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Disparities in health care resource utilization and expenditures in prostate cancer patients in the United States

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The University of Toledo

A Thesis

Entitled

Disparities in Health Care Resource Utilization and Expenditures in Prostate Cancer Patients in the United States

by

Debabrata Ray

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Master of Science Degree in Pharmaceutical Sciences, Administrative Pharmacy Option

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An Abstract of

Disparities in Health Care Resource Utilization and Expenditures in Prostate Cancer Patients in the United States

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Introduction: Studies have shown that health care disparities continue to persist in the cancer population in the United States. Few studies have been done on disparities in health care resource utilization and expenditures for prostate cancer patients. Examining and reporting potential disparities is important in order to eliminate them.

Objectives: To examine possible demographic, socioeconomic and insurance disparities while controlling for self-reported health status and confounding factors, in health care resource utilization & expenditures among prostate cancer patients in the United States using the 2000-2008 Medical Expenditure Panel Survey (MEPS) database.

Methods: The MEPS 2000-2008 database was used with a sample of 1018 subjects who had a reported condition of prostate cancer. Logistic and negative binomial survey regression was used to examine differences in utilization. Ordinary least squares survey regression was used to examine differences in expenditures. Medical provider office visits, hospital outpatient visits, hospital inpatient stays and prescribed medicines were

separately regressed against race, ethnicity, age, urban/rural location, educational level, poverty status and insurance type, along with controlling for self-reported health status.

Results: Black prostate cancer patients had a statistically significantly lower likelihood of having office-based medical provider visits compared to white patients ($p = 0.0014$), while Hispanic prostate cancer patients had a statistically significantly lower likelihood of having hospital outpatient visits compared to non-Hispanic patients ($p = 0.0087$). Statistically significant differences in expenditures were also found, where urban prostate cancer patients had statistically significantly higher hospital outpatient visit expenditures compared to rural patients ($p < 0.0001$).

Conclusion: Significant disparities continue to persist in the prostate cancer population, even when controlling for confounding factors. Future studies examining reasons as to why there are disparities are needed.

I dedicate this thesis to my father and my late maternal uncle.

Acknowledgements

It may be a cliché thing to say, but this thesis would have been improbable – no, impossible, without the love, encouragement, and support from my father, mother, paternal uncle, and sister. Without them, there was no possible way I could have pursued a graduate education. For this, I am forever thankful to them.

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Chapter 1

Introduction

Prostate cancer is one of the top causes of death for men in the United States. This chapter gives background information about the prostate and prostate cancer, health disparities in cancer, and information on health care resource utilization and expenditures. In addition, this chapter will discuss the need for the study and the significance of the study.

1.1 Prostate Cancer Statistics

Prostate cancer is the second most common cancer behind skin cancer in men and the second leading cause of cancer deaths behind lung cancer in the United States. For 2009, the American Cancer Society estimated that 192,280 new cases of prostate cancer would be diagnosed and 27,360 men would die from the disease.[1] In 2005 (the most recent year for compiled national statistics), the Centers for Disease Control (CDC) reports that there were 185,895 new cases of prostate cancer, and that 28,905 men died from the disease.[2] The average cost of treatment per patient in the United States for

prostate cancer is $13,091 per year,[3] and five-and-a-half year costs of treatment can range from $32,135 to $69,244, with an average of $42,570.[4]

1.2 Healthy People 2010

According to Healthy People 2010 (HP2010), prostate cancer, along with breast cancer and lung cancer, account for nearly one-third of the $107 billion annual costs and $37 billion direct medical costs associated with cancer in the United States.[5] Cancer costs have been identified as a significant financial burden by HP2010. In addition, HP2010 establishes a goal to "reduce the number of new cancer cases as well as the illness, disability, and death caused by cancer."[5] HP2010 also recognizes that health disparities, including those within resource utilization, in the cancer population need to be studied in order to be able to reduce the cancer burden in the United States financially and medically.[5] Health disparities among various demographic and other socioeconomic groups is a known problem in our society, and are also known to exist in the prostate cancer population, even as those patients are enjoying longer lives after diagnosis than in the past.

1.3 Background

1.3.1 Overview of the Prostate

The prostate is a gland found only in men. It is a small, walnut-sized gland that is located below the urinary bladder and just in front of the rectum.[6] The role of the prostate is to create and secrete a fluid that helps to support and sustain sperm cells when they are in semen.[6] Typically, the prostate keeps growing from before birth until adulthood. Androgens, typically testosterone, are responsible for the growth and development of the prostate. A specific enzyme, 5-α-reductase, is responsible for the conversion of testosterone into dihydrotestosterone, also known as DHT.[6] This hormone is a major hormone in the growth of the prostate; and in older men, extra growth of the prostate that is not cancerous is known as benign prostate hyperplasia, or BPH.[6] BPH is not cancer; however men that do experience common symptoms of BPH (trouble urinating, difficulty emptying the bladder) should see a medical professional to determine if it is BPH or possibly cancer.

1.3.2 Etiology of Prostate Cancer

Most prostate cancers are developed from gland cells in the prostate; all other cells that could cause prostate cancer, such as transitional cell and small cell cancers, are extremely rare.[6] What is known about most prostate cancers is that it tends to be a slow-

developing cancer. In fact, due to the tendency of it being slow moving, this lends to high survival rates and longer time alive after diagnosis.

Prostate cancer patients' five, ten and fifteen year survival rates are nearly 100%, 91%, and 76%, respectively.[1] Recently, better methods for treatment and detection of prostate cancer have been developed. This means that most prostate cancers can be found earlier and thus treated more effectively, and patients are living longer lives post-diagnosis now than ever before.[1] Since they are living longer, patients may have a greater chance, and therefore opportunity, to use health care resources.[7] However, disparities are still quite prevalent in the cancer population in the United States.

1.3.3 Prostate Cancer Treatments and Therapy

There are typically six different types of treatment available for prostate cancer therapy: radical prostatectomy, cryotherapy, brachytherapy, external beam radiation, androgen deprivation therapy (ADT, also known as hormone therapy), and watchful waiting.[4] Radical prostatectomy is surgical removal of the prostate and some surrounding tissue.[8] Cryotherapy destroys cells locally using an instrument through rapid freezing and thawing.[8] Brachytherapy uses radioactive implants to destroy cells locally over time.[8] External beam radiation uses radiation from an external source to kill cells.[8] Androgen deprivation therapy uses injectable or orally administrated medications to reduce or block the amount of available androgens in the body.[8] Watchful waiting is the use of regular monitoring, such as with a prostate-specific antigen (PSA) test or a digital rectal examination (DRE).[8]

1.4 The Definition of Health Disparities

According to Carter-Pokras and Baquet, health disparities should be viewed as potentially sequential events that can be seen as a difference in: environment, access to, utilization of, and/or the quality of care, health status, and a health outcome "that deserves scrutiny."[9] A health disparity is defined by HP2010 as "differences that occur by gender, race or ethnicity, education or income, disability, living in rural localities or sexual orientation."[10] Health disparities in the United States can also include disparities associated with the type of health insurance.[11]

1.5 Disparities in the Cancer Population

There are noted disparities in cancer patients in the United States, ranging from cancer screening, incidence rates, mortality rates, access to care (including health care resource utilization) and expenditures.[10-17] For example, African Americans are 34 percent more likely than whites to die from cancer.[5] Gross et al. found that there had been little improvement in racial disparities in general cancer treatment and therapies from 1992 to 2002. The study from Gross et al. noted that in the prostate cancer population, there had been no narrowing in racial disparities in therapy for prostate cancer.[18]

Age, race, ethnicity, educational level, income, region (urban/rural) and insurance types have all been found to be significant factors that exhibit disparities in the cancer population in the United States.[11, 12, 17-22] For example, with prostate cancer screening via prostate-specific antigen (also known as PSA, a common marker used to test for the

presence of prostate cancer) testing, there is more testing done in the 70-75 age range, even though this may be far less beneficial than testing from 50-65 years old, and mammography screening significantly declines after the age of 59.[21]

1.6 Health Care Resources & Expenditures

Many health care resources are involved in the treatment of cancer, from in-office medical provider visits, to hospital stays, and to medication use. However, unequal access to health care resources by sociodemographic categories exist in general, and this results in health inequities.[9] In the 2006 World Health Report, the World Health Organization reported that inefficient applications of health care resources could lead to increases in health care costs and expenditures.[23, 24] The National Healthcare Disparities Report (NHDR) from the Agency for Healthcare Research and Quality (AHRQ) states that health care resource utilization can be used as a measure of access to care.[25] It is important to study disparities in health care resources, as Andrulis noted that health care utilization measure is an important gauge for health care access. Andrulis' review noted that there is a positive relationship between access to care and health care resource utilization.[26] Mullins et al. found that even within a controlled socioeconomic population (such as the Medicaid population of the state of Maryland), there exist disparities in health care expenditures.[14] HP2010 noted that it is important to reduce health inequities, as it may also help mollify the nation's cancer burden financially and at the cost of human life. To date, no major study has looked at disparities associated with sociodemographics and insurance coverage on health care resource utilization and

expenditures in the general prostate cancer population while controlling for self-reported health status in the United States, using the MEPS database.

1.7 Medical Expenditure Panel Survey

The Medical Expenditure Panel Survey, commonly known as "MEPS," is a survey database from the AHRQ, a part of the United States Department of Health and Human Services. MEPS began in 1996, and is a set of surveys from families, individuals, medical providers, and employers in the United States.[27] MEPS collects data on: specific health services which Americans use; how frequently the services are used; cost of those services; how the services are paid for; and the cost, scope, and extensiveness of health insurance.[27]

1.8 Need for Study

Most prostate cancer disparity studies have focused primarily on cancer screening, choice of treatment, and mortality rates; few studies have looked at health care resource utilization and expenditures in the general prostate cancer population in the United States. It is important to examine potential disparities in resource utilization and expenditures, as reducing or even eliminating disparities in health care can help improve the burden of cancer, both financially and at the cost of life, in the United States. This study uses the most recent data available, and the results of this study may be able to gauge whether there have been notable changes in disparities. This is important in regard

to the goal that HP2010 set for the United States. In addition, the results of this study may lead to future considerations in policy, such as the Healthy People plan from the United States Department of Health and Human Services, and can possibly affect the decisions patients and medical providers make towards patient care.

1.9 Statement of Purpose & Significance of the Study

The purpose of this study is to explore differences in demographic, socioeconomic and insurance characteristics in health care resource utilization and health care expenditures within the prostate cancer population in the United State. The significance of the study is that it will examine disparities in the general prostate cancer population in the United States using recently available data and control for the patient's self-reported health status. Data is gathered using recent data from the Medical Expenditure Panel Survey (MEPS) database. With the national goal of reducing and eliminating health disparities that HP2010 set for the year 2010, this study examines disparities in health care resource utilization and expenditures in prostate cancer patients using the latest data. Policymakers need to learn about disparities from the most recent data in order to develop better targeted programs in order to reach the goals set forth by HP2010.[28] The results of this study should develop questions that can lead to further research and health policy implications, especially the Healthy People program.

1.10 Goal

To examine, analyze and report possible demographic, socioeconomic and insurance disparities involved in health care resource utilization and expenditures in the prostate cancer population in the United States using the MEPS database.

1.11 Objectives

1.) To examine possible demographic, socioeconomic and insurance disparities while controlling for self-reported health status and confounding factors, in health care resource utilization among prostate cancer patients in the United States using the 2000-2008 MEPS database.

2.) To examine possible demographic, socioeconomic and insurance disparities while controlling for self-reported health status and confounding factors, in health care expenditures among prostate cancer patients in the United States using the 2000-2008 MEPS database.

1.12 Primary Objective

To determine disparities in medical provider visit utilization in prostate cancer patients as determined by race (black & white) in the United States using the 2000-2008 MEPS database.

1.13 Research Questions

1.) Is there any difference in the prostate cancer population in the utilization of health care resources among/between various factors while controlling for self-reported health status & confounding factors?**

2.) Is there any difference in the prostate cancer population in health care expenditures among/between various factors while controlling for self-reported health status & confounding factors?**

**Various factors & confounding factors include: age groups, race, ethnic group, education level, income (poverty level), urban/rural populations, and insurance type

1.14 Research Hypotheses

1.) H_0: There is no difference in the prostate cancer population in the utilization of health care resources among/between various factors while controlling for self-reported health status & confounding factors.**

H_A: There is a statistically significant difference in the prostate cancer population in the utilization of health care resources among/between various factors while controlling for self-reported health status & confounding factors.**

2.) H_0: There is no difference in the prostate cancer population in expenditures among/between various factors while controlling for self-reported health status & confounding factors.**

H_A: There is a statistically significant difference in the prostate cancer population in expenditures among/between various factors while controlling for self-reported health status & confounding factors.**

**Various factors & confounding factors include: age groups, race, ethnic group, education level, income (poverty level), urban/rural populations, and insurance type

Chapter 2

Literature Review

This chapter summarizes the current literature on health disparities, including disparities related to prostate cancer, such as cancer screening, incidence rates, mortality rates, resource utilization, and expenditures. In addition, it also examines the variables in the study and justifies their use in this study based on evidence from the literature.

2.1 Disparities in Prostate Cancer Screening

Typically, men should be tested yearly with PSA test or a DRE every year after the age of 50, or every year after the age of 40 if in a high-risk group (i.e. first-degree relative diagnosed with prostate cancer before the age of 65).[29] Even though screening can help with treating an earlier stage of cancer and improving survival, African American males are less likely to be screened than white males.[30, 31] Reynolds and Anai et al. suggest there could be many reasons as to why this could happen, including: lack of access to health care, socioeconomic status, inadequate knowledge, fear, patient-provider communication, distrust of the medical profession, and aversion to DRE.[30, 31] In addition, even though the frequency of prostate cancer screening via PSA tests tends to increase

with age, it may be more beneficial for patients aged 50-65 to receive more screening than older patients.[21] Also, there are significant screening disparities when taking insurance factors into account. Among insurance types, 37.1% of privately insured, 20.8% of Medicaid-insured, and 14% uninsured men received a PSA test during the previous year.[11]

2.2 Disparities in Prostate Cancer Incidence and Mortality

The incidence of prostate cancer in African American men is much higher than in the rest of the population: 239.8 per 100,000 African American men versus 159.3 per 100,000 men of all races (including African American men).[32] Furthermore, this incidence rate tends to be consistently higher for African Americans than for whites, even when taking age into consideration. In 2002, white males have an age-adjusted prostate cancer incidence rate of 171.9 per 100,000 while black males had a rate of 275.8 per 100,000.[33] In addition to racial disparities in incidence rates, Albano et al. noted that there are significant disparities in prostate cancer mortality when it came to education levels and race; black men with more than 12 years of education had a death rate of 4.8 per 100,000 men, while black men with 12 or less years of education had a death rate of 10.5 per 100,000 men.[19]

2.3 Disparities in Prostate Cancer Therapy

Gross et al. noted that there had been no significant improvement in racial disparities in definitive cancer therapy; black prostate cancer patients were less likely to receive definitive therapy (brachytherapy, external radiation, and prostatectomy) than white patients from the years 1992 to 2002.[18] Underwood et al. found that black and Hispanic men were also less likely to receive definitive therapy for prostate cancer than white men ($p < 0.001$).[34] Zeliadt et al. reported that African-American (black) men were 26% less likely to receive more aggressive prostate cancer therapy than white men; and that 42.4% of black men were able to get androgen deprivation therapy (ADT) compared to 53.7% of white men ($p < 0.001$).[35]

2.4 Disparities in Prostate Cancer Health Care Utilization and Expenditures

Vast health care resources tend to be required in the treatment of prostate cancer. If certain groups of people significantly differ in utilizing resources towards their care, this could mean that there is unequal access to that care. Unequal utilization of resources and disparities in expenditures are of concern to society, policy makers, patients, physicians and other health care providers.

Past studies have examined demographic disparities for treatment decisions, such as surgery versus radiation in prostate cancer.[36] Many studies have found disparities in prostate cancer screening.[16, 21, 29-31] A study in Sweden with Swedish prostate cancer patients measured only some demographic disparities in receipt of just one health care

resource utilization variable (hospital care);[37] however due to the relatively homogenous population in Sweden compared to the United States, especially in terms of race/ethnicity and health insurance, this study is not very applicable to the US population.

Gross et al. noted that black patients, prior to their cancer diagnosis, were significantly more likely to have had no visits to a physician before their cancer diagnosis than white patients ($p < 0.001$);[18] however, this is not a utilization measure of physician visits for actual prostate cancer patients, as the present study is attempting. Gross et al. used logistic regression models to account for differences in likelihood, but did not take into account total counts or expenditures. The researchers also used four models: one controlled for age, sex, martial status, geographic region, and urban status; a second model included cancer grade and stage; a third model included the Charlson comorbidity index; and a fourth model included socioeconomic status.[18]

A study by Mullins et al. showed that expenditure disparities do exist in the prostate cancer population; however this study was limited in the use of a homogenous socioeconomic group (Maryland Medicaid patients).[14] Mullins et al. performed a retrospective cohort, cross-sectional study design analysis of Maryland Medicaid administrative claims data; the data were from a two year period from January 1, 1999 to December 31, 2000. Expenditures were calculated from physician visits, prescription medicines, and outpatient (ambulatory) visits. However, a major drawback of the study was that expenditures from prostate cancer utilization and non-prostate cancer utilization were not separated. All expenditures, including those not related to prostate cancer, were included in the analysis. The researchers found statistically significant ($p = 0.0221$)

differences in the means of annual prostate cancer expenditures among rural ($832.61), urban ($980.98), and suburban ($1,448.59) Maryland Medicaid patients.[14]

Several studies have shown that health care resource utilization and expenditure disparities do exist in various demographic, socioeconomic, and insurance type groups in the US for many disease states; however, there are few studies with regard to prostate cancer.[14, 15, 18, 33, 37]

Another study examined demographics and insurance coverage disparities in health care utilization with prostate cancer patients, but their inclusion criteria limited the study only to patients who have had radical prostatectomy;[15] thus this study is not a general sampling of prostate cancer patients, as not all patients, particularly elderly patients, undergo that procedure.[38] A study by Penson and Chan using data from 1992 to 2000 on Medicare beneficiaries found that black males with a primary diagnosis of prostate cancer utilized hospital inpatient stays at a greater rate than white males. Black males utilized hospital inpatient stays at a rate of 674 per 100,000 black patients where white patients had a rate of 591 per 100,000 white patients.[33] However, this can not be generalized to the general population as it was only Medicare patients; in addition this study did not take into account factors such as health status. Penson and Chan used data from the Urologic Diseases in America Project, a collection of both private and public health care data. However for the purposes of their study, the researchers used Medicare data from the project, specifically data from the Medicare Provider Analysis and Review Files.[33]

2.5 Health Status

MEPS does not have a variable where cancer stage is recorded. Essentially, using self-reported health status may give a level of control for cancer severity and illness burden in the patient. Researchers have used self-reported health status as a method to control for burden of illness in cancer screening and other health conditions.[39, 40] Mohan et al. reported that self-rated health using a scale of "excellent", "very good", "good", "fair" or "poor" is an adequate scale to determine health-adjusted life expectancy among patients with newly diagnosed localized prostate cancer; there is a positive correlation between health-adjusted life-expectancy and self-rated health status for prostate cancer patients.[41] This means that those patients at age 70 who self-report “excellent” health status had a higher health-adjusted life expectancy (18.9) than those that self-report "very good" (16.1), "good" (13.4), "fair" (11.7) or “poor” (9.5) health status; this follows a similar trend for older patients as well.[41] In addition, for elderly prostate cancer patients, their survival likelihood is related to both cancer severity and health status.[42]

2.6 Health Care Utilization & Expenditure Categories

2.6.1 Medical Provider Visits

Medical provider visits are also known as office-based provider visits. Age, race, ethnicity, educational level, income, urban vs. rural location, and insurance type all play a role in the utilization of medical providers.[8, 11, 14, 15, 17, 18] Medical providers, particularly

physicians, play an important role in the receipt of cancer services, early cancer detection, and treatment recommendations.[43, 44] Sadetsky et al. reported that race ($p < 0.001$) and education ($p < 0.001$) were significant predictors of medical provider utilization among prostate cancer patients that have had a radical prostatectomy; however, the study did not report utilization numbers with respect to races and education levels, only p-values.[15] With respect to prostate cancer screening, blacks exhibited far less trust with physicians than whites, thus contributing to a lower likelihood of having a relationship with the medical provider. This can contribute to greater problems with the disease among black patients.[45] Insurance also seems to be a factor for cancer screening by physicians, and for cancer survival. Medicaid patients were 1.6 times more likely to die within 5 years than those who had private insurance.[11]

2.6.2 Hospital Events

These are divided into inpatient stays and outpatient visits. Prostate cancer patients, since they tend to have high survival rates where the patient lives longer, have a greater chance of utilizing general health care resources.[7] This could mean that they have a greater potential of using medical provider visits and hospital events. Penson and Chan found that in the United States from 1992 to 2001, the inpatient hospitalization rate was greater for black prostate cancer patients than white prostate cancer patients in all time points observed; black males utilized hospital inpatient stays at a rate of 674 per 100,000 black patients whereas white patients had a rate of 591 per 100,000 white patients.[33] Penson and Chan suggest that this could be due to the higher incidence rate of prostate

cancer in blacks than for whites; however, since prostate cancer is a slow-growing cancer, oftentimes the patient is seen at the physician's office, not treated exclusively through a hospital inpatient setting.[33]

2.6.3 Prescribed Medicines

There are known disparities in the cancer population concerning prescription drug use. Black and Hispanic cancer patients tend to receive less-than-optimal pain management and unsatisfactory doses of pain medication.[46, 47] Weinick et al. noted that Hispanics are less likely to obtain prescription medicines (49.91% of Hispanics) in general compared to non-Hispanic whites (66.58% of non-Hispanic whites). In addition, studies suggest that there are insurance-based and racial/ethnic-based disparities in access and use of prescription drugs.[48-52] Gaskin et al. found that among Medicare beneficiaries, whites used 2.3 times more prescription drugs than blacks.[52] Disparities in non-hospital expenditures among Medicaid cancer patients, including prescription expenditures, have been observed.[14] MEPS has been found to be a good database for studying racial and ethnic disparities regarding prescription drugs, and affords greater statistical power to examine Hispanics, Blacks, and Asians.[53]

2.7 Expenditures and Costs of Treatment

The treatment of cancer is very expensive, even with insurance. Because of the high incidence rate and mortality rate of prostate cancer, in addition to treatment costs, a

general lack of consensus of treatment types, make for high costs associated with prostate cancer.[54] Penson and Chan showed that the older prostate patients are, up to the age of 65, the lower their expenditures. In 2002, men with prostate cancer aged 50-54 years had estimated health care expenditures from medical examinations and prescription drugs that totaled $9,905 per patient, whereas those aged 60-64 had $8,040.[33] Mullins et al. had found that there are statistically significant variations in non-hospital-based expenditures in Maryland Medicaid prostate cancer patients among urban/suburban/rural regions.[14] Mullins used expenditure figures from Maryland Medicaid pharmacy claims data, including the use of prescription drugs. The study showed that even within a homogenous socioeconomic group such as Maryland Medicaid recipients, expenditure disparities do exist. However, this study was not a national study, and also failed to control for health status of the patients. Health status is important to control for, as a cancer patient with a worse health status is potentially more liable to utilize care, and thus may potentially have greater expenditures.

Examining sociodemographic differences in health care resource utilization and expenditures will give insight into the care certain populations may or may not be receiving and form the basis for future studies of health care disparities, and potentially influence programs and health policy, such as HP2010. HP2010 set goals with reducing or even eliminating health disparities in the cancer population by the year 2010, which may help reduce the burden of cancer in the United States. With the United States focused on health care reform, it is important to examine the demographic and socioeconomic inequities in health care.

2.8 Factors Associated With Disparities

Factors such as age, race, ethnic group, educational level, urban or rural location, income level (particularly poverty level), and insurance type are all factors that are associated with disparities. In addition, these factors are potentially confounding factors that need to be controlled for in an analysis.

2.8.1 Age

Men are typically screened for prostate cancer starting at the age of 50, although high risk patients may start at an earlier age, such as 40 years old.[29] The majority of diagnoses of prostate cancer occur in men between 55 and 84 years of age, with an average age of 68, in the United States. The age-adjusted incidence rate is 159.3 per 100,000 men per year; these figures are from 2002-2006.[32] It is important to note that since prostate cancer patients tend to have longer survival times after diagnosis, there is greater use of continuing care (i.e. general health care resource utilization) versus terminal phase care.[7] It is known that there are age disparities in general cancer care utilization, particularly in cancer screening.[21, 22] Jerant et al. found that prostate cancer screening using PSA increased in age steadily from the ages of 50 years to 79 years; the researchers found that the adjusted predicted marginal cancer-screening percentages (by age group) were 52.4% (50-54 years), 65.5% (55-59 years), 70.4% (60-64 years), 76.0% (65-69 years), 77.7% (70-74 years), and 79.3% (75-79 years).[21] Jerant et al. suggests that this disparity could be due to ageist health care provider perceptions and practices, such

as prostate cancer being an "older man's disease" and not informing older patients of the merits or drawbacks associated with increased PSA testing.[21]

Treatment for prostate cancer tends to vary with age, and this can affect resource utilization and expenditures.[8] Penson and Chan found that from 1992-2000 data, average expenditures tended to decrease with age up to age 65 in prostate cancer patients.[33] However, the variables of the expenditure study were not controlled for confounding factors such as race, ethnicity and socioeconomic factors such as education level, nor did the study take health status into account.

2.8.2 Race & Ethnicity

The National Healthcare Disparities Report (NHDR), published by the AHRQ, lists "Racial and Ethnic Minorities" as a priority population for study.[55] According to the Surveillance Epidemiology and End Results (SEER) study of the National Cancer Institute (NCI), there are discrepancies by race in the incidence of prostate cancer. While the incidence for all races is at 159.3 per 100,000 men per year, black men have a rate of incidence of 239.8 per 100,000 men while Native Americans have a rate of incidence of 76.1 per 100,000 men.[32] The following table shows the incidence rates in the United States population.

Table 2.1

Incidence Rates of Prostate Cancer Among Males Aged 18 and Older in the United States by Race[32]

Race or Ethnicity	Male
All Races	159.3 per 100,000 men
White	153.0 per 100,000 men
Black	239.8 per 100,000 men
Asian/Pacific Islander	91.1 per 100,000 men
American Indian/Alaska Native	76.1 per 100,000 men
Hispanic	133.4 per 100,000 men

Disparities between races exist in a broad spectrum across cancer health care resources, ranging from disparities in physician treatments, to cancer screening, to prescriptions given for treatment.[11, 17, 22] Gross et al. noted that there had been no significant improvement in racial disparities in definitive cancer therapy from the years 1992 to 2002.[18] Underwood et al. found that black and Hispanic men ($p < 0.001$) were also less likely to receive definitive therapy for prostate cancer than white men.[34] In addition, it has been observed that minorities, particularly African Americans, suffer disproportionately from higher mortality rates from cancer.[17] The following table shows mortality rates among American prostate cancer patients by race.

Table 2.2

Mortality Rates of Prostate Cancer Among Males Aged 18 and Older in the United States by Race[32]

Race or Ethnicity	Male
All Races	25.6 per 100,000 men
White	23.6 per 100,000 men
Black	56.3 per 100,000 men
Asian/Pacific Islander	10.6 per 100,000 men
American Indian/Alaska Native	20.0 per 100,000 men
Hispanic	19.6 per 100,000 men

Mullins et al. had found that even among a socioeconomically homogenous population as in Maryland Medicaid, there are significant disparities in non-hospital expenditures between black and white cancer patients.[14] This shows that disparities can exist in a socio-economically homogeneous population. Weinick et al., using the MEPS database from 1997, reported that Hispanics are less likely than non-Hispanic whites to have any ambulatory hospital visits, and that Hispanics are less likely than non-Hispanic whites to have used any prescription medications.[56] These findings were significant at a 0.001 alpha level.

2.8.3 Educational Level

Educational level is typically classified as a socioeconomic variable. This often means that there is the assumption that the more education a person has, the higher income he/she will have. Regardless of the correlation of income earned with a higher education, studies show that there are disparities in health care resource utilization among people with different levels of education. It has been observed that there is a general

positive correlation between years of education and the chance of having cancer screening.[11] In addition, a person's insurance status is also associated with their educational level.[17] A drastic disparity in education was reported by Albano et al., where black men with less than 12 years of education had a prostate cancer death rate that was more than double that of black men that had more schooling.[19]

2.8.4 Income

Income tends to have some relationship to educational status; however that is not always the case. Income level can be a factor in cancer care utilization.[7, 11] However, the fact is that in the United States, many poorer patients are on Medicaid or simply do not have any insurance. Among those low income patients, there are disparities as well, particularly among race and type of insurance.[11] Ward et al. reported that Americans under the Federal poverty line had health care burdens that exceeded 20% of family income.[11] Short and Mallonee reported that patients with a higher income were more likely to survive cancer, and have a higher quality of life, than those with lower incomes.[20] It is also known that health care utilization is affected by out-of-pocket (OOP) expenses;[57] the greater the income, the more money there is to pay those OOP expenses.

2.8.5 Urban or Rural Location

Those living in rural areas tend to have lower access to health care resources, and thus less access to care in general.[11, 17, 22] Penson and Chan found that from 1992-2000,

the rate of physician office visits for prostate cancer was greater in urban areas than in rural areas; people in urban areas were almost twice as likely to use physician office visits than people in rural areas.[33] However, this study did not examine whether patients had non-physician based visits, nor did it account for health status of these patients. Rural areas tend to have fewer physicians per capita, and thus there is a smaller chance to utilize that health care resource. However, it may be possible that patients use other health care resources, such as nurse practitioners and physician assistants. For example, nurse practitioners are utilized more in rural areas for prescriptions than physicians.[58] Mullins et al. noted that there are significant disparities in health care expenditures among Maryland Medicaid cancer patients depending on their rural, suburban or urban location.[14] As stated before, Mullins et al. reported statistically significant ($p = 0.0221$) differences in the means of annual prostate cancer expenditures among rural ($832.61), urban ($980.98), and suburban ($1,448.59) Maryland Medicaid patients. Using MEPS, it is possible to examine differences in medical provider visit utilization among different factors. The MEPS database has a variable which distinguishes between a Metropolitan Statistical Area (MSA) and a non-MSA. MSA is defined as "counties with a large urban center(s) along with other counties that are considered to have a high degree of geographic, economic, and/or social integration with the core urban center(s)."[59]

2.8.6 Insurance Type

This is one factor among industrialized nations where it is somewhat unique to the United States. With the variety of patients being privately insured, publicly insured, both

privately and publicly insured, and uninsured, it creates a dynamic environment. Health care utilization studies done in nations with a single-payer system, such as Sweden,[37] lack the ability to assess differences in patients that do not have the same health insurance system as in the United States. In the United States, it is evident that there are discrepancies and disparities in access to care which can cause differences in health care resource utilization and health care expenditures among patients with different insurance situations.[11, 26] These discrepancies are known to exist within the cancer population as well.[11, 60] Thorpe and Howard reported that uninsured cancer patients paid 57% more than cancer patients with private insurance for their cancer care.[61] Interestingly, it also has been found that even within a Medicaid population, there are significant disparities in non-hospital expenditures (including prescription drugs), between blacks and whites, and those living in rural, urban, or suburban areas.[14]

2.9 Literature Review Keywords and Search Terms

Electronic searches of Google Scholar, PubMed, JSTOR and EBSCOhost were conducted from August 2009 to November 2011. Keywords and search terms included: prostate cancer, health disparities, prostate cancer screening, resource utilization, expenditures, physician office visits, medical provider visits, outpatient visits, inpatient visits, prescriptions, race, racial, black, white, Hispanic, ethnic, ethnicity, education, income, poverty urban, rural, health status, and insurance. Only English language articles were used. Relevant websites from the AHRQ, American Cancer Society (ACS), the

NCI, the CDC, HealthyPeople.gov, SEER, and the United States Department of Health and Human Services were also reviewed for information.

2.10 Conclusion from Literature Review

The existing literature points to the possibility that disparities in utilization and expenditures may exist in the prostate cancer population in the United States. This is important to examine, as policy programs such as HP2010 set overarching goals to reduce or even eliminate health disparities in the cancer population in the United States by 2010. Eliminating disparities may reduce the United States' cancer burden, both financially and humanitarianly. The results of the study can be used to see if there still are significant disparities in resource utilization and expenditures using the most recent data.

Chapter 3

Methodology

3.1 Data Source

The MEPS 2000-2008 database was used to procure the data, namely the full-year consolidated data files and the medical conditions files, as well as the prescribed medicines files, the hospital inpatient stays files, the office-based medical provider visits files and the outpatient department visits files from each year in the study. Prostate cancer patients are identified using the ICD-9 code of 245.2 for prostate cancer; and the CCCODEX value of 029 (029 is for "cancer of prostate") particularly when the ICD-9 code is given as V10, which stands for "personal history of malignant neoplasm." Combining an ICD-9 code of V10 and a CCCODEX code of 029 identifies a prostate cancer patient, as well as an ICD-9 code of 245.2.

Data from the years 2000-2008 were cleaned and variable names were renamed (e.g. PERWT07F changed to PERWTF) to be able to merge with other yearly files. The prescribed medicines file, the hospital inpatient stays file, the office-based medical provider visits file and the outpatient department visits file are linked directly to prostate cancer from the medical conditions file per subject per year. This results in all four

dependent variables being associated directly with prostate cancer treatment. Prostate cancer patient data were then examined and analyzed with respect to demographic and insurance variables as well as their effect on health care resource utilization and health care expenditures using the appropriate survey regression models. Survey model person weight variables were obtained from the yearly files. Strata and primary sampling unit variables, in order to account for complex survey models, were obtained from the MEPS pooled estimation linkage file, and merged into the combined 2000-2008 file. Since the expenditure data is pooled from eight separate years, expenditure and income dollar values were adjusted for inflation to the most recent year for data (2008). The consumer price index (CPI) is used to calculate inflation adjustments for expenditures and income. CPI data is available through the United States Bureau of Labor Statistics (BLS).

3.2 Study Subjects

From the MEPS 2000-2008 database, using the Medical Conditions documentation files from each year, there are a total of 1018 patients listed with cancer of the prostate. In order to determine a suitable *a priori* sample size, a sample size calculation is performed. The primary objective of the study is to determine disparities in medical provider visit utilization in prostate cancer patients as determined by race (black & white). By a representative sample in the United States, blacks and whites represent the two largest populations by race. Gross et al. 2008 notes disparities in utilization (receipt of definitive therapy) in the prostate cancer population in the USA by race.[18]

3.3 *A priori* Sample Size Calculation

In order to calculate the *a priori* sample size using our primary objective, an α of 0.05 and a statistical power of 80% was used. The equation used to calculate sample size is as follows:

$$N > \frac{(Z_{(1-\alpha)} + Z_{(1-\beta)})^2 * \sigma^2}{(\mu_+ - \mu_0)^2}$$

Where:

- N is the sample size
- $Z_{(1-\alpha)}$ is the z-score corresponding to the critical value ($\alpha = 0.05$, $Z_{(1-\alpha)} = 1.96$)
- $Z_{(1-\beta)}$ is the z-score corresponding to power ($Z_{0.8} = 0.842$)
- σ is the variability [$\sigma^2 = \mu_+(1- \mu_+) + \mu_0 (1- \mu_0)$]
- μ_+ is the null value
- μ_0 is the smallest important difference

According to Gross et al., the difference in receiving therapy (utilization) between blacks and whites was significant. Crude figures are unadjusted for the explanatory variable effects used in that study (age, gender, marital status, physician visits, geographic region, cancer-stage and grade, and comorbid conditions). Using the sample from Gross et al. 2008 in the following table, adjusted figures with the most relevant years (2000 – 2002) to this study are used to calculate the sample size:

Table 3.1

Gross et al. Adjusted Receipt of Therapy for Prostate Cancer Patients from 2000-2002

	White	Black	Difference
Adjusted Receipt of Therapy	77.9%	69.3%	8.6%

$\sigma^2 = \mu_+(1- \mu_+) + \mu_0 (1- \mu_0) = (0.7790*(1-0.7790)) + (0.6930*(1-0.6930)) = 0.38491$

$$N = \frac{(1.96 + 0.842)^2 * (0.38491)^2}{(0.086)^2} = 157.2742953 = \textbf{158 sample size for each group}$$

Therefore, in order to provide an adequate sample size as supported by the literature for the primary objective of determining disparities in medical provider visit utilization between whites and blacks in the United States with adequate statistical power, the sample size is 158 for each group (whites & blacks) based on a crude amount. The sample size available for prostate cancer in MEPS 2000-2008 is 806 and 179 for whites and blacks, respectively. This allows for a tenuous measure that a statistical power of 80% is available for both groups.

3.4 Inclusion Criteria

Since the inclusion criteria for the study are prostate cancer patients in the MEPS database from the years 2000-2008, males age 18 and over in the respective year for the data with a diagnosis of prostate cancer (ICD-9 code 245.2 or ICD-9 code V10 & CCCODEX 029) are included the study. Any patient not meeting the inclusion criteria is excluded.

3.5 Independent and Dependent Variables

The independent variables in this study are race, ethnicity, age, urban/rural location, educational level, income (poverty level), and insurance variables that were discussed in-depth in the literature review. Each variable is held fixed with the other demographic and socioeconomic factors, as well as health status. The independent variables include:

1) Age (demographic, categorical)
    a. Age 18-49
    b. Age 50-64
    c. Age 65 and older
2) Race (demographic, categorical)
    a. White
    b. Black
    c. Other Race
3) Ethnicity (demographic, categorical)
    a. Hispanic
    b. Non-Hispanic
4) Urban/rural location (demographic, categorical)
    a. Urban and MSA are interchangeable in this study
    b. Rural and Non-MSA are interchangeable in this study

5) Educational level (socioeconomic, categorical)
    a. Less than High School (H.S.) graduate. This means that the subject did not complete H.S.
    b. H.S. graduate. This means that the subject is a H.S. graduate
6) Income (socioeconomic, categorical)
    a. Binary variable for whether the subject is either at or below the poverty line, or above the poverty line
7) Insurance variables (socioeconomic, categorical)
    a. Any private insurance (either a combination of private & public insurance, or just private insurance)
    b. Public insurance only (e.g. Medicare, Medicaid)
    c. Uninsured

Health status is included in the regression model as a confounding factor by using a self-reported health status variable from the MEPS database. Self-reported health status is a categorical variable recorded as "excellent," "very good," "good," "fair," or "poor" health.

The dependent variables are the health care utilization and expenditure variables. Justification for these variables was also given in the literature review. These variables include:

1) Office-based medical provider visits
    a. Physician, Nurse Practitioner, and Physician Assistant visits (utilization: count; expenditure: continuous)
2) Hospital inpatient stays (utilization: count; expenditure: continuous)

3) Outpatient visits (utilization: count; expenditure: continuous)

4) Prescribed medicines (utilization: count; expenditure: continuous)

In order to further evaluate the receipt of health care resource utilization, a binary utilization dependent variable is also regressed against the explanatory variables using survey logistic regression. This means that for office-based medical provider visits, hospital inpatient stays, hospital outpatient visits, and prescribed medicines, a binary variable that determines whether the patient received at least one of those resources in the year of the MEPS survey is analyzed.

Race is categorized in this study into three groups: white, black and "other race." The "other race" variable consists of those who report their as Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, or multiple races reported. These races are grouped together due to their very small numbers in the study sample.

The age variable is continuous in the MEPS database. In order to simplify regression analysis and make the variables compatible using a reference variable, this variable is converted to categorical variables. Consulting the literature, and by how the United States public health insurance is set up with respect to Medicare, the age variable is categorized into three groups: 18-49, 50-64, and 65 and older; the reasoning for this is because typically the age where men start to get prostate cancer screening is at age 50.[29] In addition, the dummy variable for the age of Medicare eligibility in the United States (age 65 and older) is also created to adjust for potential effects from Medicare enrollment.

MEPS keeps a record of the individual subject's poverty category. The general poverty variable is coded as POVCAT. This variable has categorical explanations of the

subject's poverty level. In order to gauge the subject's poverty level, a dummy variable is used distinguishing whether the subject falls under or above the household income Federal poverty line. This variable does not need inflationary adjustment, as the variable determines whether the subject was at a certain poverty level within the year of the survey.

The dependent variables can be linked to medical conditions in the MEPS database; in this case, prostate cancer is linked via the ICD-9 code of 245.2 and the MEPS-specific CCCODEX value of 029 (when the ICD-9 code is V10). Each utilization variable has an expenditure component, which was used to assess expenditures. Expenditures are analyzed in terms of each category, and the sum from all categories into one expenditure variable. Health status, along with other confounding factors such as race, ethnicity, age, urban/rural location, educational level, income (poverty level), and insurance type are controlled for with respect to other variables.

All expenditure components for all dependent variables are combined from all dollar figures involved from OOP and third-party (external) payments/charges. For medical provider visits, the sum of these events relating to prostate cancer is the utilization variable, as a count variable. Provider visits and expenditures have an event component which records details of the visit, and these were linked to specific disease conditions in the final dataset, such as in this case prostate cancer. This value is in total dollars.

For hospital events, utilization is the separate summation of inpatient stays (not days hospitalized) and outpatient visits. The expenditure figure for these would be total

dollars, for each type of event. These were also linked to specific disease conditions in the final dataset, so all hospital events were prostate cancer-related.

For prescribed medicines, total utilization in MEPS is given by one variable, where it is described as the number of prescribed medicines associated with the condition. Prescribed medicines can be linked to specific conditions in MEPS, so in this case prescribed medicines were linked directly to prescriptions for prostate cancer.

The following table describes the variables used within the regression models.

Table 3.2

Variables Used in Regression Analysis

Vairable	**Explanatory Variable**	**Vairable**	**Explanatory Variable**
Race	BLACK	Health Status	EXCELLENT*
	OTHER RACE		VERY GOOD
	WHITE*		GOOD
Ethnicity	HISPANIC		FAIR
	NON-HISPANIC*		POOR
Educational Level	H.S. GRADUATE	Age Group	AGE 18-49
	LESS THAN H.S.*		AGE 50-64
Insurance Status	PRIVATE INSURANCE		AGE 65+*
	NO INSURANCE	Urban Status	MSA
	PUBLIC INSURANCE*		NON-MSA*
		Poverty Status	POVERTY
*Denotes Reference Category			NON-POVERTY*

3.6 Statistical Analysis

All of the explanatory variables used in the survey regression models are dummy-coded binary variables; therefore a test of collinearity is necessary to ensure that the explanatory variables used in the model are not interacting greatly with one another in

regression analysis. The following table is an analysis of collinearity. Please note that reference categories are not included in a collinearity analysis.

Table 3.3

Analysis of Collinearity of Explanatory Variables

Explanatory Variable	**VIF**	**SQRT VIF**	**Tolerance**	**R-Squared**
BLACK	1.12	1.06	0.8907	0.1093
OTHER RACE	1.03	1.02	0.9692	0.0308
HISPANIC	1.15	1.07	0.8676	0.1324
H.S. GRADUATE	1.25	1.12	0.8005	0.1995
PRIVATE INSURANCE	1.33	1.16	0.7492	0.2508
NO INSURANCE	1.12	1.06	0.8907	0.1093
VERY GOOD	2.72	1.65	0.3679	0.6321
GOOD	3.14	1.77	0.318	0.682
FAIR	2.76	1.66	0.3617	0.6383
POOR	2.17	1.47	0.4602	0.5398
AGE 18-49	1.04	1.02	0.9572	0.0428
AGE 50-64	1.13	1.06	0.8848	0.1152
MSA	1.05	1.02	0.9569	0.0431
POVERTY	1.1	1.05	0.9093	0.0907
Mean VIF	**1.58**			

None of the variance inflation factors (VIF) for any of the explanatory variables is greater than 10, which is suggested as a cutoff point for major problems with multicollinearity for specific variables, and the mean VIF is not considerably larger than 1, which means that the model should not have multicollinearity problems.[62, 63]

Demographic, socioeconomic and insurance profiles of the prostate cancer patients in the MEPS database are calculated using descriptive statistics. The MEPS datasets provide survey regression variables (weight, stratum, and primary sampling unit) which are used in survey regression analysis. In order to determine differences in demographic factors, socioeconomic factors and insurance type on health care resource

utilization using count modeling, survey Poisson regression analysis is performed for count model utilization. However, in order to compensate for over-dispersion in the Poisson models, survey negative binomial regression is used. In order to examine a simplified approach to the receipt of utilization services, survey logistic regression is used to determine differences in the receipt of utilization. To determine the differences in demographic factors, socioeconomic factors and insurance type on expenditures, survey linear ordinary least squares (OLS) regression is performed. The most current data (2000-2008) is analyzed for the presence of disparities. Statistical analyses will be performed using SAS 9.2 (SAS Institute, Cary, NC, USA) and Stata 10.1 (StataCorp, College Station, TX, USA).

3.7 IRB Exemption

This study was determined to be IRB exempt (category #4) status on June 15, 2010 by the Chair and Vice Chair of the University of Toledo Social Behavioral & Educational Institutional Review Board (IRB #107012).

Chapter 4

Data Analysis & Results

The analysis examines health care resource utilization and health care expenditures from each of the four health care resources (office-based medical provider visits, hospital inpatient stays, hospital outpatient visits, and prescribed medicines) individually and by a total amount by combing all of the four of the health care resources per patient from 2000 to 2008. Descriptive statistics were created using Stata 10.1 and SAS 9.2. Analysis of the four health care resource utilization variables in terms of total count and for the individual dependent variables was performed with negative binomial survey regression in Stata 10.1; SAS 9.2 was used to perform logistic survey regression analysis on the four health care resource utilization variables in binary form, and ordinary least squares (OLS) survey regression analysis on cumulative expenditures of the four health care resource variables, and for total expenditures. Statistically significant p-values (at alpha levels of 0.05) are bolded in all tables except for health status, which was used only as a measure of control in the study.

4.1 Explanation of Maximum Likelihood Estimates and β-Coefficients

Maximum likelihood estimates (from logistic regression) and β-coefficients (from negative binomial regression) are used to calculate point estimate odds ratios (OR) and incidence rate ratios (IRR), respectively. Taking e^{β}, where β is the estimate/coefficient from the logistic/negative binomial regression, will result in the multiplicative factor of the explanatory variable. For example, if from a negative binomial regression model of hospital inpatient stays, there is a coefficient of 0.8050321 for the explanatory variable "private insurance." The reference group in the model is "public insurance." After exponentiation of the coefficient, $e^{0.8050321} = 2.2367682$, this result is the multiplicative result: those with private insurance have 2.24 times as many hospital inpatient stays than those with public insurance. If it were the logistic regression model of hospital inpatient stays, the result would be interpreted as: those with private insurance are 2.24 times more likely to have had a hospital inpatient stay than those with public insurance. It is also possible to express this result as a percentage.

The following equation illustrates how to do this as a percentage:
$x = |(1 - e^{\beta})| \times 100$, where β is the estimate/coefficient from the logistic/negative binomial regression and x is the resulting percentage. Using the variables and numbers from the example above ($e^{0.8050321} = 2.2367682$), and plugged into this equation:
$x = |(1 - 2.2367682)| \times 100$, the result is 124% "more," meaning that those with private insurance have 124% more hospital inpatient stays than those with public insurance. Same thing with logistic regression except it is expressed as a likelihood: those with private insurance are 124% more likely to have had a hospital inpatient stay than those

with public insurance. What determines the "more" or "less/fewer" qualifier for the percentage expression, is the original sign of the estimate/coefficient. If the sign is positive then the qualifier is "more" and if it is negative, the qualifier is "less" or "fewer."

For OLS regression coefficients found in expenditure regression analysis, the coefficient is simply the difference in the mean compared to the reference group, all other explanatory variables fixed. A positive coefficient means greater than the (adjusted) mean of the reference group, while a negative coefficient means less than the (adjusted) mean of the reference group.

4.2 Descriptive Statistics

The total number of subjects in the study is 1018 combined from the 2000-2008 MEPS database. Please note that discrepancies in "N" in this subsection in are due to missing values within explanatory variables. Age was reported in 980 subjects; mean age is 71.28 years. The mean age of the 164 black prostate cancer patients with reported age is 70.33 years with a minimum age of 48 years and a maximum age of 90 years. The mean age of the 784 white prostate cancer patients with reported age is 71.36 years with a minimum age of 36 years and a maximum age of 90 years. The average income for all 1018 subjects is $34619.57 (dollar figures from 2000-2007 adjusted for inflation using the CPI for the year 2008), with a minimum income of $0 and a maximum income of $288490.20. The mean income of the 179 black patients with reported income is $25277.75, with a minimum income of $0 and a maximum income of $196919.30. The mean income of the 806 white patients with reported income is $37144.55 with a minimum of $0 and a maximum of $288490.20.

The mean utilization of health care resources for all 1018 subjects is 6.35 events for the combined total of all four dependent variables. The means of specific health care resource utilization in the past year for all subjects is as follows: office-based medical provider visit expenditures 4.29; hospital inpatient stays 0.0913556; hospital outpatient visits 1.10; and prescribed medicines 0.8713163.

The mean expenditure for all subjects with health care resource utilization in the past year is $5944.24 (N = 886, standard deviation: $13948.82). The means of specific health care resource utilization expenditures in the past year for all subjects are as

follows: office-based medical provider visit expenditures $3732.28 (N = 809); hospital inpatient stays $15198.20 (N = 79); hospital outpatient visits $3970.33 (N = 198); and prescribed medicines $713.4306 (N = 365). The following tables further describe the study population.

Table 4.1

Explanatory Variables by Race and Percentage-Within-Race of Prostate Cancer Patients in MEPS 2000-2008

VARIABLE	WHITE (n=784)	BLACK (n=164)	OTHER RACE (n=32)	TOTAL (n=980)
Ethnicity:				
NON-HISPANIC	712 (90.82%)	159 (96.95%)	32 (100%)	903
HISPANIC	72 (9.18%)	5 (3.05%)	0 (0%)	77
Educational Level:				
LESS THAN H.S.	185 (23.60%)	79 (48.17%)	12 (37.50%)	276
H.S. GRADUATE	599 (76.40%)	85 (51.83%)	20 (62.50%)	704
Insurnace Status:				
NO INSURANCE	14 (1.79%)	2 (1.22%)	0 (0%)	16
PUB. INSURANCE	243 (30.99%)	73 (44.51%)	16 (50.00%)	332
PRIV. INSURANCE	527 (67.22%)	89 (54.27%)	16 (50.00%)	632
Age Group:				
AGE 18-49	9 (1.15%)	2 (1.22%)	0 (0%)	11
AGE 50-65	187 (23.85%)	43 (26.22%)	4 (12.50%)	234
AGE 65+	588 (75.00%)	119 (72.56%)	28 (87.50%)	735
Urban Status:				
NON-MSA	169 (21.56%)	28 (17.07%)	4 (12.50%)	201
MSA	615 (78.44%)	136 (82.93%)	28 (87.50%)	779
Poverty Status:				
ABOVE POV. LINE	721 (91.96%)	130 (79.27%)	28 (87.50%)	879
BELOW POV. LINE	63 (8.04%)	34 (20.73%)	4 (12.50%)	101
Health Status:				
EXCELLENT	74 (9.44%)	14 (8.54%)	1 (3.13%)	89
VERY GOOD	192 (24.49%)	18 (10.98%)	10 (31.25%)	220
GOOD	250 (31.89%)	64 (39.02%)	14 (43.75%)	328
FAIR	172 (21.94%)	46 (28.05%)	5 (15.63%)	223
POOR	96 (12.24%)	22 (13.41%)	2 (6.25%)	120

Note: H.S. = HIGH SCHOOL, POV. = POVERTY, PUB. = PUBLIC, PRIV. = PRIVATE

Table 4.2

Unweighted Means of Utilization Counts by Explanatory Variables

VARIABLE	OBMP Mean Count Utilization	HIS Mean Count Utilization	OV Mean Count Utilization	Mean Count Utilization	Mean of All Count Utilization
WHITE	4.66	0.09	1.11	0.90	6.76
BLACK	3.22	0.05	1.21	0.71	5.18
OTHER RACE	3.94	0.09	1.09	1.31	6.44
NON-HISPANIC	4.34	0.09	1.17	0.84	6.44
HISPANIC	4.99	0.08	0.58	1.35	7.00
LESS THAN H.S.	4.11	0.07	0.85	1.05	6.08
H.S. GRADUATE	4.50	0.09	1.23	0.81	6.64
NO INSURANCE	5.88	0.13	0.25	2.31	8.56
PUB. INSURANCE	4.26	0.05	0.94	0.89	6.14
PRIV. INSURANCE	4.43	0.10	1.24	0.84	6.61
AGE 18-49	4.09	0.36	0.73	1.55	6.73
AGE 50-65	4.72	0.15	1.71	0.97	7.54
AGE 65+	4.29	0.06	0.94	0.84	6.14
NON-MSA	4.26	0.11	0.56	1.09	6.02
MSA	4.43	0.08	1.27	0.83	6.60
ABOVE POV. LINE	4.38	0.09	1.11	0.85	6.43
BELOW POV. LINE	4.49	0.04	1.26	1.15	6.93
Health Status:					
EXCELLENT	2.89	0.06	1.34	0.52	4.80
VERY GOOD	4.54	0.06	1.42	0.80	6.81
GOOD	4.28	0.09	1.16	0.81	6.34
FAIR	4.82	0.10	1.04	1.23	7.20
POOR	4.76	0.10	0.48	0.85	6.19

Note: H.S. = HIGH SCHOOL, POV. = POVERTY, PUB. = PUBLIC, PRIV. = PRIVATE

OBMP = Office-Based Medical Provider visits, HIS = Hospital Inpatient Stays,

OV = Hospital Outpatient Visits, PMED = Prescribed Medicines

Table 4.3

Unweighted Means of Expenditures by Explanatory Variables

VARIABLE	OBMP Mean Expenditures	HIS Mean Expenditures	OV Mean Expenditures	PMED Mean Expenditures	Mean of All Expenditures
WHITE	$3,662.96	$15,113.07	$3,645.44	$708.86	$5,901.26
BLACK	$4,204.18	$17,093.54	$6,470.41	$795.69	$6,186.45
OTHER RACE	$4,891.87	$8,159.49	$2,960.12	$534.48	$5,726.14
NON-HISPANIC	$3,810.37	$15,368.77	$4,019.11	$694.42	$6,028.00
HISPANIC	$3,414.05	$10,236.03	$4,730.79	$947.96	$4,883.46
LESS THAN H.S.	$3,622.26	$16,192.71	$2,681.89	$904.65	$5,050.26
H.S. GRADUATE	$3,834.51	$14,762.52	$4,526.48	$629.42	$6,270.08
NO INSURANCE	$4,951.99	$524.20	$2,487.17	$909.53	$5,908.65
PUB. INSURANCE	$3,464.99	$11,871.96	$2,705.09	$822.41	$4,459.07
PRIV. INSURANCE	$3,897.83	$16,221.94	$4,573.69	$650.03	$6,664.82
AGE 18-49	$1,810.04	$24,294.35	$4,368.19	$174.15	$10,605.52
AGE 50-65	$4,144.23	$16,250.90	$4,851.24	$825.35	$8,130.05
AGE 65+	$3,684.86	$13,078.97	$3,665.38	$698.75	$5,142.14
NON-MSA	$3,796.29	$21,190.76	$1,109.18	$996.63	$6,242.12
MSA	$3,776.35	$13,143.10	$4,994.86	$636.36	$5,864.05
ABOVE POV. LINE	$3,738.09	$15,219.65	$4,070.28	$683.88	$5,980.65
BELOW POV. LINE	$4,201.84	$10,293.70	$3,896.02	$947.29	$5,567.28
Health Status:					
EXCELLENT	$1,581.19	$14,794.75	$4,553.37	$355.43	$3,537.68
VERY GOOD	$4,384.71	$14,594.75	$4,393.24	$420.19	$5,959.95
GOOD	$4,223.31	$14,430.66	$4,662.06	$648.76	$6,773.80
FAIR	$3,670.79	$12,876.95	$3,846.17	$987.27	$5,971.91
POOR	$3,430.66	$22,590.39	$1,526.40	$971.65	$5,456.87

Note: H.S. = HIGH SCHOOL, POV. = POVERTY, PUB. = PUBLIC, PRIV. = PRIVATE

OBMP = Office-Based Medical Provider visits, HIS = Hospital Inpatient Stays,

OV = Hospital Outpatient Visits, PMED = Prescribed Medicines

4.3 Health Care Resource Utilization Regression Analyses

For health care resource utilization analysis, 978 subjects were used in all survey negative binomial regression analyses and 966 survey logistic regression analyses due to missing values, out of the total of 1018 subjects. An alpha level of 0.05 was chosen to determine statistical significance.

Referring to Table 4.4, a logistic regression output table for whether the patient utilized an office-based medical provider visit in the past year at all, blacks are 54.7% less likely to have an office visit in the past year compared to whites. This finding was statistically significant. Subjects with any form of private insurance are 46.4% more likely to use an office-based medical provider visit in the past year compared to someone with only public insurance. This finding was statistically significant.

Table 4.4

Office-Based Medical Provider Visits Utilization – Logistic Regression (N = 966)

Vairable	Explanatory Variable	DF	M.L. Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	OR (|1-e^β|)
Intercept (Constant)		1	1.7822	0.4018	19.6761	<0.0001	
Race	BLACK	1	-0.7916	0.2472	10.2535	**0.0014****	**0.547**
	OTHER RACE	1	-0.4741	0.4383	1.1698	0.2794	
	WHITE*						
Ethnicity	HISPANIC	1	-0.1255	0.2093	0.3593	0.5489	
	NON-HISPANIC*						
Educational Level	H.S. GRADUATE	1	0.3427	0.196	3.0556	0.0805	
	LESS THAN H.S.*						
Insurance Status	PRIV. INSURANCE	1	0.3813	0.1816	4.4064	**0.0358****	**0.464**
	NO INSURANCE	1	0.3073	0.621	0.2448	0.6208	
	PUB. INSURANCE*						
Health Status	EXCELLENT*						
	VERY GOOD	1	-0.5838	0.3909	2.2301	0.1353	
	GOOD	1	-0.4265	0.4134	1.0645	0.3022	
	FAIR	1	-0.6896	0.377	3.3458	0.0674	
	POOR	1	-0.6678	0.4436	2.2658	0.1323	
Age Group	AGE 18-49	1	-1.2017	0.9858	1.4858	0.2229	
	AGE 50-64	1	0.0436	0.2429	0.0322	0.8576	
	AGE 65+*						
Urban Status	MSA	1	-0.0361	0.213	0.0288	0.8653	
	NON-MSA*						
Poverty Status	POVERTY	1	-0.1345	0.2308	0.3396	0.56	
	NON-POVERTY*						

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE, M.L.=Maximum Likelihood

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Assessing the count utilization of hospital inpatient stays in Table 4.5, patients with any form of private insurance have 2.24 times more inpatient stays at the hospital for prostate cancer than those that have only public insurance (such as Medicare or Medicaid). Although, this is just past the designated alpha level of 0.05 and could be considered of borderline statistical significance. Interestingly enough, those that are aged 50-64 years have 2.1 times more inpatient stays at the hospital for prostate cancer than those older than 65 years. This finding was statistically significant. Subjects under the

Federal poverty level had 83.6% fewer hospital inpatient stays for prostate cancer than those who are wealthier. This finding was statistically significant.

Examining Table 4.6 for the likelihood of having a hospital inpatient stay in the past year, those aged 50-64 years are also 2.87 times more likely to have a hospital inpatient stay compared to those older than 65 years of age. This finding was statistically significant. Furthermore, patients under the poverty line are also 87.3% less likely than those who are wealthier to have a hospital inpatient stay. This finding was statistically significant.

Table 4.5

Hospital Inpatient Stays Utilization – Negative Binomial Regression (N = 978)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|	IRR (|1-e^β|)
Intercept (Constant)		-3.92162	0.6809483	-5.76	0.000	
Race	BLACK	-0.4883839	0.4367194	-1.12	0.265	
	OTHER RACE	0.5270442	0.5487053	0.96	0.338	
	WHITE*					
Ethnicity	HISPANIC	-0.3125097	0.6510052	-0.48	0.632	
	NON-HISPANIC*					
Educational Level	H.S. GRADUATE	0.173389	0.3980871	0.44	0.664	
	LESS THAN H.S.*					
Insurance Status	PRIV. INSURANCE	0.8050321	0.4115121	1.96	0.052	1.240
	NO INSURANCE	0.3225943	0.9116431	0.35	0.724	
	PUB. INSURANCE*					
Health Status	EXCELLENT*					
	VERY GOOD	0.4481606	0.5539824	0.81	0.420	
	GOOD	0.7939733	0.5076893	1.56	0.120	
	FAIR	0.9160184	0.6009956	1.52	0.129	
	POOR	1.409221	0.653504	2.16	0.032	
Age Group	AGE 18-49	1.424527	0.4196446	3.39	**0.001****	**3.156**
	AGE 50-64	0.7394222	0.2746758	2.69	**0.008****	**1.095**
	AGE 65+*					
Urban Status	MSA	-0.2144979	0.322609	-0.66	0.507	**0.193**
	NON-MSA*					
Poverty Status	POVERTY	-1.805914	0.7984064	-2.26	**0.025****	**0.836**
	NON-POVERTY*					

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Table 4.6

Hospital Inpatient Stays Utilization – Logistic Regression (N = 966)

Vairable	Explanatory Variable	DF	M.L. Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	OR (|1-e^β|)
Intercept (Constant)		1	-4.2006	0.6609	40.3963	<0.0001	
Race	BLACK	1	-0.5569	0.3492	2.5439	0.1107	
	OTHER RACE	1	0.7378	0.3095	5.685	**0.0171****	**1.091**
	WHITE*						
Ethnicity	HISPANIC	1	-0.425	0.3592	1.3998	0.2368	
	NON-HISPANIC*						
Educational Level	H.S. GRADUATE	1	0.425	0.2964	2.0552	0.1517	
	LESS THAN H.S.*						
Insurance Status	PRIV. INSURANCE	1	0.7041	0.3608	3.8084	0.051	
	NO INSURANCE	1	0.3129	0.9373	0.1114	0.7385	
	PUB. INSURANCE*						
Health Status	EXCELLENT*						
	VERY GOOD	1	0.4931	0.5557	0.7876	0.3748	
	GOOD	1	0.8677	0.54	2.5823	0.1081	
	FAIR	1	0.6705	0.6297	1.134	0.2869	
	POOR	1	1.0841	0.6328	2.9349	0.0867	
Age Group	AGE 18-49	1	1.9248	0.4044	22.6589	**<0.0001****	**5.854**
	AGE 50-64	1	1.0534	0.2548	17.0907	**<0.0001****	**1.867**
	AGE 65+*						
Urban Status	MSA	1	-0.1554	0.3151	0.2431	0.622	
	NON-MSA*						
Poverty Status	POVERTY	1	-2.0654	0.8173	6.3859	**0.0115****	**0.873**
	NON-POVERTY*						

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE, M.L.=Maximum Likelihood

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Using the results from Table 4.7, for hospital outpatient visits, those in urban areas have 80% more outpatient visits than those in rural areas. This finding was statistically significant. In addition to this, subjects under the Federal poverty level have 2.04 times more outpatient visits than those above the Federal poverty line. This finding was statistically significant. Patients aged 50-64 years have 2.11 times more outpatient visits than those 65 and older. This finding was statistically significant.

Referring to Table 4.8, logistic regression analysis of outpatient visits, those aged 50-64 years are 84.3% more likely to use an outpatient visit. This finding was statistically

significant. Hispanic patients are 49.5% less likely to have had a hospital outpatient than non-Hispanics. This finding was statistically significant. Those in urban areas are 42.4% less likely to have an outpatient visit compared to those in rural areas. This finding was statistically significant.

Table 4.7

Outpatient Hospital Visit Utilization – Negative Binomial Regression (N = 978)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|	IRR (|1-e^β|)
Intercept (Constant)		-0.7695364	0.4944319	-1.56	0.121	
Race	BLACK	0.0771469	0.3757371	0.21	0.838	
	OTHER RACE	0.2897473	0.5514746	0.53	0.600	
	WHITE*					
Ethnicity	HISPANIC	-0.6119731	0.6113209	-1	0.318	
	NON-HISPANIC*					
Educational Level	H.S. GRADUATE	-0.0750289	0.3584231	-0.21	0.834	
	LESS THAN H.S.*					
Insurance Status	PRIV. INSURANCE	0.1066367	0.3527231	0.3	0.763	
	NO INSURANCE	-1.597725	0.8834588	-1.81	0.072	
	PUB. INSURANCE*					
Health Status	EXCELLENT*					
	VERY GOOD	0.3180173	0.5178118	0.61	0.540	
	GOOD	-0.0831158	0.4762162	-0.17	0.862	
	FAIR	0.2630748	0.4699238	0.56	0.576	
	POOR	-0.8628099	0.5110519	-1.69	0.093	
Age Group	AGE 18-49	1.158499	0.7563605	1.53	0.127	
	AGE 50-64	0.7476794	0.3206402	2.33	**0.021****	**1.112**
	AGE 65+*					
Urban Status	MSA	0.587534	0.2433555	2.41	**0.017****	**0.800**
	NON-MSA*					
Poverty Status	POVERTY	0.7148005	0.3444894	2.07	**0.039****	**1.044**
	NON-POVERTY*					

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Table 4.8

Outpatient Hospital Visits – Logistic Regression (N = 966)

Vairable	Explanatory Variable	DF	M.L. Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	OR (|1-e^β|)
Intercept (Constant)		1	-1.25	0.3724	11.2651	0.0008	
Race	BLACK	1	0.1483	0.1936	0.5871	0.4435	
	OTHER RACE	1	0.164	0.3219	0.2596	0.6104	
	WHITE*						
Ethnicity	HISPANIC	1	-0.6838	0.2608	6.8733	**0.0087****	**0.495**
	NON-HISPANIC*						
Educational Level	H.S. GRADUATE	1	-0.0153	0.2235	0.0047	0.9455	
	LESS THAN H.S.*						
Insurance Status	PRIV. INSURANCE	1	0.3899	0.223	3.0585	0.0803	
	NO INSURANCE	1	0.05	0.5914	0.0071	0.9327	
	PUB. INSURANCE*						
Health Status	EXCELLENT*						
	VERY GOOD	1	-0.3662	0.3346	1.1979	0.2737	
	GOOD	1	-0.2405	0.3305	0.5294	0.4669	
	FAIR	1	0.2072	0.3351	0.3825	0.5363	
	POOR	1	-0.4823	0.4121	1.3698	0.2419	
Age Group	AGE 18-49	1	1.0343	0.447	5.3546	**0.0207****	**1.813**
	AGE 50-64	1	0.6112	0.1657	13.6044	**0.0002****	**0.843**
	AGE 65+*						
Urban Status	MSA	1	-0.5524	0.2132	6.7123	**0.0096****	**0.424**
	NON-MSA*						
Poverty Status	POVERTY	1	0.5129	0.2926	3.0721	0.0796	
	NON-POVERTY*						

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE, M.L.=Maximum Likelihood

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Table 4.9 shows that blacks have 34.3% fewer prescriptions than white patients; however this is of borderline significance. Table 4.10 shows that blacks are 33.9% less likely to have had a prescribed medicine for prostate cancer in the past year. This finding is statistically significant.

Table 4.9

Prescribed Medicine Utilization – Negative Binomial Regression (N = 978)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|	IRR (|1-e^β|)
Intercept (Constant)		-0.1580597	0.3246078	-0.49	0.627	
Race	BLACK	-0.4205344	0.2345556	-1.79	0.075	0.3433
	OTHER RACE	0.0476516	0.3881774	0.12	0.902	
	WHITE*					
Ethnicity	HISPANIC	0.3197434	0.3566091	0.9	0.371	
	NON-HISPANIC*					
Educational Level	H.S. GRADUATE	-0.3119573	0.1702399	-1.83	0.069	
	LESS THAN H.S.*					
Insurance Status	PRIV. INSURANCE	0.037019	0.1554249	0.24	0.812	
	NO INSURANCE	0.4744873	0.4821172	0.98	0.326	
	PUB. INSURANCE*					
Health Status	EXCELLENT*					
	VERY GOOD	0.2925721	0.2432065	1.2	0.231	
	GOOD	0.3799616	0.2626066	1.45	0.150	
	FAIR	0.6521496	0.2681258	2.43	0.016	
	POOR	0.4305145	0.3043924	1.41	0.159	
Age Group	AGE 18-49	0.4156714	0.38485	1.08	0.282	
	AGE 50-64	0.2011336	0.2009011	1	0.318	
	AGE 65+*					
Urban Status	MSA	-0.2649933	0.2054466	-1.29	0.199	
	NON-MSA*					
Poverty Status	POVERTY	0.2721802	0.1906615	1.43	0.155	
	NON-POVERTY*					

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

Table 4.10

Prescribed Medicines Utilization – Logistic Regression (N = 966)

Vairable	Explanatory Variable	DF	M.L. Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	OR (|1-e^β|)
Intercept (Constant)		1	-0.2876	0.3747	0.5889	0.4428	
Race	BLACK	1	-0.4134	0.1905	4.7117	**0.03****	**0.339**
	OTHER RACE	1	-0.1731	0.3697	0.2193	0.6396	
	WHITE*						
Ethnicity	HISPANIC	1	-0.1442	0.2264	0.4059	0.5241	
	NON-HISPANIC*						
Educational Level	H.S. GRADUATE	1	-0.252	0.2197	1.3156	0.2514	
	LESS THAN H.S.*						
Insurance Status	PRIV. INSURANCE	1	-0.0937	0.1754	0.2854	0.5932	
	NO INSURANCE	1	0.0187	0.5616	0.0011	0.9734	
	PUB. INSURANCE*						
Health Status	EXCELLENT*						
	VERY GOOD	1	-0.0115	0.2161	0.0028	0.9576	
	GOOD	1	0.1543	0.2519	0.3753	0.5401	
	FAIR	1	0.4904	0.2736	3.2133	0.073	
	POOR	1	0.3501	0.3137	1.2455	0.2644	
Age Group	AGE 18-49	1	1.0732	0.6063	3.133	0.0767	
	AGE 50-64	1	0.0613	0.1888	0.1053	0.7456	
	AGE 65+*						
Urban Status	MSA	1	-0.1572	0.2351	0.4472	0.5037	
	NON-MSA*						
Poverty Status	POVERTY	1	0.1281	0.2342	0.2992	0.5844	
	NON-POVERTY*						

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05

H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE, M.L.=Maximum Likelihood

Incidence Rate Ratio (IRR) or Point Estimate Odds Ratio (OR) given for statistically significant values where noted.

4.3.1 Health Care Resource Utilization – Goodness-of-Fit

Tables A.1 through A.11 located in Appendix A are used to examine goodness-of-fit (GOF) measures for the models used. Only models with an appropriate GOF were used in the study and reported. Stata and SAS have different methods and outputs for assessing GOF; therefore there are different GOF measures used for the survey negative binomial regression in Stata and survey logistic regression in SAS.

4.4 Health Care Resource Expenditures Regression Analysis

Health care resource expenditures are examined for those who actually received care in the survey year. There are a total of 852 observations (out of 1018) with any or all of the health care expenditure variables available. An alpha level of 0.05 was chosen to determine statistical significance.

From the data in Table 4.11, blacks have statistically significantly higher expenditures than whites for expenditures related to prostate cancer (estimate = 4621.9619). Those with any form of private insurance had statistically significantly higher expenditures than those with only public insurance (estimate = 1569.2712). Patients aged 50-64 years had statistically significantly higher expenditures than patients aged 65 and older (estimate = 3669.0032).

Table 4.11

OLS Regression – Total Expenditure Health Care Resources (N = 852)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|
Intercept (Constant)		242.6968	1234.6229	0.2	0.8443
Race	BLACK	4621.9619	754.68049	6.12	**<0.0001****
	OTHER RACE	2563.5114	1158.0051	2.21	**0.0278****
	WHITE*				
Ethnicity	HISPANIC	-953.595	877.01033	-1.09	0.278
	NON-HISPANIC*				
Educational Level	H.S. GRADUATE	1409.8727	1153.5506	1.22	0.2228
	LESS THAN H.S.*				
Insurance Status	PRIV. INSURANCE	1569.2712	755.84382	2.08	**0.0389****
	NO INSURANCE	-819.3055	3078.1361	-0.27	0.7903
	PUB. INSURANCE*				
Health Status	EXCELLENT*				
	VERY GOOD	3736.6855	904.86728	4.13	<0.0001
	GOOD	5364.7759	1360.9604	3.94	0.0001
	FAIR	3119.6249	767.03997	4.07	<0.0001
	POOR	4602.5371	1201.9005	3.83	0.0002
Age Group	AGE 18-49	7363.2113	4763.9061	1.55	0.1235
	AGE 50-64	3669.0032	1218.3425	3.01	**0.0029****
	AGE 65+*				
Urban Status	MSA	-1123.4479	1496.2444	-0.75	0.4535
	NON-MSA*				
Poverty Status	POVERTY	-1516.4779	985.43874	-1.54	0.1251
	NON-POVERTY*				

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05
H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

Referring to Table 4.12, blacks had statistically significantly more expenditures than whites for expenditures for office-based medical provider visits relating to prostate cancer (estimate = 2024.2761).

Table 4.12

Office-Based Medical Provider Visit Expenditures – OLS Regression (N = 782)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|
Intercept (Constant)		139.7062	1287.7053	0.11	0.9137
Race	BLACK	6182.1375	826.06814	7.48	**<0.0001****
	OTHER RACE	3326.9879	1040.8113	3.2	**0.0016****
	WHITE*				
Ethnicity	HISPANIC	-513.6691	764.4629	-0.67	0.5023
	NON-HISPANIC*				
Educational Level	H.S. GRADUATE	1106.5236	1161.5131	0.95	0.3418
	LESS THAN H.S.*				
Insurance Status	PRIV. INSURANCE	123.5264	813.35156	0.15	0.8794
	NO INSURANCE	2024.2028	2672.4088	0.76	0.4496
	PUB. INSURANCE*				
Health Status	EXCELLENT*				
	VERY GOOD	2769.8614	807.69875	3.43	0.0007
	GOOD	3757.4845	1061.9495	3.54	0.0005
	FAIR	1892.1622	561.93871	3.37	0.0009
	POOR	2442.1055	831.14542	2.94	0.0036
Age Group	AGE 18-49	-2995.9568	753.24344	-3.98	**<0.0001****
	AGE 50-64	733.397	836.88294	0.88	0.3818
	AGE 65+*				
Urban Status	MSA	-76.4428	762.50948	-0.1	0.9202
	NON-MSA*				
Poverty Status	POVERTY	-926.457	810.45612	-1.14	0.2542
	NON-POVERTY*				

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05
H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

From Table 4.13 it is worth noting that blacks (estimate = 2024.2761) and Hispanics (estimate = 2682.726) had statistically significantly higher expenditures than whites and non-Hispanics, respectively, for hospital outpatient visits. Carriers of any form of private insurance had statistically significantly higher expenditures for outpatient visits than those with only public insurance (estimate = 1514.4303). Furthermore, those in urban areas have statistically significantly higher expenditures for outpatient visits than those in rural areas (estimate = 3344.6062).

Table 4.13

Outpatient Hospital Visit Expenditures – OLS Regression (N = 189)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|
Intercept (Constant)		-1650.6089	449.71282	-3.67	0.0004
Race	BLACK	2024.2761	407.6597	4.97	**<0.0001****
	OTHER RACE	-260.9562	305.32443	-0.85	0.3948
	WHITE*				
Ethnicity	HISPANIC	2682.726	173.4935	15.46	**<0.0001****
	NON-HISPANIC*				
Educational Level	H.S. GRADUATE	686.4431	414.38662	1.66	0.1008
	LESS THAN H.S.*				
Insurance Status	PRIV. INSURANCE	1514.4303	308.28753	4.91	**<0.0001****
	NO INSURANCE	-1794.9916	457.19536	-3.93	**0.0002****
	PUB. INSURANCE*				
Health Status	EXCELLENT*				
	VERY GOOD	1945.9257	403.15414	4.83	<0.0001
	GOOD	1014.8366	298.20353	3.4	0.001
	FAIR	587.9204	526.77745	1.12	0.2671
	POOR	-510.2373	512.28708	-1	0.3217
Age Group	AGE 18-49	1388.026	1269.5166	1.09	0.2769
	AGE 50-64	465.2089	351.06646	1.33	0.1882
	AGE 65+*				
Urban Status	MSA	3344.6062	312.53704	10.7	**<0.0001****
	NON-MSA*				
Poverty Status	POVERTY	169.6153	676.17862	0.25	0.8025
	NON-POVERTY*				

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05
H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

From Table 4.14, those with any form of private insurance had statistically significantly lower expenditures for prostate cancer prescription medicines than those with public insurance only (estimate = -141.40848). This is an interesting contrast to the total expenditures, where those with private insurance had statistically significantly greater overall expenditures compared to those with only public insurance. Furthermore, those with no insurance also had statistically significantly lower expenditures for prostate cancer prescription drugs than those with only public insurance (estimate = -464.22102). In addition, prostate cancer patients below the poverty line had statistically significantly

higher expenditures for prostate cancer prescription drugs than those above the poverty line (estimate = 258.98583).

Table 4.14

Prescribed Medicine Expenditures – OLS Regression (N = 349)

Vairable	Explanatory Variable	Coefficient (β)	Standard Error	t-value	Pr > |t|
Intercept (Constant)		434.45478	145.26863	2.99	0.0032
Race	BLACK	32.15741	90.0575	0.36	0.7215
	OTHER RACE	-237.78535	32.74335	-7.26	**<0.0001****
	WHITE*				
Ethnicity	HISPANIC	-30.6531	163.29002	-0.19	0.8513
	NON-HISPANIC*				
Educational Level	H.S. GRADUATE	-131.69235	137.73405	-0.96	0.3405
	LESS THAN H.S.*				
Insurance Status	PRIV. INSURANCE	-141.40848	59.477353	-2.38	**0.0186****
	NO INSURANCE	-464.22102	186.72242	-2.49	**0.014****
	PUB. INSURANCE*				
Health Status	EXCELLENT*				
	VERY GOOD	129.09536	164.75684	0.78	0.4345
	GOOD	308.54464	143.78234	2.15	0.0334
	FAIR	543.82089	189.49174	2.87	0.0047
	POOR	503.30473	259.09053	1.94	0.0538
Age Group	AGE 18-49	-487.18174	116.66598	-4.18	**<0.0001****
	AGE 50-64	346.33237	217.24225	1.59	0.1129
	AGE 65+*				
Urban Status	MSA	-6.18749	90.84747	-0.07	0.9458
	NON-MSA*				
Poverty Status	POVERTY	258.98583	85.492116	3.03	**0.0029****
	NON-POVERTY*				

Footnotes: *Denotes reference category **Denotes statistically significant value at alpha 0.05
H.S.=HIGH SCHOOL, POV.=POVERTY, PUB.=PUBLIC, PRIV.=PRIVATE

4.4.1 Health Care Resource Expenditures – Goodness-of-Fit

Tables A.12 through A.15 located in Appendix A are used to examine GOF measures for the expenditure models used. Only models with an appropriate GOF were used in the study. All expenditure regressions used OLS survey regression in SAS.

Chapter 5

Discussion & Conclusion

The objectives of the study are to examine, analyze and report possible demographic, socioeconomic and insurance disparities involved in health care resource utilization and expenditures in the prostate cancer population in the United States, while controlling for health status and confounding factors, using the MEPS database.

5.1 Demographics – Race

The primary objective of the study is to determine disparities in medical provider visit utilization in prostate cancer patients as determined by race (black & white). From the results of the study, black Americans with prostate cancer are less likely to have had an office-based medical provider visit ($p = 0.0014$) in the past year compared to white patients and to have fewer prescribed medicines for prostate cancer than white patients. Both of these results are of concern as previous literature shows that black patients are 34 percent more likely than white patients to die from cancer, in general.[5] In addition, among prostate cancer patients, the mortality rate for black patients (56.3 per 100,000 men) is more than twice the mortality rate for white patients (23.6 per 100,000 men).[32]

As reported, black patients are significantly less likely to have received an office-based medical provider visit in the past year. Gross et al. reported that black patients were significantly less likely to receive treatment for prostate cancer than white patients.[18] Carpenter et al. noted that due to black patients' lack of trust in physicians, they are less likely to see a physician for prostate cancer screening.[45] If a patient does not trust their physician and utilize such health care resources as office visits, they could be more likely to have greater problems with their disease.[45] The fact that present study results show that black patients are less likely to use office-based medical provider visits in the past year could be explained by a lack of trust that black patients have for physicians. Other reasons, which can be extrapolated from the literature, could be lack of access to health care, socioeconomic status, inadequate knowledge, fear, patient-provider communication, and aversion to DRE.[30, 31] From using recent data, the results of this study confirm the findings from the previous literature that black patients have significant disparities when it comes to prescribed medications.[47-52] This can possibly be explained by the fact that black patients are also less likely to see a physician for prostate cancer within the past year, and are therefore less likely to obtain prescriptions for treatment of the disease.

Further examining disparities between black prostate cancer patients and white prostate cancer patients, present study findings show that black patients have significantly higher expenditures than white patients, for total expenditures ($p < 0.0001$) (combining office-based medical provider visits, hospital inpatient stays, hospital outpatient visits, and prescribed medicines), and expenditures for both office-based medical provider visits ($p < 0.0001$) and hospital outpatient visits ($p < 0.0001$). This is unusual, considering that

black patients were shown to be less likely to utilize an office-based medical provider visit.

There may be possible explanations for these findings. Due to many barriers to care as mentioned previously,[30, 31, 45] black patients may seek care when health conditions are worse, and may thus require more aggressive, expensive treatment.

5.2 Demographics – Ethnicity

Study results show a similar trend for Hispanic patients. There is a lower likelihood that a prostate cancer patient of Hispanic descent is to use a hospital outpatient visit ($p = 0.0087$) in the past year than a non-Hispanic patient; yet the Hispanic patient has higher expenditures ($p < 0.0001$) for hospital outpatient visits than non-Hispanics. This finding also applies the updated data from this study and confirms the findings in the previous literature that significant disparities currently exist between Hispanics and non-Hispanics. In addition, the results confirm that for a specific form of utilization, outpatient visits/ambulatory care, there are disparities between Hispanics and non-Hispanics in that Hispanics are far less likely to use ambulatory care.[56] This may also suggest, as with black patients, Hispanics may possibly delay treatment, and when treatment is finally rendered, the patient is at a more difficult stage to treat and therefore may have higher expenditures.

5.3 Demographics – Age

Age, another demographic variable, was found to have significant disparities in total expenditures, number of hospital inpatient stays, number of outpatient visits, and likelihood of having an outpatient visit in the past year. Patients aged 50-64 had greater expenditures ($p = 0.0029$) than those aged 65 and older, and had more hospital inpatient stays ($p = 0.008$), more outpatient visits ($p = 0.021$), and a greater likelihood of having an outpatient visit ($p = 0.0002$) in the past year. This may be related to previous literature findings that younger patients are more likely to pursue radical prostatectomy (a hospital surgery typically requiring a hospital inpatient stay) than older patients.[38] However, present study findings that patients aged 50-65 had more outpatient visits and were more likely to have had an outpatient visit is in contrast to Wilson et al., who reported that those aged 65 and older consisted of the majority of all patients to have outpatient procedures such as external beam radiation and brachytherapy.[4] Wilson et al. also reported that over the first 6 months the average cost per patient was highest for those under the age of 55 ($12,656) and then gradually went down with each age group that was reported: 56-65 ($11,902), 66-75 ($11,587) and greater than 75 ($9,664).[4] This may reflect the results of the present study, with those aged 50-64 years having greater expenditures ($p = 0.0029$) than those older than 65. Jerant et al. suggested that the disparity in prostate cancer screening could have been due to ageist health care provider perceptions. It is unclear from the results of the present study whether that is actually the case.

5.4 Demographics – Urban/Rural Location

As for the final demographic factor, among rural and urban populations, there is an interesting result from this study. Prostate cancer patients in urban areas use a greater number of outpatient visits than those in rural areas; however, those in urban areas are less likely to have had an outpatient visit (p-value = 0.0096) in the past year. Furthermore, urban subjects have far higher expenditures than rural subjects for outpatient visits ($p < 0.0001$). There are two commonly accepted procedures performed in outpatient visits: brachytherapy and external beam radiation.[64, 65] Brachytherapy is performed with far fewer outpatient visits (1-2 weeks)[65] compared to external beam radiation, which can go on for five days a week for six to nine weeks; however these two therapies can be combined.[66] Brachytherapy also has far lower costs compared to external beam therapy, as brachytherapy can cost 20% less than external beam therapy.[67] The findings from this study, as well as referencing the past literature, could suggest that rural patients, with lower expenditures and fewer counts of outpatient visits, may have less access to external beam radiation therapy than for brachytherapy compared to those in urban areas. This could invariably affect the treatment options available for rural patients, as external beam therapies may be of greater benefit to some patients.[68, 69] The results of this study also partially confirms the results from Mullins et al., where in their study, rural prostate cancer patients had lower overall expenditures (which included non-prostate cancer related conditions). However, neither this study, nor Mullins et al., adjusted for cost of living differences that exist between urban and rural locations. This factor might possibly have an impact on expenditures as well.

5.5 Socioeconomics – Educational Level

The results of this study suggest that education level, a socioeconomic factor, is not a significant factor when controlling for all the explanatory variables used. This is in contrast to a study from Albano et al., where black patients with 12 or fewer years of education had nearly a double rate of mortality compared to those with more education. This could mean that utilization and expenditures may not be very much related to mortality in terms of education. More research is needed to examine the effect of education with respect to health care resource utilization, expenditures, and mortality.

5.6 Socioeconomics – Income (Poverty Level)

Present study results show that subjects under the poverty line have a greater number of hospital inpatient stays and outpatient visits, a greater likelihood of hospital inpatient stays and outpatient visits, and a greater amount of prescription medication expenditures. Ward et al. reported that Americans under the poverty line had health care burdens that exceeded 20 percent of family income.[11] Short and Mallonee found that patients with higher income were more likely to survive cancer and had greater quality of life.[20] Based on the results of the present study, having greater expenditures for prescription medications may pose additional financial hardship on those patients under the poverty line.

5.7 Insurance Type

Insurance type is the final independent variable examined in this study. This study focused on three forms of insurance: private insurance (the subject has private insurance, even if they have some form of public insurance), public insurance (public insurance only) and no insurance. Public insurance was the reference variable to which private and no insurance were compared. Those with any form of private insurance had significantly higher expenditures overall ($p = 0.0389$) and significantly higher expenditures for outpatient visits ($p < 0.0001$). This may possibly be explained by the negotiating power of public versus private insurances. Private insurances, in theory due to smaller enrollment, would have less negotiating power over prices than a large public insurance. In order to test this theory, the "any private insurance category" will have to be separated from those with only private insurance, and those with a combination of public and private insurance in a future study. Another statistically significant issue with private insurance is that a subject with any private insurance coverage was more likely ($p = 0.0358$) to have had an office-based medical provider visit in the past year compared to a subject with only public insurance. This is similar in part to the study from Thorpe and Howard, where they reported that cancer patients with private insurance had 15.04 health care events (inpatient admissions, outpatient hospital visits, emergency room visits, physician office visits) in the past year, compared to 13.38 for Medicaid and 16.95 for Medicare; however none of these results were statistically significant. The last statistically significant outcome with respect to insurance is that those with no insurance have lower outpatient expenditures than those with public insurance ($p = 0.0002$). Thorpe

and Howard reported that uninsured cancer patients in general spent 57% as much as a privately insured patient for their cancer care. This compares with the statistically significant figure in the present study where prostate cancer patients with no insurance have lower outpatient visit expenditures compared to those with any form of insurance.

5.8 Study Limitations

The primary limitation of this study is the fact that the MEPS database does not include the stage of cancer at diagnosis, or the stage of the cancer upon receipt of treatment. Other limitations of the study include the fact that this is a retrospective database study. This limits the researcher's ability to control for additional confounding factors (such as cancer stage at diagnosis). Examining races other than blacks or whites was also an issue, as the total number of Asians, Native Americans and mixed races was quite low. The discrepancy in races could be made up for by using databases with larger numbers of prostate cancer patients. Another limitation was the sample size; the smaller sample size for hospital inpatient stay expenditures resulted in that dependent variable not being analyzed alone.

In addition, it is difficult to make claims of causality since the analysis is based on survey data. At best, it is possible to report that differences and disparities do exist in the population as the results of the study show. These may offer hints toward causality, but not actual proof.

5.9 Recommendations for Future Research

Examining the potential causes of disparities, such as the potential of how or why different races and ethnicities seem to exhibit different levels of trust when it comes to the medical profession, may be influential in relieving racial and ethnic disparities. In addition, there may be more research to examine if different races and ethnicities within the United States respond differently to self-reported health status questions. Examining potential barriers in access to care for rural populations in terms of access to varied or more modern forms of health care technology may help rural populations have better access to care.

One crucial recommendation that can add to understanding of utilization and expenditure disparities would be to control for cancer stage at diagnosis by using a database that has this information. This will allow for better control of the dependent variables, as similar subjects will further be controlled within the research models.

5.10 Conclusion

This study confirms the continued existence of significant health disparities in the prostate cancer population. By using updated and more current data, significant disparities still exist, and reaching the Healthy People 2010 goal of reducing or even eliminating disparities may be quite difficult. Race and ethnicity-based disparities are particularly glaring problems that need to be addressed. Black patients have far greater expenditures, but in general have less relative resource utilization than whites, and that is

a confounding conclusion. Hispanic patients continue to be disadvantaged in terms of outpatient visits. In order to have a more equitable society, these issues need to be further researched.

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Appendix A

GOF Measures for Regression Models

Only models used in the analysis are listed here. Models not used in the analysis either did not have significance (total utilization, office-based medical provider visits utilization) or the sample size was too small (hospital inpatient stay expenditures).

Table A.1

Hospital Inpatient Stay Utilization Negative Binomial Survey Model GOF Measure

Number of obs	978
Design df	170
F(14, 157)	4.62
Prob > F	0.0000

Table A.2

Outpatient Visit Utilization Negative Binomial Survey Model GOF Measure

Number of obs	978
Design df	170
F(14, 157)	1.65
Prob > F	0.0071

Table A.3

Prescribed Medicines Utilization Negative Binomial Survey Model GOF Measure

Number of obs	978
Design df	170
F(14, 157)	1.92
Prob > F	0.0275

Table A.4

Office-Based Medical Provider Visit Utilization Logistic Survey Model GOF Measure

Criterion	Intercept Only	Intercept and Covariates
AIC	9852390.1	9468146.7
SC	9852394.9	9468219.8
-2 Log L	9852388.1	9468116.7

Table A.5

Office-Based Medical Provider Visit Utilization Logistic Survey Model Global Null Hypothesis Test

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	384271.375	14	<0.0001
Score	419732.324	14	<0.0001
Wald	48.14	14	<0.0001

Table A.6

Hospital Inpatient Stay Utilization Logistic Survey Model GOF Measure

Criterion	Intercept Only	Intercept and Covariates
AIC	6313724	5748522.9
SC	6313728.9	5748596
-2 Log L	6313722	5748492.9

Table A.7

Hospital Inpatient Stay Utilization Logistic Survey Model Global Null Hypothesis Test

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	565229.153	14	<0.0001
Score	564623.661	14	<0.0001
Wald	68.6073	14	<0.0001

Table A.8

Outpatient Visit Utilization Logistic Survey Model GOF Measure

Criterion	Intercept Only	Intercept and Covariates
AIC	11034991	10558083
SC	11034996	10558156
-2 Log L	11034989	10558053

Table A.9

Outpatient Visit Utilization Logistic Survey Model Global Null Hypothesis Test

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	476936.447	14	<0.0001
Score	484124.521	14	<0.0001
Wald	60.178	14	<0.0001

Table A.10

Prescribed Medicines Utilization Logistic Survey Model GOF Measure

Criterion	Intercept Only	Intercept and Covariates
AIC	14432835	14203695
SC	14432840	14203768
-2 Log L	14432833	14203665

Table A.11

Prescribed Medicines Utilization Logistic Survey Model Global Null Hypothesis Test

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	229168.315	14	<0.0001
Score	229840.267	14	<0.0001
Wald	27.2445	14	0.0179

Table A.12

Office-Based Medical Provider Visits Expenditures GOF Measure (N = 782)

R-square	0.01971
Root MSE	15793
Denominator DF	229

Table A.13

Outpatient Visits Expenditures GOF Measure (N = 189)

R-square	0.07419
Root MSE	7577.81
Denominator DF	98

Table A.14

Prescribed Medicines Expenditures GOF Measure (N = 349)

R-square	0.05596
Root MSE	1089.13
Denominator DF	158

Table A.15

Total Expenditures GOF Measure (N = 852)

R-square	0.03261
Root MSE	17202
Denominator DF	241

Appendix B

Race Per Year Table

Table B.1

Race per Year of Prostate Cancer Patients in MEPS 2000-2008

MEPS File Year	White	Black	Other Race
2000	56	19	0
2001	80	15	1
2002	102	19	4
2003	86	16	2
2004	95	12	4
2005	86	18	6
2006	79	27	2
2007	104	26	7
2008	118	27	7
Total	806	179	33