern, 1996). Thus, ethnic minority status was also associated with diabetes.

Many studies looked at the association between obesity, which is a risk factor for cardiovascular conditions and race/ethnicity. Though there was a mixed result, but there were
several studies that found higher mean BMI in blacks, Mexican Americans than in whites (Winkleby, Kraemer Ahn, & Varady, 1998). Sundquist et. al (2001) also reported that older black women had the highest prevalence of abdominal obesity, then followed by white, and Mexican American women. This shows racial and ethnic differences in obesity prevalence that increases the likelihood for a cardiovascular condition.

Another risk factor for cardiovascular conditions was smoking. Winkleby et al. (1998) found that Mexican Americans had significantly lower prevalence of smoking when compared to whites and blacks. Other studies showed that American Indiana/Alaskan Natives had a higher prevalence of smoking when compared to all other racial and ethnic groups (Harwell et al., 2001). Thomas, Eberly, Smith, Neaton, & Stamler (2005) reported higher prevalence of smoking among blacks when compared to whites.

Lack of physical activity was another risk factor for cardiovascular conditions associated with race/ethnicity. There were many studies that showed a significant correlation between lack of physical activities and racial/ethnic group. Winkleby et. al (1998) also found that Mexican American women had the highest prevalence for lack of physical activity when compared to other ethnic groups. Other studies have shown that American Indians and blacks have higher prevalence for lack of physical activity when compared to whites (Sundquist et al., 2001).

In summary literature indicates that cardiovascular conditions affect racial minorities disproportionately and are often the leading cause of death for these racial groups. Early targeted identification efforts need to be put in place in order to create awareness of cardiovascular conditions risk factors. The risk factors for cardiovascular conditions such as smoking, obesity, lack of exercise, and diabetes are common among racial and ethnic minorities because of socio-economic factors such as income, housing, and access to health services (Frierson et al., 2013).

**CARDIOVASCULAR CONDITIONS AND AGE**

Studies have also shown that age is a determining factor of cardiovascular condition. Data available at the National Center for Health Statistics shows that the majority of those who die of cardiovascular conditions are older than 65 years (Xu, Kochanek, Murphy, & Tejada-Vera, 2010). The situation is exacerbated by increased life span and leads to an
increase in the number of Americans affected by cardiovascular conditions in the next few years (National Center for Health Statistics, 2010).

Older people are more susceptible to cardiovascular conditions because of higher risk factors of cardiovascular conditions including, heart failure, racial/ethnic and socioeconomic disparities, continued risk factor burden, and comorbidities (Greenlund et al., 2012).

Mortality due to heart disease remains the leading cause of death among the elderly (National Center for Health Statistics, 2010). Stroke is also another killer that has risen to become the third leading cause of death for persons over 65 years of age. It also remains the leading cause of disability for older Americans (National Center for Health Statistics, 2010). Heart failure, also called congestive heart failure, is another chronic condition common among the elderly. Xu et al. (2010) reports that 92% of deaths due to heart failure was experienced by older people who were over 65 years. Hospitalization due to heart failure has consistently been increasing since the 1980s showing the impact of age on cardiovascular conditions. However, It is believed that the reason for the sudden spike in the rate of hospitalization is improved survival time after an initial cardiovascular event happens (Greenlund et al., 2012). Another factor increasing the heart failure is the age-related vascular changes in the body such as such as arterial stiffness, increased systolic blood pressure, hypertension, and diabetes (Greenlund et al., 2012).

Occurrence of heart diseases among the elderly is unevenly distributed among the different racial and ethnic groups in the United States. In the year 2006, the age-adjusted mortality rates for coronary heart disease was higher for blacks (161.6 per 100, 000) than whites (134.2 per 100, 000), American Indians/Alaskan Natives (97.4 per 100, 000), and Asians/Pacific Islanders (77.1 per 100, 000), (Keenan & Shaw, 2006). Older Hispanic men and women had lower rates of heart disease and stroke mortality than non-Hispanic white men and women (Greenlund et al., 2012). Furthermore, the proportion of deaths occurring as a result of coronary heart disease among older people aged 45 to 74 years was higher for black men (61.5%) than white men (41.5%), and higher for black women (37.9%), than for White women (19.4%) in United States (Greenlund et al., 2012).

The prevalence of hypertension also increases with age and it is estimated that more than 60% of men, and more than 70% of women over 65 years have hypertension (Greenlund et al., 2012). Based on 12 years of follow-up on a community based cohort, Anderson, Odell,
Wilson, & Kannel, (1991) concluded that age is the strongest predictor of cardiovascular condition given the aging population because of the retiring baby boomers. Another study that looked at the relative importance of diastolic (DBP), systolic (SBP), and pulse pressure (PP) as predictors of coronary heart disease (CHD) risk in different age groups found that, after 20 years of follow-up, DBP was the strongest predictor of CHD risk in the age group below 50 years, (Franklin et al., 2001). Franklin et al. (2001) also indicated that, “with increasing age, there was gradual shift from DBP to SBP, and then to PP as predictors of CHD” (Franklin et al 2001). This meant that with increasing age, there is a high chance of large artery stiffness occurrence contributing to the risk for cardiovascular diseases in older adults.

In summary, age is a determinant factor for cardiovascular conditions especially for those who are over 65 years old (Xu et al. 2010). This is because older people are more vulnerable to hypertension, heart attack, and diabetes, which increase the risk for cardiovascular conditions. Heart diseases among the elderly is also unevenly distributed among the different ethnic and racial groups with the rates for black being the highest when compared to other racial groups.
CHAPTER 3

METHODOLOGY

DATA

One of the clinical Healthcare Effectiveness Data and Information Set (HEDIS) measures used to determine the performance of care is cholesterol management for patients with cardiovascular conditions. According to the Agency for Healthcare Research and Quality (AHRQ), cholesterol management for patients with cardiovascular conditions is, percentage of members 18 to 75 years of age who were discharged alive for Acute Myocardial Infarction AMI, coronary artery bypass graft (CABG), or percutaneous coronary interventions (PCI) in the year prior to the measurement year, or who had a diagnosis of ischemic vascular disease (IVD) during the measurement year and the year prior to the measurement year, who had a LDL-C screening and LDL-C control (less than 100 mg/dL). (Agency for Healthcare Research and Quality, 2014)

Two sources of data were used for the study: LIHP claims data and LDL data obtained from clinic charts.

1. LIHP Claims data was used to determine the number of enrollees with a cardiovascular condition. Four quarters (1 year) of data was used for this study; July 2012 to June 2013. Quarter five included the month of July, August, and September of 2012. Quarter six included October, November, and December of 2012. Quarter seven included January, February, and March of 2013, and quarter eight included April, May, and June of 2013. Measurement period was based on the previous year reporting period, so for quarter five, the measurement period was from October 1, 2011 to September 30, 2012. For quarter six, the measurement period was January 1, 2012 to December 31, 2012. Quarter seven’s measurement period was from April 1, 2012 to March 31, 2013 and for quarter eight, the measurement period was from July 1, 2012 to June 30, 2013. Generally, the LIHP population was comprised of 53% men, and 48% women, ages 19-64 years old, all were residents of San Diego County in California. The family income of the enrollees was below 133% federal poverty level. All LIHP enrollees were assigned a primary care medical home, a specific clinic site within a CHC.

Based on the LIHP claims data, enrollees who had a diagnosis of one of the defined cardiovascular conditions were identified by an International Classification of Diseases, ICD-9 Code 410.x1, 411, 413 through 414.9, 429.2, 433, 434; 440.1 through 440.4; 444, and 445 and CPT Codes 33510-33514,
There were four parameters listed below that UnitedHealth Care ASO used to determine the denominator, which was all LIHP enrollees who reported a diagnosis of one the defined cardiovascular condition during the measurement period. Parameters:

1. Those patients captured via diagnosis, Dx code, the claims are from inpatient hospital only (location=inpatient hospital/01)
2. Those patients captured via procedure, Px code, the claims are from ERs or inpatient physician claims (location=emergency room / 23 or inpatient physician/21)
3. Location is in the data set - both in alpha and numeric
4. The patient must have eligibility in the month after the study quarter

Once the patients with cardiovascular condition during the study period were obtained, the data was selected by quarter based on the “date of service”. All duplicated member ID was removed to obtain the number of patients with a cardiovascular condition per quarter.

2. LDL data collected from the participating medical homes was a separate database. LDL values from a laboratory test were entered into the patient charts by the medical homes. They then sent it to UnitedHealth plan ASO as a separate database. The LDL database also included variables such as “Last Name”, “First Name” and “Member ID” and comments section for the provider. But it was de-identified so I could only use the “Member ID” variable to link the two datasets.

**DATA MERGING AND CLEANING**

The two databases were linked using the “member ID” variable. Where an individual enrollee did not have an LDL value, a period was entered to indicate non-compliant, meaning LDL was above 100 mg/dL or no LDL test was drawn for the four quarters selected. Those who were LDL non-compliant were still included in the sample in order to determine the percentage of enrollees who were non-compliant for the measure. All four quarters were combined to create a single database file for analysis in SPSS. The new dataset created contained 34 variables required in order to answer the study questions. Data screening was carried out to clean the data and remove duplicated users, and those with missing any of the identifying information such as age or gender. The sample for this study had 1,569 patients who had one form of cardiovascular conditions. Of those 1,569 patients with cardiovascular conditions, 812 had their information sent to medical homes for lipid test. Of those 812 patients, 394 patients had their blood drawn or finger-stick done to get their LDL value. For multivariate linear regression, 112 cases with missing/unknown ethnicity were removed,
remaining 282 patients with valid LDL test value. Figure 1 shows the breakdown of the data sample used to answer the study questions.

**Figure 1. Breakdown of sample used to answer the study questions.**

The number of patients with cardiovascular conditions for quarters five, six, seven, and eight as shown in table above was initially analyzed (n=1569). Descriptive analysis was done on the sample to find out the patient characteristics.

**MEASUREMENT**

The following measurements were carried out to analyze the demographic and percent test rate for those patients with cardiovascular conditions

**DEPENDENT VARIABLE: LOW-DENSITY LIPOPROTEIN**

According to the National Cholesterol Education Program (NCEP), Low-Density Lipoprotein popularly known as “bad cholesterol” is made up of fat and protein
(Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2004). The fats and proteins carry substances such triglycerides, cholesterol and fats in the blood stream to other parts of the body (Semenkovich, 2007). But when those substances accumulate in the blood stream, also referred to as “bad cholesterol” they will clog the arteries causing serious cardiovascular condition (Semenkovich, 2007). The LDL test is usually measured in milligram per deciliter (mg/dL). Blood is usually drawn from the veins, or finger-stick test is done to determine the LDL value. According to the US National Cholesterol Education Program (NCEP) working with the American Heart Association (AHA), blood LDL is considered optimal when the value is less 100 mg/dL (sometimes less than 70 mg/dL for those with a history of cardiovascular condition) (Grundy et al., 2004). For this study, an LDL of over 100 mg/dL was considered non-compliant, and was coded as 1 in SPSS. Those who were below 100 mg/dL were coded as 0. The recoded LDL was then used for the multiple regression as the dependent variable.

**INDEPENDENT VARIABLES: AGE, GENDER, AND RACE/ETHNICITY**

Patients’ demographic characteristics such age, gender, and race/ethnicity was used as the independent variables to test the associations between LDL and those demographic variables. For multiple logistic regression independent variables were recoded to have fewer categories. The Age variable was recoded to have three dummy variables with those 50 years being the reference category (below 50, 51-55, 56-60, 61-64). The gender variable had one dummy variable with males being the reference category. Race/ethnicity had one dummy variable with white acting as the reference category (white, non-white).

**CLINIC CHARACTERISTICS: PERCENT OF LDL TEST**

It is important to include clinical characteristics in the logistic regression model because the study was examining factors that contributed to the increased LDL level among LIHP patients. Percent LDL test rate for different community clinics that serve LIHP patients is a great indicator to find out whether variation in providers testing rate contribute to lower LDL below 100 mg/dL. The percent of LDL test for cardiovascular conditions was determined for each Community Health Center, CHC by determining the number of patients tested at each CHC, and then dividing it by the number of cardiovascular patients assigned to
that CHC. The percent of LDL test for all participating CHC’s was divided into two categories: Those below 50 percent, and those above 50 percent. Percent of LDL test variable was also correlated with the dependent variable to determine whether there is an association between percent test rate and the level of LDL for patients tested.

**STATISTICAL ANALYSIS**

In order to answer the primary question of this study, (“Were all the people with cardiovascular conditions screened for lipids during quarters five, six, seven, and eight?”) a descriptive statistical analysis was carried out to determine the number of patients with cardiovascular conditions for study period. To answer the study question 2, “What was the effect of demographic factors and percent testing rate on LDL?,” a multiple logistic regression technique investigated how LDL non-compliance (above 100 mg/dL) was associated with gender, race/ethnicity, age, and percent of LDL test.

The null hypothesis for the research question states that whites have a lower likelihood of LDL above 100 mg/dL when compared to non-white racial groups; women have a lower likelihood of LDL above 100 mg/dL when compared to men; and young adults have a lower likelihood of LDL above 100 mg/dL when compared to older adults. Standard 5% alpha level is assumed to determine statistical significance of the association.

In order to answer the study question 1, descriptive analysis was carried out on the number of enrollees with cardiovascular conditions. This descriptive analysis will be based on 1,569 patients with cardiovascular conditions during the study periods as shown in figure 1 above. The mean and standard deviation of all variables were determined. The percent frequency for all the variables used in the analysis was also determined. Descriptive analysis results will present the number of enrollees with cardiovascular conditions, and those whose LDL was drawn as shown in figure 1 above. Statistical analysis showing the three demographic variables: gender, age, and race/ethnicity were also determined.

**BIVARIATE ANALYSIS**

Before conducting multiple linear regression, simple logistic regression was carried out for each of the independent variable to explore the relationship with the response variable, LDL above 100 mg/dL: ethnicity, gender, age, and percent testing rate. The regression table in the simple linear regression was used to check whether the model was
significant, showing whether explanatory variables were good predictors of LDL. The odds ratio was also presented to describe unadjusted relationship between the independent variables and dependent variable.

**MULTIPLE LOGISTIC REGRESSION**

Multiple logistic regression tested for adjusted relationships between the dependent variable, which was whether LDL was above or below 100 mg/dL, and the independent variables which were: ethnicity, gender, age, and percent of LDL test. This study selected multiple logistic regression to test hypotheses stated in study question 2 because the multiple logistic regression tests all four independent variables at the same time in the regression model. The test provided an opportunity to examine the variation in the independent variables when they are all combined in a single regression model.
CHAPTER 4

RESULTS

QUESTION 1

Basic simple characteristics such as mean age, standard deviation, and frequencies for the four quarters analyzed was carried out in order to answer the first question of the study, “Are all the LHIP enrollees with cardiovascular conditions screened for lipids during quarters five, six, seven, and eight?” Other simple characteristics analyzed in order to answer the study question were frequencies of different racial/ethnic groups for all the patients with cardiovascular conditions.

Descriptive statistics for all those enrollees with cardiovascular condition based on the Current Procedural Terminology, CPT and diagnosis codes was determined. The total number of those with cardiovascular conditions for all the four quarters was 1,569. The frequency for each quarter was: quarter five was 529, quarter six was 270, quarter seven was 362, and quarter eight was 408. There were 1101 males, and 468 females. Table 2 shows the number of patients who reported cardiovascular conditions based on LIHP claims data per quarter for the four quarters studied.

Table 2. Number of Patients Who Reported Cardiovascular Conditions Based on LIHP Claims Data Per Quarter

<table>
<thead>
<tr>
<th>Quarter 2012-2013</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (July~Sep 2012)</td>
<td>529</td>
<td>33.7</td>
</tr>
<tr>
<td>6 (Oct~Dec 2012)</td>
<td>270</td>
<td>17.2</td>
</tr>
<tr>
<td>7 (Jan~Mar 2013)</td>
<td>362</td>
<td>23.1</td>
</tr>
<tr>
<td>8 (Apr~Jun 2013)</td>
<td>408</td>
<td>26.0</td>
</tr>
</tbody>
</table>
The mean age of cardiovascular patients in the study across all the quarters was 53.97, and the standard deviation was 7.13. The frequencies for the different racial groups for all those patients with cardiovascular conditions were: Whites 577, African Americans 134, Hispanics 297, Asians 85, and Native Americans 7. Majority of those with cardiovascular conditions were white. Table 3 shows the descriptive results for those patients with cardiovascular conditions in this study.

Table 3. Descriptive Statistics of Three Demographic Variables In The Final Sample (N=282 Patients whose LDL Was Drawn)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>282</td>
<td>0</td>
<td>1</td>
<td>0.3</td>
<td>0.46</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>282</td>
<td>1</td>
<td>6</td>
<td>2.29</td>
<td>1.44</td>
</tr>
<tr>
<td>Age</td>
<td>282</td>
<td>34</td>
<td>64</td>
<td>54.57</td>
<td>6.18</td>
</tr>
</tbody>
</table>

The results indicate that all the patients with cardiovascular conditions have not been screened during the four quarters analyzed in this study.

**QUESTION 2**

Basic simple characteristics and multiple linear regression was carried out for the all the factors that determine whether LDL was above 100 mg/dL in order to answer the study question, “In the subgroup that had lipids drawn, what factors determine whether LDL>100?”

The number of patients whose LDL was drawn was also determined by descriptive analysis. The total number of patients found to have had their LDL drawn or finger-stick done across the four quarters of this study was found to be 394 (25 percent). After removing those with unknown/missing ethnicities, the number of patients remaining was reduced to 282 (18 percent). The mean age for those whose lipids was drawn was 54.5 years. The minimum age was 34 years, while the maximum age was 64 years. The standard deviation was found to be 6.18. The age ranges for those whose LDL was drawn was skewed towards
the rights, meaning more people in this sample were 50 years and older. Table 4 shows the descriptive: minimum, maximum, mean, and standard deviation for those patients whose lipid was drawn.

Table 4. Frequencies for Gender and Race/Ethnicity for Those Whose Patients LDL was drawn

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>198</td>
<td>70.2</td>
</tr>
<tr>
<td>Female</td>
<td>84</td>
<td>29.8</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>131</td>
<td>46.5</td>
</tr>
<tr>
<td>Hispanics</td>
<td>93</td>
<td>32.9</td>
</tr>
<tr>
<td>African-American</td>
<td>16</td>
<td>5.7</td>
</tr>
<tr>
<td>Asians</td>
<td>23</td>
<td>8.2</td>
</tr>
<tr>
<td>Native Americans</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>6</td>
</tr>
</tbody>
</table>

The frequencies for the gender variable was determined for those patients whose LDL was drawn as shown in table 5. Males were 198, and females were 84. For ethnicity variable, the frequencies for different racial groups were: Whites 131, Hispanics 93, African-Americans 16, Asians 23, Native Americans 2, and other racial groups 17. As described in the measurement section of this study one dummy variable was created, separating non-whites. Other categories in race/ethnicity were removed due to small count. This dummy variable for non-white racial/ethnic category was included in the logistic regression. White served as reference.

The frequency for the ethnicity dummy variable was: white 131, non-white 151. For the gender variable, the frequency was: male 198, female 84. A dummy variable was also
created to be included in the multiple logistic regression. Age variable was divided into 4 groups: those under 50 years, 51-55, 56-60, and 61-64. Three dummy variables representing the four categories of age were created with the reference (under 50 year old) and included in the logistic regression analysis below. The frequency for the new age dummy variable was: those under 50 years were 61, those 51-55 years were 80, 56-60 years was 98, and 61-64 years was 43. Table 5 shows the frequencies for all the new dummy variables created for logistic regression.

Table 5. Frequency Table for All The Variables Used in The Logistic Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Male</td>
<td>198</td>
<td>70.2</td>
</tr>
<tr>
<td>Age Female</td>
<td>84</td>
<td>29.8</td>
</tr>
<tr>
<td>Race/Ethnicity White</td>
<td>131</td>
<td>46.5</td>
</tr>
<tr>
<td>Race/Ethnicity Non-White</td>
<td>151</td>
<td>53.5</td>
</tr>
<tr>
<td>Age Under 50</td>
<td>61</td>
<td>21.6</td>
</tr>
<tr>
<td>Age 51-55</td>
<td>80</td>
<td>28.4</td>
</tr>
<tr>
<td>Age 56-60</td>
<td>98</td>
<td>34.8</td>
</tr>
<tr>
<td>Age 61-64</td>
<td>43</td>
<td>15.2</td>
</tr>
<tr>
<td>LDL Test Rate Below 50%</td>
<td>106</td>
<td>37.6</td>
</tr>
<tr>
<td>LDL Test Rate Above 50%</td>
<td>176</td>
<td>62.4</td>
</tr>
</tbody>
</table>

Of the 1569 patients found to have reported one form of cardiovascular conditions based on the CPT and diagnosis codes for the four quarters analyzed, 812 was found to have been assigned to a medical home. Of those 812 patients assigned to a medical home, 394 have been screened for lipids. And of the 394 screened (whose LDL was drawn or finger-stick done), 295 were found to have had “good” LDL, meaning below 100 mg/dL. For quarter five (July-Sep 2012), the number of patients with “good” LDL, meaning below 100 mg/dL was 95, for quarter six (Oct–Dec 2012), the number of patients with “good” LDL,
meaning below 100 mg/dL was 41. The number of patients with “good” LDL, meaning below 100 mg/dL for quarters seven (Jan~Mar 2013) and eight (Apr~Jun 2013) were 72 and 87 respectively. There were 99 patients with “bad” LDL, meaning above 100 mg/dL. After analyzing those 99 patients with “bad” LDL, it was found that 16 of them were retested in the subsequent quarters resulting in a retest rate of 16% for the four quarters for this study. The graph in Figure 2 shows the total number of patients with cardiovascular conditions, and those with LDL below 100 mg/dL for the four quarters analyzed. For quarter five, the number of patients with cardiovascular conditions were 529 and those screened for lipids and had LDL below 100 mg/dL (compliant) were 95 patients (18 percent). For quarter six, the number of patients found to have had cardiovascular conditions were 270 and those screened for lipids and had LDL below 100 mg/dL were 41 patients (15 percent). For quarter seven, the number of patients found to have a cardiovascular condition was 362 while those screened for lipids and had LDL below 100 mg/dL were 72 patients (20 percent). For quarter eight, the number of patients found to have cardiovascular condition was 408 patients, while those screened for lipids and had LDL below 100 mg/dL were 87 patients (21 percent).

Figure 2. Total number of patients with cardiovascular conditions and those with LDL<100 mg/dL.
SIMPLE ASSOCIATIONS OF STUDY VARIABLE WITH LDL LEVEL (>100)

Simple logistic regression was implemented to investigate the unadjusted associations of study variables with bad LDL level. The first variable was percent of LDL test was significantly associated with bad LDL level (>100 mg/dL). The Odds Ratio of the percent of LDL test was 0.182, which indicated that higher LDL test rate in the assigned medical home is associated with higher rates of bad LDL level (p=0.000).

Gender was also significantly associated with the bad LDL level (Odds Ratio=1.94, p=0.02, 95% CI), indicating that female gender is 1.9 times as likely as male to have LDL above 100 mg/dL. The third variable was Race/Ethnicity, which was also significant. The odds ratio of non-white, compared to white, was 1.88, p=0.02, 95% CI showing that non-white racial group was 1.88 times as likely as whites to have a bad LDL above 100 mg/dL. Age with three dummy variables was not significantly associated with the bad LDL above 100 mg/dL. Table 6 shows the bivariate logistic regression results for the four variables used in the study as the independent variables: percent test rate, gender, race/ethnicity, and age.

Table 6. Bivariate Logistic Regression Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Test Rate (Ref: Above 50%)</td>
<td>0.18</td>
<td>0.09 - 0.38</td>
<td>0.00</td>
</tr>
<tr>
<td>Gender (Ref: Males)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.94</td>
<td>1.11 - 3.39</td>
<td>0.02</td>
</tr>
<tr>
<td>Race/Ethnicity (Ref: White)</td>
<td>1.88</td>
<td>1.09 - 3.26</td>
<td>0.02</td>
</tr>
<tr>
<td>Age (Ref: Below 50 years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-55</td>
<td>1.16</td>
<td>0.54 - 2.49</td>
<td>0.69</td>
</tr>
<tr>
<td>56-60</td>
<td>0.84</td>
<td>0.39 - 1.78</td>
<td>0.64</td>
</tr>
<tr>
<td>61-64</td>
<td>1.82</td>
<td>0.78 - 4.25</td>
<td>0.17</td>
</tr>
</tbody>
</table>
MULTIVARIATE LOGISTIC REGRESSION RESULT

In order to test the research hypothesis for the study question 2, a multiple logistic regression was implemented including four independent variables of this study: ethnicity, gender, age, and percent of LDL test. The dependent variable was LDL, which was either above or below 100 mg/dL. This multiple logistic regression model predicts the likelihood of bad LDL level (above 100 mg/dL). The number of patients included in this multiple logistic regression was 282. The model’s summary had a Nagelkerke R square of 20.2%, which meant that 20 percent of variances in LDL were predicted by the independent variables. Table 7 shows the results from multivariate logistic regression for the four independent variables analyzed for the study: percent test rate, gender, race/ethnicity, and age.

Table 7. Results from Multivariate Logistic Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Test Rate (Ref: Above 50%)</td>
<td>Below 50%</td>
<td>0.158</td>
</tr>
<tr>
<td>Gender (Ref: Males)</td>
<td>Female</td>
<td>2.548</td>
</tr>
<tr>
<td>Race/Ethnicity (Ref: White)</td>
<td>Non-white</td>
<td>1.573</td>
</tr>
<tr>
<td>Age (Ref: Below 50 years)</td>
<td>51-55</td>
<td>1.666</td>
</tr>
<tr>
<td></td>
<td>56-60</td>
<td>1.109</td>
</tr>
<tr>
<td></td>
<td>61-64</td>
<td>1.779</td>
</tr>
</tbody>
</table>

After controlling for other variables in the model, the percent of LDL test was significantly associated with the LDL above 100 mg/dL. When compared to patients assigned to those clinics with a test rate of above 50 percent, patients assigned to clinics with below 50% of LDL test rate was 84% less as likely to show LDL above 100 mg/dL (OR=0.158, p=0.000) In other words, patients with clinics that had a test rate of above 50 percent showed more likelihood for LDL above 100 mg/dL.
For the gender variable with male as the reference, the odds ratio was 2.548, which means that females showed 2.5 times more likelihood for LDL above 100 mg/dL. No significant associations were found with race or age.
CHAPTER 5

DISCUSSION AND CONCLUSION

Results of this study based on LIHP claims data and LDL data during 2012-2013 revealed that all the patients who reported cardiovascular conditions have not been screened for lipids within the four quarters analyzed. There were 1,569 patients found to have had a diagnosis of one of the defined cardiovascular conditions identified by an ICD-9 and CPT codes. The LDL database showed that there were only 394 patients screened for lipids with their last LDL reading. There were 418 patients that were assigned to a medical home during the study period, but did not have any LDL value on their charts during the four quarters analyzed. The remaining 757 patients were not assigned to any medical home, and no lipids drawn during the four quarters analyzed for the study.

For those 418 patients with no LDL values, their charts had indicated some reasons for the lack of LDL values. The majority of them had missing values, meaning either the patient was not found, was not schedule for an appointment, or did not show up if the appointment was scheduled. Other charts simply read, “ND” meaning no data available. Others had letters sent to them but have not established care despite repeated attempts to reach them.

The results showed that percent LDL test rate among providers varied significantly. This could contribute to the missed compliance target for the CVC-LDL HEDIS measure. Higher percent of LDL test rate was correlated with LDL level above 100 mg/dL. It is maybe because more people were coming to the clinics to be screened, considering that they are poor, uninsured patients with a cardiovascular condition. Since all the patients in the sample had a diagnosis of one of the defined cardiovascular conditions, it was expected that more people with higher LDL value above 100 mg/dL was going to be seen for the group if the percent rate for the medical homes was higher. In other words, what this meant was that if more patients in this program were able to take the LDL test, more people with high LDL above 100 mg/dL was likely to be seen.

There are numerous articles to support the importance of LDL testing for patients with cardiovascular conditions, indicating that LDL cholesterol level is a significant indicator
for the occurrence of cardiovascular conditions (Di Angelantonio et al., 2009). In one longitudinal study that had 304,460 individuals found that all the individuals in the study did not have any known cardiovascular conditions at baseline, but after the follow-up period, they reported hazard ratios for Coronary heart disease (CHD) of 1.38 for each 1 standard deviation increase in directly measured LDL (Di Angelantonio et al., 2009), showing an association between high LDL levels, and onset of cardiovascular conditions.

Testing for LDL is the cornerstone for cholesterol management among patients with cardiovascular conditions. According to the Framingham Heart Study, “regular LDL testing is very important because of the correlation between cholesterol and heart diseases” (Kannel et al., 1971). LDL testing should be done for physicians to determine the appropriate intervention for the patient with cardiovascular conditions. When patients are found to have higher than normal LDL (above 100 mg/dL), majority of them are put on statin medication to manage their blood cholesterol level, while others whose LDL level is below 100 mg/dL are simply recommended for a diet change. If patients are not properly monitored for blood cholesterol level, or care is interrupted by lack of follow-up, they might end up in the emergency room with more severe illnesses. This could results in higher health care cost of providing care to the indigent population. Studies have also shown that a reduction in LDL value through pharmaceutical intervention, diet change, or statin therapy have resulted in the prevention of primary, and secondary coronary heart disease (Cholesterol Treatment Trialists’ (CTT) Collaboration et al., 2010). Thus it is important for participating medical homes in the LIHP program to encourage their patients to take LDL test for appropriate decision on treatment regimen.

Periodic monitoring of LDL level among cardiovascular patients is important (Kannel et al., 1971). However, for the patients included in the sample of this study, the appropriate LDL monitoring was not evident. In this study there were 99 cardiovascular patients whose initial LDL level was above 100 mg/dL. Each of them was assigned to a medical home. Only 16 out of 99 (16%) patients who were LDL non-compliant were retested. This lower LDL retest rate indicates that providers have to do better in their outreach efforts to have their patients show up for lipid screening. They should have efficient monitoring systems to tag and follow up individual patients who consistently miss appointment or plan for other ways to reach them. Medical homes should also provide incentives such as free transportation,
health and wellness classes, and free counseling to incentivize their patients to show up for screening.

Three demographic factors were found to be determinant factors for whether a patient had LDL above 100 mg/dL. These were gender, ethnicity, and age. As expected, gender was found to be significant, showing that women were more likely going to have higher LDL. This result is partly because of the higher risk for cardiovascular conditions among women. Pre-menopausal women have lower risk for cardiovascular conditions because of their ovarian hormones that have been shown to protect them against the risk for cardiovascular conditions. But after menopause, women have been found to have higher rates of cardiovascular conditions when compared to men as is consistent with literature (White et al., 1997).

Ethnicity was also found to be significantly associated with LDL higher than 100 mg/dL that is consistent with findings from previous studies (Frierson et al., 2013). Non-whites were more likely have LDL above 100 mg/dL when compared to the white counterpart. This could mostly be attributed to the socio-economic disparities that exist among white, African-Americans, and Hispanics, and other racial groups. Economic hardships due to unemployment, unequal access to education, and good housing continued to increase the disparities in health outcomes (Frierson et al 2013).

However, age was not significantly associated with LDL above 100 mg/dL in this study. This could be because the age ranges for the study sample was 19-64 years in which incidence of a cardiovascular conditions was relatively lower than those 65 years and above. And also higher LDL values above 100 mg/dL are more common among cardiovascular patients who are above 65 years.

In conclusion, the result of this study provide implications of why low-income cardiovascular patients showed lower LDL compliance. The majority of those patients analyzed were non-compliant because they have not been either tested for lipids or their LDL was above 100 mg/dL for the period analyzed. Of the three demographic factors identified to be determinant factors for whether patients had LDL above 100 mg/dL, gender and race/ethnicity were found to significant. Age was not found to be significant because the age ranges for the sample studied was 19-64 years, who have lower incidence of cardiovascular conditions when compared to those above 65 years.
**STRENGTHS OF THE STUDY**

The LIHP program writes a quarterly report detailing utilization trends for the program, but this study was the first attempt to examine the impact of demographic factors such as gender, race/ethnicity and age on the level of LDL for LIHP population. The study attempted to find out whether all patients who reported a diagnosis of one of the defined cardiovascular conditions have been screened for lipids.

**LIMITATIONS OF THE STUDY**

This study had some limitation primarily resulting from the data used to answer the questions. The data was obtained from the Emergency Medical Services (EMS) data center, which housed the county’s data records. This study used claims data to pull the member records, and linked it with the LDL data files by “member ID”. Because of time and logistical constraints, pharmacy data was unavailable for analysis. The pharmacy data would have helped this study to get a better understanding of the type of medication given to patients with cardiovascular conditions. There is a possibility that some variability existed between providers based on the care they provided to enrollees contributing to whether a patient had higher or lower LDL. The LDL file had only the most recent measurement for each patient, and so might not have captured the entire picture.

**FURTHER STUDY AND FUTURE RECOMMENDATIONS FOR MEDI-CAL**

Further study needs to be done on the pharmacy data to find out what happened to those individuals that were non-compliant. Examination should be done to see if medications were prescribed, or they were merely asked to change their diet. This would be beneficial to know because all the LIHP patients have been transitioned to the expanded Medicaid on January 1, 2014 and the missed compliance goals for CVC-LDL in the LIHP program could be avoided if further studies are done on this population. It will also be important to follow all the individuals with high LDL using eligibility data in order find out whether they have been continuously enrolled in LIHP since July 1, 2011 when the program started.

Another potentially interesting topic to look at will be issues around continuity of care, and how the new Medicaid enrollees will affect health care usage for everyone. It will be very helpful to analyze the original LDL clinic charts for the all quarters starting when
LIHP was implemented in order to follow up individual patients, and get a clear picture on what happened to them through the end of the program and after they have been transitioned to the expanded Medicaid.
REFERENCES


