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The Impact of a Coordinated Care Program on Uninsured, Chronically Ill Patients

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The Effect of a Coordinated Care Program
On Uninsured, Chronically Ill Patients

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University

by

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ABSTRACT

THE EFFECT OF A COORDINATED CARE PROGRAM ON UNINSURED,
CHRONICALLY ILL PATIENTS

By Jennifer Christine Mills Neimeyer, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of
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This study explored how being enrolled in a program that both coordinates patient care

and provides a medical home changes health care utilization for uninsured patients, more

specifically those persons with chronic conditions, through the use of the Chronic Care

Model and Andersen and Aday's Behavioral Model for Access to Health Care.

Uninsured patients typically seek out care in a fragmented manner, which may lead to

ineffective and inefficient care, especially for conditions that may require ongoing

treatment and monitoring such as chronic conditions.   The methodology used to examine

the relationship between the interaction of enrollment and chronic condition status and

health care utilization was multivariate linear regression.   The results of this study show

that enrollment in a coordinated care program does have an impact on health care

utilization, and that the impact differs for patients with no chronic conditions, a single chronic condition, and multiple chronic conditions. These results point to the effectiveness of implementing the Chronic Care Model to improve access to health care for patients with chronic conditions.

CHAPTER 1: INTRODUCTION

The purpose of this study is to explore how being enrolled in a program that both coordinates patient care and provides a medical home changes health care utilization for uninsured patients, more specifically those persons with chronic conditions.   The study will be carried out using patients who have been enrolled in Virginia Coordinated Care for the Uninsured (VCC) program, which was established by the Virginia Commonwealth University Health System (VCUHS) to enable the enterprise to better serve a subset of its uninsured patient population.

The provision of health care to uninsured patients has been studied in a variety of different contexts, especially with respect to utilization and outcomes for these patients. This study provides a unique opportunity to delve into one such program, which attempts to transform what has been episodic, on-demand care into a program of coordinated care for uninsured patients, in order to study the impact of such a program on patients with chronic conditions.   Provision of health care for the uninsured is often provided in an extremely fragmented manner, which leads to a decreased quality of care for indigent patients, especially those with chronic conditions who require more frequent and complex utilization than patients with acute health problems.

Indigent Care and the Uninsured

Each year, the number of Americans without health insurance continues to increase. According to the United States Census Bureau, at the end of 2007 the number of uninsured persons in the United States totaled around 45.7 million people, accounting for a little over 15% of the population (US Census Bureau, 2008).   The number of uninsured persons is a result of an increase in the cost of insurance, making it less desirable or impossible for employers to offer their workers health care coverage.   In addition, the cost of caring for the uninsured was estimated at around $35 billion in 2001 (The Cost of Caring for the Uninsured, www.kff.org).   The cost of caring for the uninsured reflects hospitals' uncompensated care costs, clinics and direct care programs, and uncompensated and reduced-fee care provided by physicians.

The cost of caring for the uninsured and the burden it places on the health care system does not reflect the equally important problems of the reduced quality of care and the difficulty accessing care that uninsured patients often face.   Much of the safety net care that is provided to patients is done so in a manner that is extremely fragmented and lacks continuity, which means that care is not provided in an efficient and effective manner.   According to the Commonwealth Fund, those who are uninsured are more likely to report poorer quality care and chronic conditions are less likely to be properly managed; and the use of emergency rooms and inpatient hospital care is twice as high for those with chronic conditions who are uninsured as for those who are continuously insured (35% versus 16%). The Commonwealth Fund report reflects that uninsured patients often require more complex and costly treatments when they do seek health care

because by the time they access the care they need, they often have more advanced

medical conditions (The Uninsured and Their Access to Health Care, www.kff.org).

The Role of Insurance in Providing Health Care Access

Providing care for uninsured patients has been an issue that health care providers

have had to deal with ever since health insurance became more common around the time

of World War II.   Since an employer may provide health insurance, those who are

unemployed and those whose employers do not provide health insurance have faced

problems in accessing the health care system.   A study by Hadley (2007) shows that

patients without insurance are much less likely than patients with insurance to make

subsequent visits to a health care provider, even when they are recommended, suggesting

that uninsured patients do not receive the follow-up care they require, especially in the

face of chronic conditions.

The number of those without health insurance in the United States has been rising

steadily over the last 20 years (US Census, 2006).   This means that as more people are

without health insurance, the burden that they place on the health care system becomes

greater.   Providing health care for uninsured patients is costly and often inefficient.

Since the health care system is designed around patients who have health care coverage,

the care that is provided for patients without insurance can be very fragmented and

unnecessarily expensive for both patients and providers.   This means that patients who

require ongoing utilization with the health care system, such as those with chronic

conditions, often do not receive care that is up to par with the care that patients with

health care coverage are able to receive.   As an answer to this, many health care providers seek to create solutions for the patients who they treat.

<div align="center">Chronic Disease and the Chronic Care Model</div>

In 2009, Nearly half of all Americans, or about 133 million people, have a chronic condition.   In addition, nearly half of these people have more than one chronic condition. Since chronic conditions are so common, it is becoming increasingly important for health care providers to be able to provide high quality care for these patients (Improving Chronic Illness Care, www.improvingchroniccare.org, 2009).   According to the Center for Disease Control, those with chronic conditions account for around 75% of the nation's health care costs, or about $1.5 trillion (2007).

The chronic care model was first developed in 1993 as a synthesis of literature by the MacColl Institute for Health Care Innovation (Wagner, 1998).   Later refinements by a panel of experts and comparison with leading chronic care programs across the country led to an update of the model in 1998 and a similar process was undertaken in 2001, which led to the creation of the current model (Wagner et al, 2001).

The current chronic care model identifies the idealized elements of a health care system that encourages high-quality chronic disease care. These elements are the community, the health system, self-management support, delivery system design, decision support and clinical information systems (Improving Chronic Illness Care, 2008). By putting these elements into practice through various types of programs, health outcomes for patients with chronic conditions can be improved (Wagner, 1998), even for programs that are only able to undertake few of the elements.

Virginia Coordinated Care

This study is concerned with how uninsured patients seek out health care, especially in the face of chronic conditions. In many markets, academic medical centers provide a bulk of the health care for indigent patients. This is also true for VCUHS. While the Health System provides care for a large portion of indigent persons in the Richmond area, it did not seek to impact where and when these patients received care, and how they received care. However, indigent patients with chronic conditions can place a large burden on such a system, especially in receiving episodic care. This led to the formation of the Virginia Coordinated Care program, which provides indigent patients within the city of Richmond with a medical home and a way to coordinate their care to ideally make it more appropriate.

VCC was established in 2000 through funding provided by the VCU Health System and enrolled approximately 11,400 Richmond-area uninsured patients in that first year.   As of January 2007, enrollment approached 19,000.   VCC enrolls patients from the VCU Health System on the basis of a financial screening and zip code of residence. Low income persons who obtain services at VCUHS and who do not qualify for either private or public coverage may be enrolled in the program to have their care covered by VCC. This means that patients with a variety of conditions become members of VCC as the screening process does not reflect a medical need.   Since VCC is a coordinated care program, not all patients will be served equally well by such a program—since many of them may have only short-term needs and do not seek care regularly at the VCUHS. It is estimated through Health System reports that nearly half of all VCC patients do not seek

care the VCU Health System or other VCC providers within the year they are enrolled and do not re-enroll once their year is up.

VCC is a program that is designed to provide access to affordable health care for uninsured individuals living in the Greater Richmond Metro and the Tri Cities areas. VCC enrollees are assigned to a primary care physician who is responsible for providing routine care as well as being an access point for specialty services.   A variety of services are covered in the VCC program including many components of primary care, hospital services, pharmacy services, emergency vision and dental services, behavioral and mental health services, and OB/GYN services for women. The VCC program also offers the opportunity for enrollees to be covered for treatment at another Richmond area hospital that is not affiliated with the VCU Health System, Richmond Community Hospital.

In addition to health care services, VCC provides a number of elements that mirror managed care plans, most notably a medical home, a network of providers, care managers, and the means for promoting and tracking continuity of care.   This encourages patients to be seen in primary care settings rather than waiting until their health care needs become more acute and therefore needing to be seen in a hospital setting. Also, by coordinating patient care with specialty providers in the VCUHS, diseases and conditions can be diagnosed and treated on a more preventive basis, which is often less costly and more efficient than episodic care.   As mentioned, around 50 percent of patients who enroll in VCC do not maintain their enrollment after the initial 12 months.   The other half who do re-enroll in VCC are patients who most likely have ongoing health care

needs in the form of chronic conditions as nearly half of the US population lives with a chronic condition (Improving Chronic Illness Care, 2008).

Statement of the Problem

This study aims to assess the role of a coordinated care program in the treatment of chronic conditions in an indigent population.   By examining chronic care for indigent patients, this study will add to the body of knowledge surrounding how these patients access the health care system and how this access might be improved, both in terms of quality and cost.

VCC provides a unique opportunity for study, as it is a coordinated care program with a mixture of patients with chronic and acute conditions.   A substantial number of the persons with chronic conditions (e.g. diabetes, asthma, congestive heart failure) have been long term patients of the VCUHS and thus it is possible to explore how transitioning these patients into a coordinated care system may alter their patterns of utilization for the conditions.   A relatively large percentage of patients with chronic conditions allows research to be conducted on how enrollment in such a program impacts utilization for this unique population, which will enhance the body of knowledge surrounding chronic care for the uninsured.

This research will use both the chronic care model developed by Wagner (1998), as well as the access to health care model as most recently put forth by Andersen and Aday (1995). The chronic care model will be used to identify the key components of structured delivery systems for persons with chronic illness and how the components may affect use of services.   This will be used as an ideal model to show how enrollment in

VCC, which provides a subset of chronic care services, may change the way patients with chronic conditions seek and obtain health care. The access to health care model will be used to explain how enrollment in VCC may change the way that patients access and utilize the health care system as they move into a more structured delivery arrangement, and will be used as a way to organize the predisposing characteristics of enrollees in the VCC program, the enabling resources of the VCC program, and the resulting use of health care services. Combining these two models will show the impact of enrollment on patient behavior and how their utilization of health care services may change.

Research Questions

Based on the information above about providing health care to patients with chronic conditions in a coordinated care program, the following questions of interest will be addressed in this paper:

1. How does being enrolled in a program that provides coordination of care services, including a medical home, change health care access and utilization for uninsured patients?

2. Does enrollment in a program that provides managed care services have a larger impact on health care access and utilization for those with multiple chronic conditions than those with a single chronic condition?

By addressing these questions, this study will enhance not only the body of knowledge about how a coordinated care program might change utilization of health care services, but will also improve understanding of the chronic care model and how it might be applied to different populations and different situations.

Study Methodology

The sample for this study includes all VCUHS patients that are enrolled in the VCC program since its inception. To qualify, patients must meet criteria based on age, income, locality, and insurance status. Patients must not have any other insurance, and must be low-income, meaning that anyone over age 65 who is a US citizen does not qualify for this program as they are covered by Medicare. Similarly, any low-income child should qualify for Medicaid, so enrollees should only be between ages 19 and 64. Also, patients must reside in the Richmond area, as defined by a zip code catchment area.

In order to study enrollee utilization and how it changes in the face of enrollment in a coordinated care program, the Andersen and Aday Behavioral Model of Access to Health Care (Andersen & Aday, 1995) will be used to organize the many facets that impact utilization. In the model, there are two types of categories that impact health care utilization and in turn, health outcomes: predisposing characteristics and enabling resources. Within predisposing characteristics, the Andersen and Aday model considers both medical need and demographic characteristics.   For this study, medical need is considered through an enrollee's chronic condition status and their risk level; and the demographic characteristics are age, gender, and race/ethnicity.

The other factor in the Andersen and Aday model that impacts health care utilization is enabling resources. Since this study is concerned with how enrollment in a coordinated care program impacts utilization, the primary enabling resource is the program itself. The VCC program provides access to a medical home which helps to coordinate patient care, as well as to provide enrollees with access to other resources that

they could or did not access before. Since enrollees may become better at using program resources to utilize health care in a more appropriate manner the longer they are enrolled, length of enrollment will be considered as well. Past insurance enrollment is also considered to be an enabling resource as it previously aided in access to health care.

The main aim of this study is to examine utilization and how utilization changes after enrollment, especially by those enrollees with one or more chronic conditions. Several different ways of measuring utilization will be used in this study to provide a more complete picture of utilization, including number of encounters with VCC providers (primary care physician use, outpatient hospital use, and inpatient hospitalization) and total cost. Additionally to examine how enrollees in the VCC program use health care services, appropriateness of ED use and hospitalizations for ambulatory sensitive conditions will be considered.

This study will use a panel design to determine how utilization changes upon enrollment in the VCC program. Since there are two periods, pre-enrollment and during enrollment, the fixed effects and first differences models are equivalent will be used to examine the change in utilization. With this type of model, patient characteristics will not be included as they are the same in both periods. In order to test for differences based on patient characteristics, VCC enrollees will be divided into groups to check for differences in change in utilization.

Policy Implications

The results of this study have the potential to impact the way health care is provided to indigent patients with chronic conditions. Currently, the health care system

for indigent patients is quite fragmented.   This is sufficient for some patients who need care on an acute basis, but does not provide adequate care for patients with complex and ongoing healthcare needs.   As a result of this, many health care systems and local communities are enacting their own solutions to improve care for this patient population, but many of them cannot show results of enrolling patients in programs that are intended to improve access to health care for those who need it.

By showing the impact of a coordinated care program on indigent patients with chronic conditions, this study can help inform policy and business decisions on how to create programs that effectively improve access and quality of care for these patients in an efficient manner.

Summary

In summary, this study was designed to help determine how enrollment in a coordinated care program may impact the way indigent patients with chronic conditions access the health care system.   Chronic care costs account for a large percentage of health care costs, and by treating indigent patients with chronic conditions in a more appropriate manner, not only will quality of life be improved for these patients, but the burden of these patients on the health care system will be lessened.   By using information collected on VCC patients with chronic conditions, the questions raised in this study regarding chronic care for indigent patients will be answered.

In the following chapters, indigent care, the chronic care model, and the Behavioral Access to Health Care model will be explored in more detail.   Chapter 2 contains information in indigent patient care, the health care safety net, and chronic

conditions.   Chapter 3 will address the Chronic Care Model and the Behavioral Access to

Health Care Model, developed by Andersen and Aday, including their development and

use.   Chapter 4 will detail the study design, sample, and data analysis and methodology.

Chapter 5 will present the results of this analysis, while Chapter 6 will discuss the

implications of the results as well as limitations, implications, and areas of future

research.

CHAPTER 2: REVIEW OF LITERATURE

In this chapter, relevant literature and prior studies will be examined in order to form a base of knowledge surrounding the uninsured and how they seek care, sources of disparity in health care, chronic conditions and the uninsured, and some of the problems around providing chronic care for the uninsured.   Then, the relationship between the uninsured with chronic conditions and how they seek care will be examined, as well as how the chronic care model fits in with the current safety net health care system. To understand these issues by examining recent studies, it will then be possible to apply this knowledge to the research question at hand. In turn, this will help to better understand how a multi-faceted coordinated care program will impact health care access for indigent patients with chronic conditions.

The Uninsured

Insurance coverage is perhaps one of the strongest enabling resources in being able to access health care when it is needed and of having improved health outcomes when care is accessed (Eisert & Gabow, 2002; Ayanian et al., 2000; Baker et al., 2000). The way the United States health care system is structured necessitates that patients have a means for paying for the health services that they receive, with health insurance being one of the common means. However, many Americans do not have health insurance. Most patients without health insurance do not choose to be in such a situation, and in fact

understand the need for health insurance and the importance of insurance in gaining

access to health care (Weisbrod, 1991). Without health insurance, many people do not

receive the health care that they need in a timely manner. In addition, those without

health insurance face serious medical and financial ramifications when they do seek

health care, as it is often intensive and quite costly (Hadley, 2003).

Who are the Uninsured

According to the US Census Bureau, as of 2007 the number of uninsured in the

United States totaled around 45.7 million people, accounting for just over 15% of the

population. This reflects a 1.4% increase in the past 5 years, increasing the number of

uninsured by about 5.5 million. Of this group, about 45% are below 200% of the federal

poverty level. The federal poverty level was $20,614 for a family of four in 2006, so

200% of this would be $41,228 (www.kff.org, 2006).

In addition, more than 80% of the uninsured come from working families, and

70% of families having at least one member employed full time. Only 18% of the

uninsured have no family connection to the workforce. Most of the working uninsured is

so because their employer does not offer coverage and they cannot afford to buy it on

their own (www.kff.org, 2006; Singh & Golden, 2006, www.covertheuninsured.org,

2007). This means that a large percentage of the uninsured is made up by the working

poor, a factor that is often ignored. There is also a portion of the uninsured who have

higher incomes. These people are often self-employed or employed at small businesses

and choose to not have health insurance. There is also a group of the uninsured who are

over 200 percent of the federal poverty level, but they are not a consideration in this study as they are not eligible for the Virginia Coordinated Care program.

Racial and ethnic minorities are much more likely to be uninsured than whites. Around 13% of whites are uninsured, compared to about 22% of African Americans, 36% of Hispanics, and 33% of Native Americans. This disparity reflects the fact that minorities are much less likely to have health insurance offered through their jobs, to be eligible for the benefit, or be able to afford their share of the premiums (www.kff.org, 2006). In addition, more recent immigrants might not understand the health care system in the United States and therefore the importance of having health insurance. Interestingly, 17% of Asians are uninsured. This reflects their higher likelihood of having better paying jobs and jobs that offer health insurance coverage (Singh & Golden, 2006).

Of the uninsured, 20% are age 18 or younger.   This group is made up of children in families that are not poor enough to be covered by Medicaid and but who also do not have private insurance coverage.   Children in families that are poor can get coverage through Medicaid, as can the disabled.   The other 80% of the uninsured are ages 19-64, with younger adults having a higher likelihood of being uninsured than older adults because they typically have lower income and lower perceived health risks (Singh & Golden, 2006). Therefore, as age increases, the likelihood of having insurance coverage also increases.   This is because older adults often have jobs that offer health care coverage and higher pay, making it easier to obtain health insurance.   In addition to

being more able to obtain insurance, older adults are more likely to have more ongoing

health needs, so it is more likely that they will be interested in health insurance coverage.

Most people age 65 and older have health insurance coverage through Medicare

(www.kff.org, 2006). However, Medicare by itself does not offer comprehensive

coverage, leaving gaps for those who do not purchase supplemental insurance.

According to a report by Cover the Uninsured, women are somewhat more likely

than men to have health insurance coverage than men, although they are less likely to

have this coverage through an employer (www.covertheuninsured.org, 2007). This same

report states that women are also covered by Medicaid while they are pregnant if they

have low income, but this coverage only lasts for the time while they are pregnant and the

birth. In addition, women are more likely than men to have health insurance and to have

a regular health care provider because of many of the beliefs around women's health and

the need to have regular exams in order to get birth control. Also, women typically

access the health care system more than men, which may either be a result of their

increased likelihood of having health insurance or may be the cause of their increased

likelihood of having health insurance (www.covertheuninsured.org, 2007).

The Importance of Health Insurance

Health insurance is one of the main indicators of being able to access the health

care system in a timely manner when it is needed. Being able to access the system when

it is needed has a large impact on health outcomes and quality of life. Lack of health

insurance typically leads to lack of accessing the health care system (Eisert & Gabow,

2002). This means that those without health insurance typically go without care that they need as compared to those with insurance (Ayanian et al., 2000). Some patients without health insurance do manage to have a regular source of care, but even in these cases their health care is still less in quantity and quality than those with insurance (Sox et al., 1998). This is even true in cases where the patient has ongoing health care needs following an acute disease episode that requires follow up care from a physician (Baker et al., 2000).

In many cases, uninsured patients seek out health care in hospital emergency departments, often for a variety of reasons. One reason that uninsured persons frequent hospital Emergency Departments (EDs) is that they know they are guaranteed treatment there, and they know that they will not be turned away (Dohan, 2002). This is in part due to regulations such as the Emergency Medical Treatment and Active Labor Act, and in part due to personal beliefs of the patient. A belief that the ED is the only place they can seek care compounds this problem for the uninsured. Also, the uninsured often wait longer before seeing a doctor, making it more likely that they require emergency services (White et al., 2007). As a result of having a bulk of their health care delivered in the ED, patients without health insurance often go without preventive services and tests that are given on a regular basis to those with insurance, meaning that patients without insurance are more likely to suffer from diseases that the insured do not (Zuvekas & Weinick, 1999).

Based on poor health outcomes from not being able to access the health care system, not having health insurance can subsequently have a negative impact on health

and quality of life. Not only that, but not having health insurance over an adult lifetime can lead to a decline in overall health (Quesnal-Vallee, 2004). Among the near-elderly, not having insurance puts them at greater risk of dying prematurely than their insured peers (McWilliams et al., 2004). In addition, the longer a person is uninsured, the lower their health is inclined to be, and therefore their quality of life also becomes lower (Baker et al., 2001). These relationships hold true even when controlling for other sociodemographic variables such as income and race/ethnicity (Bharmal & Thomas, 2005).

These problems are becoming more and more relevant as both the number and percentage of Americans are uninsured. The cost of health insurance premiums has been steadily rising, making it difficult for employers to continue to offer their workers health insurance (Kronick & Gilmer, 1999), explains much of the decline in health care coverage. Even among those employers that do offer health insurance coverage to their employees, some employees are declining coverage, also due to the high cost. Employees that decline coverage simply cannot afford their share of the premiums (Cooper & Schone, 1997). Some of this slack has been taken up by private insurance purchased for an individual or a family and by expanding government sponsored health insurance, such as Medicaid (Holahan et al., 1995).

There are two government programs that offer health care coverage to select groups. These programs are Medicare and Medicaid. Medicare is run by the federal government and provides health care coverage to those who have worked 10 years in

Medicare-covered employment and are over age 65, some who are disabled, and those

with end-stage renal disease. This coverage includes inpatient hospital care, hospice

services, home health services, doctor's services, outpatient care, and prescription drugs,

but does not cover long term care, dental care, eye care, and hearing care and aids.

Medicaid is administered by each state, and so coverage varies from state to state

(http://www.medicare.gov, 2007).   In Virginia, those eligible for Medicaid include

children and pregnant women in families below 133 percent of the federal poverty level

through programs such as State Children's Health Insurance Program; those who are over

age 65, are blind or disabled and below 80 percent of the federal poverty level; and those

who require long term care (longer than 30 days) whose income and resources are

insufficient to cover the cost of their care

(http://www.dss.virginia.gov/benefit/me_famis/, 2007).   Medicaid covers different health

care procedures depending upon which program the participant is enrolled in, but

typically includes hospital care, doctor's visits, prescription drug coverage, mental health

services, and rehabilitative services.

Due to the strict guidelines surrounding income and disability requirements for

those who wish to enroll in Medicare and Medicaid, there are many patients with health

care needs who are not eligible for coverage. Many of these patients turn to programs

like VCC because their employer does not offer health insurance but they do not qualify

for a government program and cannot afford to purchase private insurance. Another

reason that patients turn to programs such as VCC is because they have a high level of

health care needs that they could not afford otherwise, but do not have so many health care needs that they can be defined as disabled.

<div align="center">Sources of Health Care for the Uninsured</div>

Caring for the uninsured is a task that involves the entire spectrum of health care providers. Typically, the uninsured are treated in community clinics and safety net hospitals. These clinics and hospitals are often operated by the government or non-profit organizations and provide a bulk of the health care for the uninsured, including specialty care, laboratory work, diagnostic work, and prescription medicines. However, this care is often fragmented, inefficient, and costly, especially considering that health outcomes for the uninsured are typically worse when taking the cost of providing this care into account (www.kff.org, 2003).

<div align="center">*The Health Care Safety Net*</div>

The health care safety net is made up of a variety of health care providers, ranging from primary care to emergency departments to prescription drugs. In the outpatient setting, there are three main types of safety net providers: community health centers and clinics, physicians' offices, and hospital outpatient clinics (Forrest & Whelan, 2000). Hospitals also provide safety net care primarily through their emergency departments, but also through the inpatient setting, specialists, and labs. Many hospitals provide these services, but there are hospitals that provide a higher proportion of care to indigent patients which also receive more funding from the government. These are typically

government, non-profit, or teaching hospitals.   Hospitals can also provide prescription

drugs to the uninsured (Cunningham & Tu, 1997).

The health care safety net also includes public health organizations and other

health related non-profit organizations.   According to the Institute of Medicine, a core

safety net provider has the two following distinguishing characteristics: (1) By legal

mandate or explicitly adopted mission, they maintain an "open door," offering patients

access to services regardless of their ability to pay; and (2) a substantial share of their

patient mix is uninsured, Medicaid, and other vulnerable patients (IOM, 2000).

Since the health care safety net is financed primarily through government funds

and grants, it is somewhat fragile and is very fluid in its composition.   Over the last

several years, as the number of uninsured has increased, the capacity of the health care

safety nets have also increased in many communities, although at a somewhat slower rate

(Felland et al., 2003; Mann et al, 1997).   Also, the number of community based primary

care providers has increased in an attempt to remove some of the burden from safety net

hospitals and to provide care in a more cost effective setting (Hadley & Cunningham,

2004).

Even though the community-based health care safety net has been increasing in

size over the last several years, there has been an increasing fear over the vulnerability of

the safety net.   Many safety net providers are facing decreases in funding from the

government, and are taking on more patients as they are being encouraged to seek care in

a community setting rather than from hospitals.   Even in this case, hospitals are still

needed to provide specialty and diagnostic services (Gusmano et al., 2002). However, by changing the financing structure of the safety net to make community based clinics more viable, the entire safety net could be strengthened (Asplin, 2001).

In addition to these problems, many safety net providers face other difficulties such as lack of appropriate staff, lack of access to laboratories and other facilities and specialists, language and culture barriers, and lack of support from their communities (Hortin, 2006). The safety net performs an important function, but in recent years the safety net has been put in the spotlight with regard to these and other issues, such as efficiency and effectiveness. This has also weakened the health care safety net, as this has tarnished its reputation in many communities, making it difficult for the safety nets to try and secure additional funding and support.

However, the desirability of promoting a strong health care provider safety net has for some time been called into question. There are many studies that suggest that it would be more effective to use funding for these sites to enroll patients in health care coverage programs (Busch & Duchovny, 2005; Manning et al., 1987), meaning that they would, on the whole, no longer need to utilize the safety net system and could obtain care from more routine sources (Baxter & Mechanic, 1997). The hospitals and clinics that make up a majority of the health care safety net understand the importance of increasing insurance enrollment and improving managed care practices, and are now attempting to work with these organizations rather than competing with them (Lipson & Naierman, 1996). More recently, strengthening the health care safety net is the primary focus of

trying to eliminate disparities in health care based on insurance coverage and the patient's

ability to pay for their care (Politzer et al., 2001.)

Safety Net Hospitals

A large part of the health care safety net, and the organizer of the program that is

the subject of this study, are safety net hospitals. Although there has recently been a shift

in the composition of the safety net to include more community based providers, safety

net hospitals still provide a large amount of health care to the uninsured.   Also, hospitals

are realizing that uninsured patients can be treated in a more efficient and effective

manner in community based settings, and are developing programs to move care out into

the community (Taylor, 2001). However, there are still services that must be provided in

the hospital, such as specialized services, diagnostics, and care for critically ill persons

(Meyer, 2004). These hospitals face the same problem as many of the community based

clinics in maintaining staff levels, providing high quality care, and providing culturally

competent care.

Safety net hospitals are those that provide a significant level of care to low-

income, uninsured, and vulnerable populations (National Association of Public Hospitals

and Health Systems (NAPH), 2006). Hospitals that have a low income utilization rate of

25 percent or more or a high level of Medicaid utilization receive funding from the

government since they are a hospital with a disproportionate share of these patients.

Teaching hospitals also receive some aid from the government, and provide charity care

by their students in return. Safety net hospitals also provide large amounts of

uncompensated care, for which they get no direct reimbursement (Fishman & Bentley, 1997).

Most safety net hospitals are located in urban areas, are large, and provide a high level of complex care. In addition, many teaching and medical school hospitals provide a large amount of care to indigent patients in return for teaching opportunities for their students and for funding (www.kff.org, 2005). Privately owned for-profit hospitals do provide uncompensated care, a trend that has been increasing in recent years (Mann et al., 1995). Even though these hospitals provide some care for indigent patients, the amount they provide fluctuates with the amount of funding they receive and the amount they are willing to contribute to such care, which is often based on their financial performance, whereas nonprofit hospitals typically provide a steady amount of care for the uninsured over time (Ferris & Graddy, 1999). In addition, non-profit hospitals are less likely to have to close because they are losing money, and are more likely to continue to offer services that do not make money, such as burn units and trauma centers (Zuckerman et al., 2001).

Many safety net hospitals receive funds from Medicare and Medicaid because they see a relatively large number of low-income patients with special needs. This is known as disproportionate share funding, and helps offset the high costs of treating low-income, high acuity patients (Medicare Disproportionate Fact Sheet, 2008). A hospital can qualify to receive disproportionate share funding either by treating a large number of low-income patients, or by having a relatively high portion of their revenue come from

state and local government sources for indigent care (Centers for Medicare & Medicaid

Services, 2008).   States may also receive funds from the federal government for services

provided to Medicaid patients that are reimbursed at a lower level than Medicare allows.

These are known as upper payment limits, and may be used and disbursed as the state

sees fit (The Lewin Group, 2006). In addition, the Commonwealth of Virginia has also

established the Indigent Care Trust Fund. The trust fund is funded by the General

Assembly, mandatory hospital contributions, and voluntary contributions from hospitals

and other entities such as local governments. Hospitals are then reimbursed from the

Fund for charity care that they provide in excess of the state charity care standard

(Community Catalyst, 2009).

As safety net hospitals are realizing that a large amount of their care could be

shifted to community settings in order to save money, they are implementing programs in

conjunction with community based providers to encourage patients to seek care in a more

appropriate setting by applying many of the principles of managed care programs. In

2005, the National Association of Public Hospitals and Health Systems reported on five

safety net hospitals which had implemented such programs, including the VCC program

at the VCU Health Center. By working with the clinics, these hospitals are also working

to ensure that there is more continuity of care for uninsured patients, making the safety

net system as a whole not only more effective but also more efficient. However, one

drawback that many of these hospitals are facing is that they cannot use their

disproportionate share funding to help pay for this care since funding has been allocated

only to institutional providers.   This is hampering efforts that hospitals are making to try and improve care for the uninsured (Coughlin & Liska, 1998).

Richmond Area Uninsured

In 2007, Richmond Enhancing Access to Community Healthcare (REACH), a non-profit community interest group, compiled a report which contained information about the uninsured in the Richmond area.   The greater Richmond metropolitan area was examined in the REACH report, which included the cities of Richmond, Colonial Heights, Hopewell, and Petersburg as well as the counties of Chesterfield, Goochland, Hanover, Henrico, Prince George and Powhatan.   In this report, the number of persons in the Richmond area without health insurance in 2004 was approximately 129,000, or around 13 percent (REACH, 2007).

The Richmond area has a variety of community based health care providers that offer services to the uninsured. These providers include free clinics, Federally Qualified Health Centers (FQHC's), county based health district offices, and other community based providers such as low-cost clinics. Data were collected from five free clinics, two FQHCs, three other community-based health centers, and three health districts.   Table 1 shows visit and patient information pertaining to these providers, which is a synthesis of the REACH findings (2007).

In addition to the community based providers, there are also several hospitals in the Richmond Area. Those included in the REACH report are the VCU Health System, four Bon Secours hospitals, four Hospital Corporation of America hospitals, Southside

Table 1. Richmond Area Community-Based Health Care Providers

Type of Provider	Name of Provider	Number of Patients - 2004	Number of Patients - 2005	Number of Visits - 2004	Number of Visits - 2005
Free Clinics	Commonwealth Clinic	471	881	1,725	2,443
	Cross Over Ministry	4,212	3,673	16,673	14,794
	Fan Free Clinic	4,119	4,280	5,184	6,051
	Free Clinic of Goochland	564	610	1,849	3,265
	RAHBPC	2,184	2,371	2,193	735
FQHC's	Daily Planet Health Care for the Homeless	2,902	3,312	7,734	9,350
	Vernon J. Harris Health Center	6,496	6,896	10,249	9,225
Health Districts	Henrico Health District	11,985	12,846	-	-
	Chesterfield Health District	14,953	12,357	-	-
	Richmond Health District	1,663	6,164	-	-
Other Providers	Hayes E. Willis (VCUHS)	4,400	4,243	13,314	10,668
	Craig Health Center	1,029	1,173	4,172	4,078
	Planned Parenthood	7,747	8,909	8,299	9,418

Regional Medical Center, and Poplar Springs Hospital. Table 2, also from the REACH

report (2007), shows the inpatient hospital discharges for self-pay patients in 2005.

These data from the REACH report show that care for the uninsured in the

Richmond area, as is many other areas, is provided in a variety of settings across the

community, with the VCU Health System playing a large role in caring for those patients

with chronic conditions in need of specialized care.

Possible Solutions to the Plight of the Uninsured

Many of the solutions to the problems of providing health care to the uninsured

Table 2.   Richmond Area Hospital Discharges for Self-Pay Patients

Hospital	Self-pay Discharges	% of Total Self-Pay Discharges	All Discharges	% of Total Discharges
Bon Secours Memorial Regional Medical Center	182	3%	9,373	7%
Bon Secours Richmond Community Hospital	367	6%	2,693	2%
Bon Secours St. Mary's Hospital	323	5%	20,292	16%
Bon Secours St. Francis Hospital	17	<1%	977	1%
Total - Bon Secours Richmond Health System	889	14%	33,335	26%
CJW Medical Center	1,569	24%	31,493	25%
Henrico Doctors Hospital	485	7%	19,091	15%
John Randolph Hospital	415	6%	5,945	5%
Retreat Hospital	240	4%	3,923	3%
Total - HCA Richmond Hospitals	2,709	41%	60,452	48%
VCU Health System	2,203	33%	19,754	15%
Total - VCU Health System	2,203	33%	19,754	15%
Southside Regional Medical Center	530	8%	10,306	8%
Total - Southside Regional Medical Center	530	8%	10,306	8%
Poplar Springs Hospital	76	1%	1,114	1%
Total - Poplar Springs Hospital	76	1%	1,114	1%
Total Discharges for Richmond Area Residents at Local Hospitals	6,407	97%	124,961	97%
Total Discharges for Richmond Area Residents Treated in all Virginia Hospitals	6,579	100%	128,794	100%

involve enrolling them in programs that at least mimic the main components of health

insurance, such as providing a medical home or managed care (Gray & Rowe, 2000;

Davis, 2007). A medical home, in the context of this study, is defined as a community

based primary care provider that is accessible, continuous, comprehensive, family-

centered, coordinated, compassionate, and culturally effective (American Academy of Pediatrics, 2004). It is a place for patients to seek out primary care in a setting that focuses on fostering relationships between patients and practitioners, and can be effective in improving the quality of health care (Orazno et al., 2009).

Adults who have been enrolled into programs with managed care often still exhibit many of the same health seeking behaviors as they did prior to their enrollment, and also participate in the managed care components (Kwack et al., 2004). This means that they are still delaying care and still using the ED in an inappropriate manner for acute disease episodes, despite participating in the managed care program. This is not true for children, whose enrollment in an insurance program reduces their ED care and increases their primary care. This may be due in part to the availability of primary care providers for children and parents' attitudes surrounding the importance of their child's health care (Brousseau et al., 2002; Kravits et al., 1998).

Enrolling uninsured patients in health insurance or insurance-like plans has been a popular way to deal with providing health care to the uninsured, however, it has been shown that in communities with a high degree and high quality of available charity care, enrolling uninsured patients makes no difference in their quality and quantity of health care because of the availability of charity care (Herring, 2005). In addition, simply enrolling uninsured patients often does not provide them with access to the services that they require to stay healthy or to services of better quality (Eisenberg, 2000). Often patients in these programs have no choice in providers, little flexibility in access to care,

and little or no access to specialty or inpatient hospital services, as many of the health care providers for these services select to take on patients with better insurance coverage (Monnickendam et al., 2007).

However, it has also been found once patients enroll in health insurance programs, their utilization gradually increases, making it more similar to the utilization of those who have had insurance, indicating that their needs are now being met and were not before (Busch & Duchovny, 2005, Manning et al., 1987). As patients are enrolled in health insurance programs for longer amounts of time, their utilization increases until it matches that of those who have been insured for their adult lives (Schoen & DesRoches, 2000). Also, those who recently became insured were shown to have a more difficult time paying their medical bills, even the copayments for their insurance.   Therefore, those who have recently become insured reap little benefit in the first years as they have little disposable income and difficulty navigating the health care system (Hadley, 2003).

These studies show that by enrolling uninsured patients in both public and private health insurance, their access to and quality of health care may improve.   Therefore, many health care organizations such as the government, health care providers, or other organizations, wants to improve the health care for the uninsured, they will create insurance-like programs that closely mimic private health insurance plans.

Other Sources of Disparity in Health Care

There are several sources of disparity in health care. These are important to consider in addition to lack of health care coverage as they often contribute to or

compound difficulties in accessing the health care system. Differences in patient characteristics may indicate disparities and will be considered for purposes of this study include race/ethnicity, gender, age, and income. Patients often face reductions in the quality and quantity of health care that they receive based on their demographic characteristics (Freeman et al, 1987; Berk et al., 1995; Pincus et al., 1998).

In addition, patients with multiple characteristics associated with disadvantages often face even more disparities in the health care that they receive, compounding inequalities in access and quality. These characteristics and their impact on the provision of health care will be examined in more detail below. In addition, these characteristics work together along with lack of health care to compound difficulties that patients have in accessing the health care system.

Race and Ethnicity

Racial and ethnic minorities, on the whole, face disparities in health care. African Americans, Hispanics, Native Americans, and some Asian/Pacific Islander groups have reduced access to health care compared to whites, especially for diagnostic treatments and long term care (Mayberry et al, 2000). In addition, poor public health indicators, such as having higher infant mortality rates and higher mortality rates from conditions such as coronary disease, breast cancer, and diabetes in racial and ethnic minorities (Weinick et al, 2000). This is important because nearly one in four Americans is a racial or ethnic minority, and therefore their health care behaviors and health status are potentially affected by these disparities (Lillie-Blanton et al., 2000).

Disparities in health care based on race/ethnicity have a variety of causes including inability to pay for care, lack of transportation and child care, decreased understanding of treatment plans, and inability to incorporate prescribed health plans into daily living patterns (Russell & Jewell, 1992). Also, racial and ethnic minorities are less likely to have a regular source of care, meaning that their care is fragmented and lacks continuity (Weinick et al, 2000). Not only this, but these groups are also less likely to seek out preventative treatments and screenings, meaning that when these groups do seek out health care, they are more likely to need treatment of a higher intensity (Solis et al., 1990).

Gender

Throughout history, medical research and care has been focused on men. This means that health outcomes have typically been poorer for women, which is still true today (Mertzel, 2000). Even though women typically have longer life expectancies, they have historically had higher rates of morbidity and health service use, indicating that generally women are less healthy than men (Verbrugge, 1985; Verbrugge, 1989). Women routinely have higher rates of morbidity from acute conditions and nonfatal chronic diseases (Verbrugge, 1985). Women also have exhibited, perhaps as a result of higher morbidity rates, a greater likelihood of having health insurance and a regular source of care, meaning that they seek care more often than men, and in a more routine manner rather than for acute problems only (Mertzel, 2000). In spite of this, women are still thought to have worse health than men.

Age

Age is an interesting factor in access to health care in the United States because of Medicare and Medicaid. Children who are under the age of 18 and who live in low income households qualify for Medicaid coverage, which means that they have access to a somewhat stable source of health care, although the Medicaid system does have some gaps such as dental and vision coverage. Similarly, most Americans over age 65 qualify for Medicare coverage, meaning that they also have access to a stable but not comprehensive source of health care. Since these two groups are covered by Medicare and Medicaid, they are more likely to receive the care they need when they need it (Deaton & Paxson, 1998).

These two systems leave several gaps in health care coverage, which lead to disparities in health care. These gaps include those between the ages of 18 and 64, and children in families who do not qualify for Medicaid and also cannot afford health care or health insurance. Young adults typically consume less health care than older adults because they are more likely to be in good health. However, this means that when they do need to access the health care system, they are less likely to have a normal health care provider and are much more likely to wait until their health problem is more severe before they seek care.

Socioeconomic Status

Disparities in health care due to income have been a persistent problem in the United States (Lantz et al., 1998). Those with lower incomes have consistently had

reduced access to health care as well as poor health outcomes. People with lower socioeconomic status are more likely to visit the emergency department and less likely to access primary care (Schoen et al., 2000). These differences based on income are typically due to an inability to pay and lack of health care coverage. An inability to pay for health care (often compounded by a lack of health care coverage) leads many patients to put off accessing health care until it is absolutely necessary (Andrulis, 1998). Then, when they do finally seek care, those with lower incomes are more likely to need more complex care, including in hospital inpatient settings (Billings et al., 1993). In addition, those with low income are less likely to have health insurance, making it difficult to access health care when it is needed (Palmer, 2004; US Census, 2006). This relationship can also be explained by education, which is a strong predictor of income (Schittker, 2004).

In addition, communities with a high degree of unequal income distribution typically have poorer health as a whole (Kawachi & Kennedy, 1999). This has led to some question as to the nature of the relationship between income and health. Until recently, it was assumed that lower income communities have poorer health as a result of their income. However, recent studies have indicated that communities that have lower incomes are a result of the population having poor health (Deaton, 2003; Ettner, 1996; Smith, 1999; Smith, 2004). This is cause for concern because interventions have typically been aimed at reducing disparities in health care, but recent research suggests

that focusing interventions on income disparities may have better outcomes for communities, including reducing disparities in health care.

Multiple Factors and Interaction Effects

In many situations, there are multiple factors that work together to compound disparities in health care. For example, racial and ethnic minorities are more likely to have lower incomes, which would have a greater impact on health care access. This relationship is frequently studied because of the strong correlation between race/ethnicity and income, and their large impact on health care access (Fiscella et al., 2000; Kaufman et al., 1997). Other sources of disparity can work together as well, such as race/ethnicity and gender, age, and socioeconomic status. One study examining these factors found that even when controlling for income, gender and ethnicity sill play a large part in accessing the health care system (Adamson et al., 2003). In addition, older patients (under the age of 65 that do not qualify for Medicare) are much more likely to seek health care than younger patients (Campbell et al., 2001).

Being of a racial/ethnic minority makes it more likely that a person will have barriers to accessing health care as well as not having insurance, leading to a decreased likelihood of having a regular source of health care, of being able to get health care when it is needed, and poorer health outcomes (Hargraves & Hadley, 2003; Zuvekas & Taliaferro, 2003). This is also true of being male, being a young adult, and being poor. For example, a study by Selassie and colleagues (2003) found that those without insurance, who belonged to an ethnic minority, and who were male were more likely to

visit the ED with more acute health problems, indicating that they had been unable to seek primary care and thus waited for their condition to worsen before seeking care (Selassie et al., 2003). As the number of categories that are associated with decreased access to health care that a person falls into increases, their likelihood of having insurance, of being in good health, of having access to health care, and of obtaining quality of health care becomes less and less possible. Therefore, while many of the problems of the uninsured would be mitigated by addressing their insurance status, many of the uninsured face additional barriers in access to health care that would concurrently need to be addressed.

<div align="center">Chronic Conditions and the Provision of Chronic Care</div>

As of 2007, nearly half of all Americans, or about 133 million people, have a chronic condition. In addition, nearly half of these people have more than one chronic condition. Since chronic conditions are so common, it is becoming increasingly important for health care providers to be able to provide high quality care for these patients (Improving Chronic Illness Care, 2007).

<div align="center">*Chronic Conditions in the United States*</div>

Chronic conditions account for nearly 70 percent of deaths each year in the United States (Centers for Disease Control and Prevention, 2005) and about 47 percent world-wide (Epping-Jordan, 2004). By 2030, this number is expected to be over 170 million (Wu & Green, 2000). In addition, over 75 percent of all health care costs in the United States are incurred by those with chronic conditions, which is about $1.05 trillion

annually (Wu & Green, 2000). Among those aged 18 to 64 with chronic conditions, which accounts for around half of those with chronic conditions (Center for Studying Health System Change, 2004), the most prevalent conditions are hypertension, respiratory diseases, arthritis, and chronic mental conditions (Robert Wood Johnson Foundation, 2004). The leading causes of death for those with chronic conditions are heart disease, cancer, and stroke (Centers for Disease Control and Prevention, 2005)

According to the Centers for Disease Control and Prevention, the burden of chronic conditions on racial and ethnic minorities is greater, as it also is for women (2005). In 1998, rates of death from cardiovascular disease were about 30% higher among African American adults than among white adults. Also, the prevalence of diabetes is 70% higher among African Americans and nearly 100% higher among Hispanics than among whites, while is it about twice that of the population among American Indians and Alaska Natives. Of those who die from heart disease annually, more than half are women. In addition, more women than men have diabetes. Even though life expectancy is longer for women, they are more likely to suffer from a chronic condition after age 70 than men (Centers for Disease Control and Prevention, 2005).

The cost of treating patients with chronic conditions is typically greater than treating those with acute health problems, even for those with health insurance (Hwang et al., 2001). In addition, many employers are unwilling to make provisions for employees who are diagnosed with chronic conditions, making it difficult for them to retain their jobs as well as their insurance coverage (Montenegro-Torres et al., 2001). The problems

of patients with chronic conditions and how to treat them are being exacerbated by population change. As the population ages, there are fewer younger adults to spread the cost of caring for the elderly, who are more likely to have chronic conditions, among (Anonymous, 2001).   Also, the percentage of the population that is made up of racial/ethnic minorities, who are more likely to have chronic conditions and less likely to be able to seek care as discussed in more detail below, is growing (Wolf, 2001).

The prevalence, high cost, and low quality of care for chronic conditions has lead many health care providers to question the way chronic care is being provided (Bringewatt, 2001).   One of the main barriers to implementing change in the way that chronic care is provided is the fragmented nature of the health care system (Gask, 2004). Other obstacles to improving care for those with chronic conditions are changing the behavior of clinicians, organizational design and performance, and public policy (Vladeck, 2001).   At the root of the changes needed to the way chronic care is provided are research into the best practices for treating patients with chronic conditions and performance measurement and quality improvement for practitioners (Davis et al., 2000).

Some changes to the way chronic care is provided that have already been implemented include the need for eligibility and coverage standards (Anderson & Knickman, 2001), changing and organizing primary care to better meet the needs of those with chronic conditions rather than acute (Nixon et al., 2006), and the importance of information technology and new developments (Bonomi et al., 2002).

Providing Chronic Care for the Uninsured

As with health care in general, the uninsured often do not receive the health care that they need for their chronic conditions, and typically have worse outcomes (Institute of Medicine, 2002). Nearly half of the uninsured, about 45 percent, have one or more chronic conditions. These conditions include hypertension, high cholesterol, heart disease, asthma, diabetes, arthritis, severe headache or migraine, cancer, chronic bronchitis, liver condition, disability post-stroke, emphysema, and anxiety or depression. For those without insurance, over 25 percent reported no visits to health professionals in 2005 and more than 35 percent reported that they had no regular source of health care (The Urban Institute, 2005). Of those who did report having a regular source of care, the most frequently cited source of care was a private or HMO provider, with many others receiving care in community clinics or hospital outpatient departments (The Urban Institute, 2005). In addition, almost 50 percent of the uninsured with chronic conditions reported going without medical care or prescription drugs due to the cost. Even though the uninsured are foregoing care, they still report spending around $2000 for health care in a year (The Urban Institute, 2005).

In addition, those without health insurance are more likely to have worse outcomes and complications with their chronic conditions. This has been shown to be true by many studies for a myriad of chronic diseases including diabetes (Nelson et at., 2005), asthma (Ferris et al., 2002; Friebele, 1996; Northridge et al., 2002), hypertension (Duru et al., 2007; Gandelman et al., 2004), stroke (Levine et al., 2007; Shen &

Washington, 2007), COPD (Tsai et al., 2007), cancer (Bradley et al., 2005; Thorpe & Howard, 2003), HIV/ADIS (Shackman et al., 2001), and severe headaches/migraines (Chan & Ovens, 2004).

The uninsured are more likely than the insured to both have chronic conditions and to not receive appropriate screening or treatment (Hagdrup, 1997). The uninsured with chronic conditions do not have a usual source of care and must often delay seeking health care, typically because they cannot afford it (Ross et al., 2007). This shows the interaction between insurance and socioeconomic status.

In addition, other factors that are barriers to health care access such as race/ethnicity, age, and gender can play a role in utilization of chronic care treatment. Age plays a very important role in the treatment of chronic conditions. Since chronic conditions become more common as one ages, there are more older adults that seek out chronic care. However, insurance coverage also becomes more common with age. In spite of this, there are larger numbers of older adults (but who are too young for Medicare) who have trouble accessing chronic care than younger adults (Beatty, 2003). This relationship is similar for women. Women are more likely to be covered by health insurance than men; however, they still report being unable to seek chronic care (Murasko, 2006).

Perhaps the largest factor that affects the ability to utilize chronic care when uninsured is race/ethnicity. While about 59 percent of the uninsured with chronic conditions are whites, a large proportion of blacks and Hispanics with chronic conditions

are uninsured relative to the total population (The Urban Institute, 2005). This is believed to be due in part to the much lower rates of insurance among racial/ethnic minorities and their beliefs about accessing the health care system (LaVest et al., 2000). In addition, those who are racial or ethnic minorities are also more likely to be of lower socioeconomic status, further complicating their ability to garner health insurance and the health care system (Hayward et al., 2000; Kington & Smith, 1997). These relationships are found to be true among many people with chronic conditions such as heart disease (Carlisle et al., 1997), cancer (Kolb et al., 2006), and diabetes (Harris, 1999).

Conclusion

In summary, there are many people in the United States who need health care, but cannot afford it because they do not have access to health care coverage. The problems associated with a lack of health care coverage are numerous including lack of access to health care, lower quality of health care, and lack of continuity of care. In addition to those without coverage, there are millions of Americans with chronic health conditions that require extensive use of the health care system and a high degree of continuity of care. Those with chronic conditions but without health care face many difficulties in accessing the health care that they require to sustain a good quality of life. By using the chronic care model, this study will examine uninsured patients with chronic conditions. However, the chronic care model has not been used to study those without insurance. The ways in which these patients access the health care system will be explored in more

detail in the following chapter using the behavioral access to health care model developed

by Anderson and Aday.

CHAPTER 3: THEORETICAL OVERVIEW

Based on the information presented in the literature review in the previous chapter, not having health insurance coverage can have a profound impact on health outcomes for those that need care.   Patients without health care coverage face problems in receiving and paying for the care that they need in order to have the best possible quality of life.   As discussed in Chapter 2, there are many factors that interact to increase the likelihood of not having health coverage and thus making it difficult to access the health care that they need, such as income, race/ethnicity, age, and gender.   This is especially true for patients who are uninsured and have chronic conditions.   Chronic conditions typically require extensive health care that must be coordinated among several providers.   However, those chronic patients with no coverage typically also do not have a medical home or a regular health care provider, making it difficult to coordinate care for these patients and ensure that they are getting the care they need in an efficient and effective manner. This is especially true for patients with multiple chronic conditions. They often see many different providers and have many different treatment plans, some which may be in conflict.

The purpose of this study is to explore how being enrolled in a program that both coordinates patient care and provides a medical home changes health care utilization for uninsured patients, more specifically those with chronic conditions.   In order to do this,

the Chronic Care Model will be used, along with the Andersen and Aday model of behavioral access to health care as an analytical framework, and this combination will be applied to the Virginia Coordinated Care (VCC) program.   By using the Andersen and Aday behavioral model, it will be possible to organize the many factors that have an impact on access to health care.

<div align="center">The Chronic Care Model (CCM) as a Conceptual Framework</div>

The chronic care model was first developed in 1993 as a synthesis of literature by Wagner for the MacColl Institute for Health Care Innovation (Wagner, 1998).   This model can be viewed as both an operational design for providing chronic care and as an evidence-based template for understanding how the components can lead to improved outcomes for patients with chronic conditions. The initial model, which highlights components of high-quality chronic illness care, places much emphasis on evidence-based, planned care which is divided into four categories. These categories focus on (1) practice redesign for providers, including such things as frequent, practice-initiated patient contact; (2) patient education; (3) an expert system whereby physicians are expected to participate in continuing education and the consultation of experts; and (4) the appropriate use of information to ensure that care is planned in such a way as to maximize patient outcomes (Wagner et al., 1996).

Later refinements by a panel of experts and comparison with leading chronic care programs across the country led to an update of the model in 1998 and a similar process was undertaken in 2003, which led to the creation of the current model. Figure 1 depicts the chronic care model (Wagner et al., 1998).

Community	Health Systems		
Resources and Policies	**Organization of Health Care**		
Self-Management Support	Delivery System Design	Decision Support	Clinical Information Systems

Patient Centered	Timely & Efficient	Evidence-Based & Safe	Coordinated

Services

Informed Empowered Patient and Family	←→ Productive Interactions ←→	Prepared Proactive Practice Team

Improved Outcomes

Figure 1. The Chronic Care Model (Wagner, 1998)

The current chronic care model identifies the idealized elements of a health care system that encourages high-quality chronic disease care. The chronic care model shows health systems and providers as a part of the larger community, both of which should work together to improve care for patients with chronic illnesses.   These elements of the chronic care model are resources and policies in the community; and within the health system: self management support, organization of health care, delivery system design, decision support and clinical information systems (Improving Chronic Illness Care). These are explained in more detail below as defined in Bodenheimer et al., 2002.

Community Resources and Policies: These resources help chronic care providers by allowing patients access to services that will help them stay healthy such as exercise centers, senior centers, and self-help groups. This also includes support services such as transportation and translation.

Health Care Organization: This element highlights the position of the health care organization within the community, the organization's relationship with purchasers and insurers, and their views on chronic care impact how the organization itself will provide chronic care. If the organization is in a community that values and supports chronic care, then they will be more likely to support and provide high quality chronic care. These environmental factors work with the organization's views on chronic care.

Self-Management Support: Since patients can live for many years after they have been diagnosed with a chronic illness, it is pertinent to educate the patient to manage their own care since much of it is administered themselves. This includes such things as diet, exercise, self-monitoring, and the use of medications.

Delivery System Design: In order to provide high quality chronic care, practices must devote staff to providing care to patients with chronic conditions. These providers are ideally trained in the treatment of chronic conditions such as supporting patient self management, arranging for routine periodic tasks, and ensuring appropriate follow-up.

Decision Support: For practices providing chronic care, following evidence based guidelines ensures that chronic conditions are being treated according to standards for optimal chronic care.

Clinical Information Systems: Provider information systems can perform three important roles in the provision of chronic care. Firstly, they can be used as reminders to help providers comply with practice guidelines. Second, they can provide feedback to physicians, showing how their patients are faring. Lastly, they can be used to plan individual patient care and to conduct population-based care.

Ideally, the six components of the chronic care model, Community Resources and Policies, Health Care Organization, Self-Management Support, Delivery System Design, Decision Support, and Clinical Information Systems, are used in conjunction to help chronic care providers ensure that their services are patient centered, timely and efficient, evidence-based and safe, and coordinated. This leads to productive interactions between the informed, empowered patient and family and the prepared, proactive practice team. These interactions between patients and their health care providers in turn lead to improved health outcomes for those with chronic conditions (Wagner, 1998).

Since the chronic care model has been developed, there has been much research done concerning the effectiveness of the model in its entirety or in components of the model. A study done by Bodenheimer et al. (2002) found that in 32 of 39 studies done on diabetes programs using some or most of the chronic care model components showed improvements in treating their patients, and 18 of 27 studies concerned with containing costs found that the chronic care model helped to improve efficiency . In addition, the chronic care model on the whole can be used to help prevent diseases such as breast and lung cancer by encouraging patients to utilize community resources and to undergo screening tests and procedures to help catch chronic diseases at early stages so they will

be easier to treat (Glasgow et al., 2001). The most effective way to improve chronic care is to not only add new features to an existing acute care system, but to implement fundamental changes in the way care is provided (Wagner et al., 2001).

In many if not most practice settings, it is impractical or impossible to implement more than a few of the components of the chronic care model. Research has shown that in these cases, implementing one or a few of the components can still have a positive impact on patient outcomes (Glasgow et al., 2002; Nutting et al., 2007; Siminerio et al., 2006; Vargas et al., 2007). At the same time, incompletely implemented models may have fewer or more muted impacts on patients and their health care utilization.

An important feature of the chronic care model is that it coordinates the features of the community and the health care system to work together in a more efficient and effective manner. While this is important for a patient with a single chronic condition, it is even more so for patients with multiple chronic conditions. For patients with a single chronic condition, having a medical home or a routine place to get care may be sufficient to manage their ongoing medical needs and can be focused on a single disease. For patients with multiple chronic conditions, coordinating care becomes especially important as these patients often see many different providers and have many different treatment plans. A medical home then becomes not only a place that these patients can rely on for medical care, but also a place that provides them with the necessary resources to manage their multiple conditions. Therefore, the chronic care model may have more of an impact on these patients.

There have been few studies that have attempted to show the effect of systematically using the Wagner chronic care model (or parts of it) to treat chronic conditions, even among the uninsured. The use of multiple chronic care model elements in conjunction has been shown to be effective in treating children with asthma (Mangione-Smith et al., 2005), in caring for diabetes (Nutting et al., 2007; Siminerio et al., 2006; Vargas et al., 2007), and in heart failure (Glasgow et al., 2002).   Many of these studies focus on patient self-management along with other various components of the chronic care model such as information systems, community resources, and consultations with specialists (Glasgow et al., 2002; Mangione-Smith et al., 2005; Nutting et al., 2007; Siminerio et al., 2006; Vargas et al., 2007).

Health outcome improvements are also seen when using the chronic care model in treating uninsured patients with the same conditions. Using care managers, specialty consultation, and patient self-management, community clinics have shown that it is possible to overcome the obstacles that go along with being uninsured as well as other barriers in access to health care in order to improve health outcomes for their patients (Katz et al., 2001; Clancy et al., 2003; Hupke et al., 2004; Hupke et al., 2004; Stroebel et al., 2005). One of the main focuses on research of the chronic care model components has been patient self management. There have been many studies done that show the importance of patient education and encouraging and empowering the patient to take charge of their care.   In these cases, patient outcomes are greatly improved (Bodenheimer et al., 2002; Holman & Lorig, 2000; Lorig et al, 1999).   In addition to patient self-management, patient physician interaction is also important in managing

chronic conditions. Physicians and primary care providers who work more closely with their patients and proactively manage their care also show improved outcomes for patients with chronic conditions (Oswald, 2001; Rothman & Wagner, 2003; VonKorf et al., 1997). One important factor to improve outcomes for those with chronic conditions that is not often mentioned is providing psychological support for those patients (Wagner et al., 2001).

Also, other components of the chronic care model have been shown to have an impact on patient outcomes. For instance, it has been shown by Casalino and colleagues that the use of information systems and decision support can improve patient outcomes for those with chronic conditions (Casalino et al., 2003). Another factor of importance in providing care to those with chronic conditions is the importance of access to prescription medications, either through a health care provider or a community resource. By having access to prescription medications and being empowered to use them correctly, patients with chronic conditions can have improved health outcomes (Goldman et al., 2004).

Providing care for the chronic care to the uninsured in an academic medical center, as is the case in this study, poses particular challenges. Academic medical centers face different challenges and have different priorities than other health care providers. Their teaching, research, and service missions may conflict with one another. They often have funding that is directed to specific programs, such as medical education, biomedical research, and innovation. This is in addition to having a patient mix that is typically made up of a high level of Medicaid patients (Shine, 1997; Mechanic et al,

1998). Academic medical centers also receive Medicaid funding for providing graduate medical education.   This helps offset the high costs of treating Medicaid patients in such a costly setting (Anderson et al, 2001).   Since academic medical centers provide a high level of specialized care, they are not the most efficient or effective setting to provide chronic care to indigent patients.   As with other safety net providers, academic medical centers are working to move routine care for indigent patients with chronic conditions to community providers.   However, this creates problems with funding and how to pay for care in the community.

The chronic care model may work especially well for patients with multiple chronic conditions.   One of the main components of the chronic care model is coordinated care, and for patients with multiple chronic conditions this means that they will now have a medical home to help them keep track of their different diseases and treatments as well as giving them access to other resources to help them stay as healthy as possible (Rothman and Wagner, 2003; Von Korff et al, 1997). Once a patient has a chronic condition, it is more likely that they will be diagnosed with another chronic condition, so it is important that they seek out routine care (Vargas et al, 2007). Many chronic disease programs focus on one disease-specific intervention, but a model like the Wagner chronic care model, which provides patients with a medical home, allows for a central source of care that is not disease specific and can help patients manage their many conditions (Kronick et al, 2008).

Virginia Coordinated Care (VCC)

VCC is a program that is designed to provide access to affordable health care for uninsured individuals living in the Greater Richmond Metro and the Tri Cities areas. Low income persons who obtain services at VCUHS and who do not qualify for either private or public coverage may be enrolled in the program to have their care covered by VCC. This means that patients with a variety of conditions become members of VCC. Many of the patients enrolled in VCC may have only short-term needs and do not seek care regularly at the VCUHS. Since VCC is a coordinated care program, not all patients will be served equally well by such a program. It is estimated that nearly half of all VCC patients do not seek care at the VCU Health System or from other VCC providers within the year they are enrolled and do not re-enroll once their year is up. On the other hand, the patients most likely to remain in VCC are those with chronic care needs.

VCC enrollees are assigned to a primary care physician based upon their zip code. This primary care physician is paid a monthly fee for each enrollee that they are assigned, and is responsible for providing routine care as well as being an access point for specialty services. A variety of services are covered in the VCC program including many components of primary care, hospital services, pharmacy services, emergency vision and dental services, behavioral and mental health services, and OB/GYN services for women. In addition to health care services, VCC provides a number of elements that mirror managed care plans, most notably a medical home, a network of providers, care managers, and the means for promoting and tracking continuity of care. This encourages patients to be seen in primary care settings rather than waiting until their health care

needs become more acute and therefore need to be seen in a hospital setting. Also, by coordinating patient care with specialty providers who are part of the VCUHS, diseases and conditions can be diagnosed and treated on a more preventative basis, which is often less costly and more efficient than episodic care.

A prior study done using data from the VCC program found that utilization rates of enrollees for inpatient hospitalizations and emergency room visits decreased over a three year period for those who were assigned to a community primary care provider for at least one month during the study (Retchin et al., 2009). The study done by Retchin et al. gives a basis for anticipating patient behavior to change upon utilization.

Currently, around 50 percent of patients who enroll in VCC do not maintain their enrollment after the initial 12 months. The other half who do re-enroll in VCC are patients who most likely have ongoing health care needs in the form of chronic conditions as nearly half of the US population lives with a chronic condition (Wagner, 1998). For patients with chronic conditions but without health insurance coverage, VCC represents a way for them to receive the health care that they require in an efficient manner. For the patients that do not have ongoing medical needs, VCC may not be the most cost effective way for VCU Health System to provide treatment.

VCC provides a unique opportunity for study, as it is a coordinated care program with a mixture of patients with chronic and acute conditions. A substantial number of the persons with chronic conditions (e.g., diabetes, CHF, CAD) have been long term patients of the VCUHS and thus it is possible to examine how transitioning these patients into a coordinated care system may have altered their patterns of care for these

conditions. This will be done using the Chronic Care Model combined with the Behavioral Access to Health Care model, which will be used to organize patient characteristics.

<div align="center">Application of the CCM to VCC</div>

The Virginia Coordinated Care program uses a number of the components of the Chronic Care Model in order to provide higher quality health care to uninsured patients with chronic conditions. The Chronic Care Model shown above represents an ideal type of a chronic care model. With programs that only offer a subset of the components and philosophies outlined by the chronic care model, such as VCC, it would still be expected that enrolling patients in such a program would impact the way they seek and obtain health care. However, such an impact might be mitigated by the limited program components, so the effect is likely to be relatively smaller in size or more limited in scope. By exploring different diseases and conditions individually, as well as examining different types of utilization measures, it may be possible to determine which of these conditions are impacted the most by enrollment.

In order to better understand how enrollment in a program such as VCC will impact patients with chronic conditions, it is first necessary to determine how the VCC program fits with the Chronic Care Model. VCC does not completely fulfill all six of the Chronic Care Model components, as further discussed below, which means that being enrolled in VCC may not have as much of an impact on patient outcomes as being enrolled in an ideal program would.

Community Resources and Policies: In the Chronic Care Model, community resources and components are organizations that do not provide health care services but may have an impact on the overall health of a patient. The VCC program has ties to many community resources and encourages patients to utilize them when needed, but there are few formal relationships with these organizations. In some cases, these relationships are developed with VCUHS, and the services of these organizations are therefore available to VCC enrollees. VCC patients undergo an initial financial screening to determine their eligibility for this program as well as others in the community, and then they have access to outreach workers who can help them with things such as transportation, housing, and food. In addition, VCUHS provides counseling to VCC patients through the Nutrition Clinic.

Health Care Organization: According to the Chronic Care Model, an organization will support and provide chronic care if there is interest both within the organization and the surrounding community. While little information is available about attitudes towards chronic care in the Richmond area, the VCU health system has shown that it supports chronic care by enrolling patients in the VCC program, where they are provided with a medical home. The VCC program was developed with an awareness that many uninsured patients who utilize the VCU Health System have chronic conditions and were treated in an episodic manner in the past, showing the desire to develop an organizational response to better meet the needs of their patients.

Self-Management Support: Self-management support has been shown to play a major role in improving patient outcomes (Katz et al., 2001; Clancy et al., 2003; Hupke

et al., 2004; Hupke et al., 2004; Stroebel et al., 2005). However, as with Community Resources and Policies, VCC has no formal guidelines for providing patient self-management support. Even so, anecdotal information from VCC providers suggests that a variety of information is typically supplied in written and oral form to patients with chronic conditions. Since there is no formal arrangement for self-management support within the program, it is difficult to determine how this might impact patient outcomes. Likewise, VCC does not have a patient helpline or access to nurse advice that is often found in chronic care management programs.

Delivery System Design: Delivery system design includes many aspects of the provision of health care. Since VCC patients are provided with a medical home, many of the tasks typically associated with the provision of ambulatory care and chronic care are expected to be done by primary care physicians. This means that patients are encouraged to seek care in a very different manner than they had been. Patients now have access to a routine source of care which can provide stability and continuity, and providers are paid a management fee to maintain access, make specialist referrals, and respond to the needs of patients who are enrolled in their practice. In principle, an enrollee's assigned primary care provider is positioned to manage the total care for the VCC patients that are paneled to them.

Decision Support: Decision support ensures that health care organizations are following evidence based practice guidelines. It is becoming more common for providers to be expected to comply with these guidelines to ensure that patients are receiving appropriate care, and while this information is collected on service utilization for VCC

enrollees, it is not used to monitor and report on utilization. The VCC program is planning to implement a program that would include decision support in the near future. This system would include supplying providers with information about the types of care that their patients with chronic conditions should be receiving and perhaps providing them with an incentive to perform in accordance with the guidelines.

Clinical Information Systems: In the Chronic care Model, clinical information systems perform many functions, some of which VCC utilizes. Currently, VCC collects data on enrolled patients, but does not track patients or send this information to the providers for them to use for feedback and planning purposes. In the near future, VCC is planning on implementing a program that will perform many of the clinical information system functions defined in the chronic care model.

Table 3 defines the components of the Chronic Care Model and shows how VCC fits into the model.

As patients move through VCC, they will encounter different components of the Chronic Care Model. Currently, when an uninsured patient is seen at a VCU Health System facility, representing their need for medical care, they go through the financial screening process. If in this process they are found to be eligible and they live within the catchment area (the city of Richmond), they are enrolled in VCC. This is the first stage in the process.   Next, the patient is assigned to a medical home based on proximity of the provider to the patient's home address. Patients are encouraged to see these providers for routine and follow up care. By doing so, the patients receive additional care management

Table 3. Application of the CCM to VCC

Component	Chronic Care Model Definition	VCC Adoption
Community Resources and Policies	Systematic utilization of community organizations that do not provide health care services	VCC does not maintain formal relationships with community resources in a way that can be measured for study, however does provide access to community resources.
Health Care Organization	Organization's: • Position within the community • Relationship with purchasers and insurers • Views on chronic care	Fulfills some of these requirements. The organization understands the importance of providing chronic care and enrolls uninsured patients in the VCC program.
Self-Management Support	Educating patient to manage their own care	VCC does not have formal standards for patient self management but encourages primary care physicians to aid enrollees in any way possible.
Delivery System Design	Staff dedicated to and trained in treating patients with chronic conditions	While VCC does not have medical providers that are specifically trained in treating patients with chronic conditions, VCC does make an attempt to try and treat uninsured patients with chronic conditions in a more effective manner by enrolling them in the program and providing them with a medical home and referring them to necessary specialty care.
Decision Support	Following evidence based guidelines to ensure optimal care	Does not fulfill this component in a way that can be measured for study, however, VCC plans to do so in the near future

Table 3 (continued)

Component	Chronic Care Model Definition	VCC Adoption
Clinical Information Systems	Used to: • Help providers comply with practice guidelines • Provide feedback to providers • Plan individual and population-based care	VCC does not fulfill the first two parts of component in a way that can be measured for study, however, plans to do so in the near future. Does not use CIS to plan individual patient care, but does use it for population based care (as in this study)

and a higher level of continuity of care. This is reflected through change in health services utilization, which should in turn lead to improved patient outcomes. Figure 2 is a visual representation of this process and shows how it fits with the Chronic Care Model components.

Analytical Framework: The Behavioral Model for Access to Health Care

The behavioral model for access to health care was first developed in the 1960's by Andersen and Newman (1973) to examine the factors influencing health care utilization, and has changed and adapted over time to reflect how patients access the health care system. The initial model focused primarily on the patient and how their characteristics lead to utilization, while the current model also includes the impact of the environment, population characteristics, and outcomes (Andersen & Newman, 1973). For this study, the behavioral model for access to health care will be used to organize and analyze the many factors related to access to health care that will be considered. The behavioral model for access to health care was first developed in the 1960's as a way to explain the use of formal personal health services (Andersen & Newman, 1973). This

VCC Enrollment and Care Process

Patient Contact ⟶ VCC Enrollment ⟶ Medical Home Assignment ⟶ Additional Care Management ⟶ Utilization Outcomes ⟶ Patient Health Status

The Chronic
Care Model

Health Care Organization

Delivery System

Decision Support*

Decision Support*

Clinical Information Systems*

Clinical Information Systems*

Community Resources**

Self-Management Support**
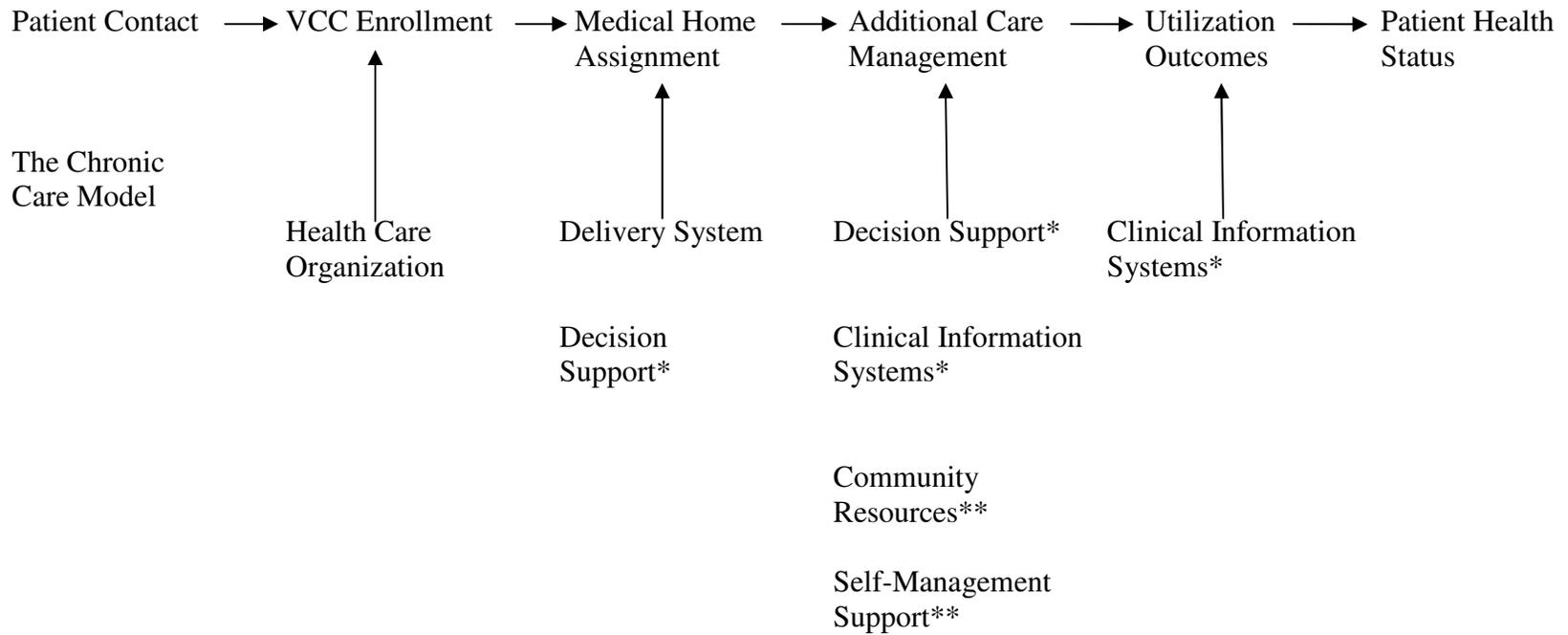
*These CCM components exist in multiple phases of the VCC program

**These CCM components are not able to be measured in the VCC program as it exists now, but if the components were able to be measured, they would be in this phase of VCC

Figure 2.   The Chronic Care Model and the VCC Enrollment and Care Process

model suggests that people's use of health services is a "function of their predisposition to use services, factors which enable or impede use, and their need for care" (Andersen, 1995). This initial model focused primarily on the patient and how they would access the health care system (Andersen & Aday, 1978).

In the 1980's, the behavioral access to health care model was expanded to focus on determinants of health behavior, health behaviors, and health outcomes. By changing the model, it allows for consideration of the external environment, including the physical environment, the political environment, and the economic environment (Andersen, 1995). In addition, the health outcomes component allows for the extension of measures of access for health policy and health reform and to distinguish between efficient access, which is when the level of health status or satisfaction increases relative to the amount of health care consumed, and effective access, which is when utilization studies show that use improves health status or consumer satisfaction (Aday & Andersen, 1981).

The latest version of the behavioral access to health care model includes factors such as the environment, population characteristics, health behavior, and outcomes. This model expands on the last model by separating the environmental and population characteristics. In addition, this model has directional feedback loops, showing the importance of health outcomes on population characteristics and health behaviors. This makes the model more complicated to implement in terms of study design and statistical analysis, but allows for a more complete understanding of how health outcomes might have an impact (positive or negative) on future health care utilization. By adding these

feedback loops, the dynamic nature of the health care system can be taken into account (Andersen, 1995). This model is shown in Figure 3.

Environment   Population Characteristics   Health Behavior   Outcomes
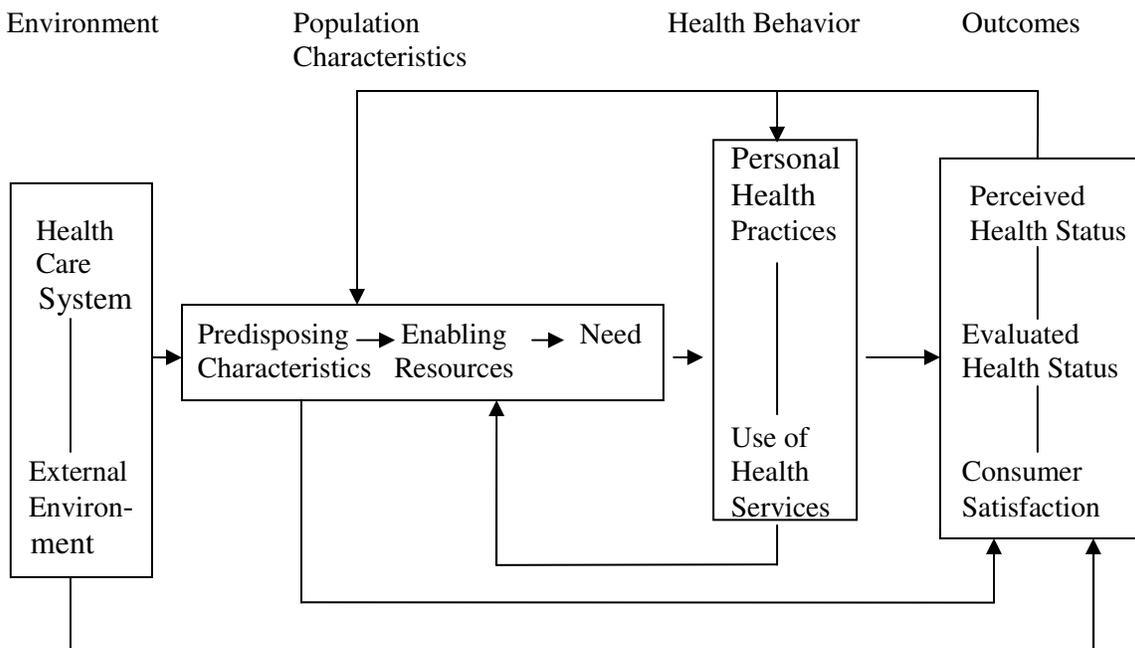
Figure 3. The Behavioral Model of Access to Health Care (Andersen, 1995)

     For the purposes of this study, the behavioral access to health care model will be used to help organize the many factors that have an impact on access to health care for patients with chronic conditions. The Anderson model has been extensively employed in studies of patient care and programs designed to influence this care (Davidson et. al., 2004; Anderson & Bartkus, 1973; Honda, 2004; Richardson & Hwang, 2001; Hargraves & Hadley, 2003). It will be combined with the Chronic Care Model in order to better understand how enrolling patients in a program that has components of the Chronic Care Model will change their utilization of health care services. This combined model will be presented below.

Support for the Behavioral Model

The behavioral access to health care model was first developed as a way to assist in the understanding of why families use health services, to define and measure equitable access to health care, and to assist in developing policies to promote equitable access (Andersen, 1995). Since then, it has been used in various applications. In most cases, the behavioral model is used to describe either patient characteristics or environmental characteristics to examine the impact that they have on health care utilization.

When examining patient characteristics in the Andersen and Aday behavioral model, there are numerous factors that can be considered. Some of the common patient qualities that have been shown to have an impact on health care utilization can be divided into predisposing, need, and enabling characteristics and include demographic factors, social factors, beliefs, perceived need, evaluated need, income, health insurance, and usual source of care (Davidson et. al., 2004). Of these, many of the most often studied are demographic and social factors as well as income, health insurance, and usual source of care. There are many demographic factors that are related to health care access. For example, Fiscella et. al. found that being of a racial/ethnic minority and speaking a language other than English can have a negative impact on health care utilization (2002). In addition, gender and age can also have an impact on health care access (Anderson & Bartkus, 1973; Honda, 2004), and many of these factors can work together to compound differences in access to health care (Taylor et. al., 1975).

In the Andersen and Aday model, income, health insurance, and usual source of care are considered enabling characteristics when studying access to health care. As one

would expect, higher income is associated with more frequent access, as is having health insurance or health care coverage. Also, having a usual source of care increases health care access, even when other sources are utilized (Davis, 1991). These characteristics have been shown to have a large impact on access to health care, and can also work together with other characteristics, such as demographics, to determine access (Anderson & Bartkus, 1973; Davis, 1991; Gelberg et. al., 2002). Need characteristics also play a large role in accessing health care, when a patient or their health care provider perceived need, access is increased. Many times, a patient can have an evaluated need, but does not have an internally perceived need, and so access is not impacted. The reverse of this is true as well (Taylor et. al., 1975; Andersen & Newman, 2005).

When examining environmental characteristics that affect access to health care, the environment in which care is provided has a large impact. Environments that are more conducive to providing access lead to higher utilization. This includes providers that accept many forms of health insurance and who are willing to provide services to patients who do not have health care coverage, such as safety net and community care providers (Richardson & Hwang, 2001; Hargraves & Hadley, 2003). In addition, patients are more likely to seek care from providers who they feel provide high quality service in a respectful manner, regardless of insurance status (Fiscella et. al., 2001). In addition, community characteristics such as having a high level of support for the health care safety net, a strong belief in the right to health care, and a great deal of emphasis on the importance of access to health care often lead to improved access (Phillips et. al., 1998)

A Conceptual Framework for Evaluating the Consequences of Uninsurance

In 2001, the Institute of Medicine (IOM) released a report on insurance and health care, Coverage Matters. The purpose of this report was to present a view of health insurance and examine the consequences of being without insurance. The IOM report developed a new framework for evaluating the consequences of uninsurance, with the behavioral model as a centerpiece for the new framework. This framework, which is shown in Figure 4, has three major components: determinants of coverage, process of obtaining access to health services, and how health insurance influences health outcomes and affects families and communities.
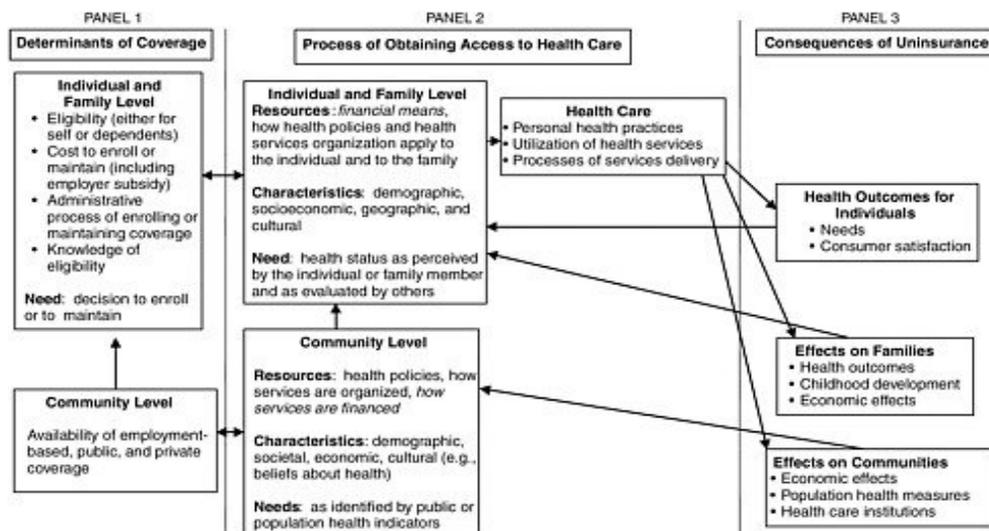
Figure 4.   The IOM's Conceptual Framework for Evaluating the Consequences of Uninsurance (2001)

In the first panel, key determinants of coverage status are addressed, both at the individual and community levels. Insurance status then impacts the process of obtaining access to health services, which is shown in the second panel. The second panel features

the components of the behavioral model. The third panel details the consequences of

uninsurance and the impact that it may have not only on health outcomes, but also on

families and communities (IOM, 2001).

The IOM framework presents a means for organizing many aspects of health care

as they are related to and impacted by health insurance status. While this framework is

quite valuable, it extends far beyond the scope of this research study. For the purposes of

this study, the simplest form of the behavioral model will be used as shown in Figure 5.

The most recent version of the behavioral model, while more comprehensive, includes

many aspects that are unable to be included in this study due to data limitations.

Predisposing ⟶ Enabling ⟶ Need ⟶ Use of
Characteristics   Resources   Health Services

Demographic   Personal/   Perceived
                 Family

Social Structure   Community   Evaluated

Health Beliefs
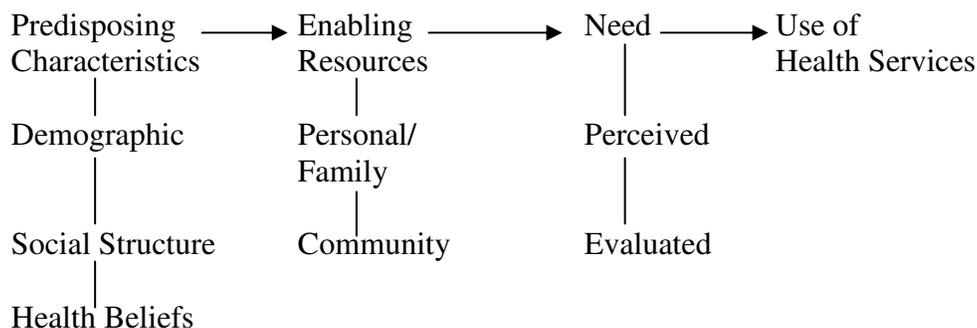
Figure 5.   The Behavioral Model (Andersen, 1995)

The Chronic Care Model as discussed above in the context of VCC will be

examined by using the Andersen and Aday model in order to better understand how

enrolling patients in a program that has components of the Chronic Care Model will

change their utilization of health care services.

Application of the Behavioral Model to the Chronic Care Model

The combined model, found in Figure 6, shows how the components in the VCC/CCM model can be organized and analyzed by using the Andersen and Aday behavioral model. By organizing the model in this manner, it is possible to see how the enabling features of the Chronic Care Model as embodied in VCC work in conjunction with the population characteristics provided by the Andersen and Aday model to influence health behaviors, which in turn lead to health outcomes. Together, these models show how the chronic care environment and patient characteristics can lead to changes in health access behaviors in the VCC program. By changing the provision of health care services and the way health care is utilized by offering a coordinated care program, it is expected that patients will change the way they seek and obtain health care. Based on Figure 6 on the following page, it is expected that enrollment in a program to promote the provision of more efficient and effective care. This study will examine two specific research questions related to these possibilities.

Research Questions

Based on the information above about providing health care to uninsured patients with chronic conditions, the following questions of interest will be addressed in this study:

1. How does being enrolled in a program that provides coordination of care services, including a medical home, change health care access and utilization for uninsured patients?

Predisposing Characteristics →   Enabling Resources →   Use of Health Services →   Health Outcomes

Medical Need   VCC Enrollment   Utilization   Health Status

   Chronic Condition   Medical Home   Cost   Patient

   Status   Additional Care   Satisfaction

   Severity   Management

Demographics   Prior Insurance

   Age   Enrollment

   Race/Ethnicity

   Gender

Interact with — *To Impact* — *And*
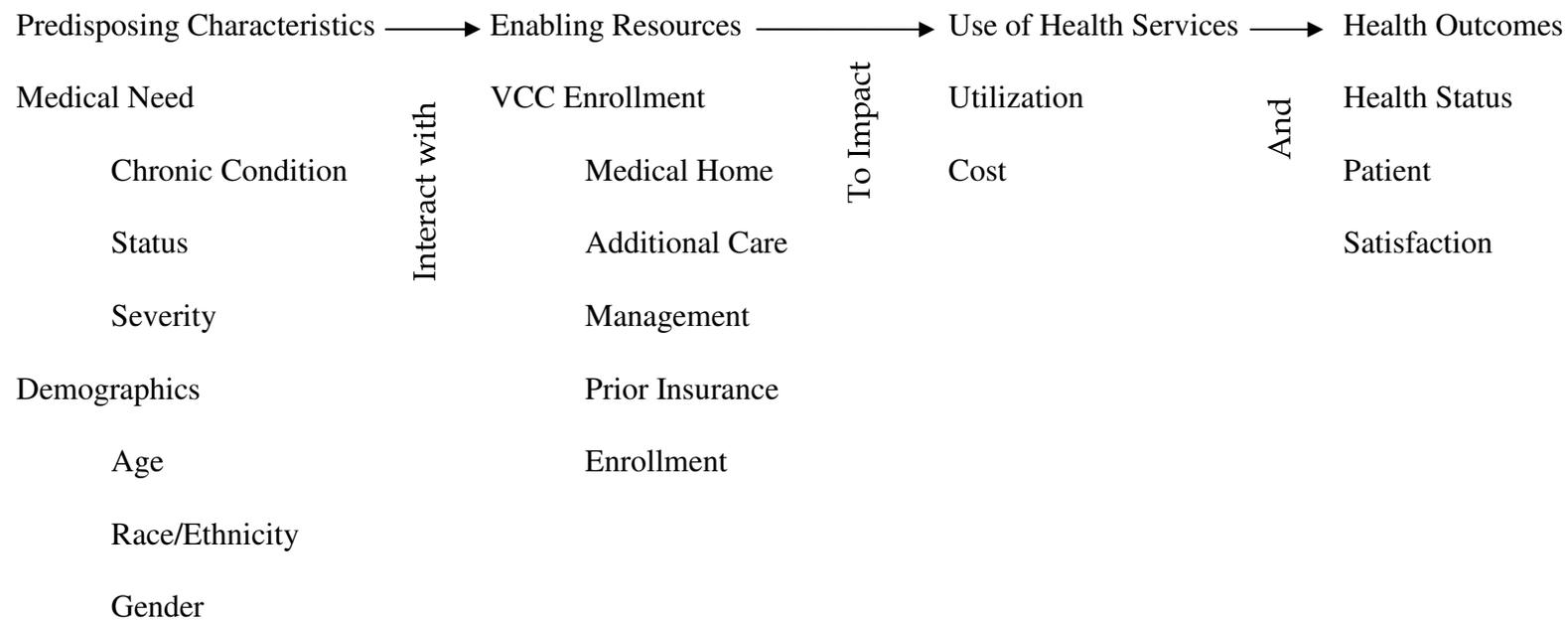
Figure 6.   Analytical Framework: The Behavioral Model for Access to Health Care

2. Does enrollment in a program that provides managed care services have a larger impact on health care access and utilization for those with multiple chronic conditions than those with a single chronic condition?

By addressing these questions, this study will enhance not only the body of knowledge about indigent populations and how they seek care, but will also improve understanding of the chronic care model and how it might be applied to different populations and different situations.

Hypothesis Development

Based on the analytical model above, several hypotheses will be tested in this study. From this model, in general it is expected that a program such as Virginia Coordinated Care that offers coordinated care services with a medical home based on the CCM will promote more effective use of the health care system. This means that health care services are expected to be used in a more appropriate way, with enrollees seeking out care from their medical home instead of using hospital services when they are not necessary. This is expected to be especially true for patients who have chronic conditions that need ongoing monitoring. By giving enrollees a medical home and access to resources as well as managing their care, avoidable hospitalizations may be decreased. In addition, patients with multiple chronic conditions may be even better served by such a program as a medical home will provide them with the resources and the coordination to manage their multiple conditions and treatment plans.

The following hypotheses are based on the presence of chronic conditions in VCC enrollees as identified by an algorithm developed by Healthcare Cost and Utilization

Project (HCUP). This algorithm identifies health care visits as chronic or acute based on

diagnosis code. The HCUP algorithm also divides each visit into one of 18 body system

categories, which are listed in Appendix A. For this study, an enrollee with no chronic

conditions is defined as having no visits identified as chronic by the HCUP algorithm.

An enrollee with a chronic condition in one body system can have visits for acute

conditions and must have at least one visit for a chronic condition, but the chronic

condition visits must be in one body system as identified by the HCUP algorithm. An

enrollee with chronic conditions in multiple body systems can have visits for acute

conditions and must have multiple visits for chronic conditions, with the chronic

condition visits being in multiple body systems as identified by the HCUP algorithm.

The HCUP tool was first developed by Hwang and colleagues in 2001 (Hwang et

al., 2001) using information from the Medical Expenditure Panel Survey (MEPS). A

panel of physicians reviewed diagnosis codes to determine whether they represented

acute or chronic conditions. Since then, HCUP has extensively reviewed diagnosis codes

not included in the MEPS data, as well as reviewing any disagreements with the panel

which performed the original classification and having expert medical coders also review

the classifications.   The HCUP algorithm has been used in many studies, showing that it

can be effective in identifying chronic conditions (Friedman et al., 2006; Bynum et al.,

2004; Wheeler et al., 2004; Yu et al., 2004).

It is expected that for patients with chronic conditions, their utilization of different

features of the health care system will change after they have been enrolled in VCC.

This leads to the following hypotheses for primary care physician services utilization, emergency department utilization, hospital services utilization, and cost of care.

Primary Care Physician Services

A main component of the chronic care model is the design of the delivery system, which includes a medical home. For patients with chronic conditions, it is important that they seek care from the most appropriate provider, receive the most appropriate treatments, and undergo the most appropriate tests. These treatments and tests can often be done in a primary care setting conditions (Oswald, 2001; Rothman & Wagner, 2003; VonKorf et al., 1997). In the VCC program, patients are assigned to a primary care provider and given a medical home.   Research done based on the CCM indicates that once patients with chronic conditions are enrolled in such a program, their utilization of primary care physician services will increase (Rothman and Wagner, 2003; Ross et al, 2007). This leads to the following two hypotheses:

H1: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in primary care physician services utilization.

H1a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in primary care physician services utilization.

Of growing concern is the highly coordinated and specialized care that is required by patients with multiple chronic conditions. There are many treatment programs that focus on one specific disease or condition, but there are very few that focus on patients

with multiple chronic conditions. These patients with multiple conditions are better served by a medical home because the complexity of treating multiple chronic conditions will be greatly aided by having a resource to help them manage their care in the most effective way.   In addition, these patients often require care from a variety of resources, and by coordinating this care via the CCM (and thereby giving these patients access to a different delivery system, community resources, and self-management support) patients with multiple chronic conditions can have improved outcomes (Oswald, 2001; VonKorf et al., 1997). This subset of chronic condition patients should show the same enrollment outcomes as patients with just one chronic condition, but the effect of enrollment should be larger as the coordination of care will have an impact on their multiple conditions. This leads to the following sub-hypothesis:

H1b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in primary care physician services utilization than the increase for patients with just one chronic condition.

Emergency Department Use

With enrollment in a program that provides patients with a medical home as outlined in the CCM, patients will seek out care from this medical home, thereby decreasing their emergency department utilization (Chan and Owens, 2004; Tsai et al, 2007). In addition, having increased access to more community resources and self-management support upon enrolling in the program will encourage patients, particularly

those with multiple conditions, to seek care from sources other than the emergency department.   Therefore, the following hypotheses are proposed:

H2: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department utilization.

H2a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department utilization.

H2b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department utilization than the decrease for patients with just one chronic condition.

Appropriateness of Emergency Department Use

As patients seek care from their primary care providers their emergency department utilization should decrease from a shift in health care settings. This should be reflected mainly in a decrease in ED visits that are not truly emergencies as patient health outcomes improve from being treated in a more appropriate setting, and therefore an increase in the ratio of ED visits that are for emergent needs (Katz et al., 2001; Clancy et al., 2003; Hupke et al., 2004; Hupke et al., 2004; Stroebel et al., 2005). Patients will still be encouraged to use the emergency department when they truly need it, but should seek out care for routine services from their primary care physician.   Since patients with one or more chronic conditions will typically require more routine services, they will be less inclined to continue to use the emergency department for non-emergent services.   This leads to the additional hypotheses related to emergency department use:

H3: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergent emergency department usage.

H3a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in emergent emergency department usage.

H3b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in emergent emergency department usage than the decrease for patients with just one chronic condition.

Emergency Department Use for Ambulatory Sensitive Conditions

In the same vein as ED use for non-emergent conditions, it is expected that enrollees will seek out care from a more appropriate setting, especially for conditions that are ambulatory in nature. This leads to the following hypotheses:

H4: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department usage for ambulatory sensitive conditions.

H4a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department usage for ambulatory sensitive conditions.

H4b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department usage for ambulatory sensitive conditions than the decrease for patients.

Inpatient Hospital Admissions

Similar to emergency department services, for patients with chronic care needs it is expected that if their needs are being met effectively in a primary care setting by their medical home, they will have less need and therefore less utilization of hospital services (Oswald, 2001; Rothman & Wagner, 2003; VonKorf et al., 1997; Nixon et al., 2006). Therefore, once patients are enrolled in a coordinated care program with components of the CCM, their hospital admissions should decrease (Lorig et al, 1998). Patients with chronic conditions will ideally have their conditions managed by their medical home, with the help of community resources and self-management support, which should mean that they should need fewer hospital services. Therefore, the following hypotheses are proposed:

H5: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change the rate of inpatient hospital admissions.

H5a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions.

H5b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions that than the decrease for patients with just one chronic condition.

Inpatient Hospital Admissions for Ambulatory Sensitive Conditions

Again, as with the emergency department services, the decrease in hospitals services should be for services that are more appropriately treated in a primary care

setting, and so this should be reflected mainly as a decrease in hospital admissions for ambulatory sensitive conditions (Katz et al., 2001; Clancy et al., 2003; Hupke et al., 2004; Hupke et al., 2004; Stroebel et al., 2005). Patients will be encouraged by VCC to continue to use the hospital in an appropriate manner, but should seek out their primary care physician for ambulatory services. Coordinating the care of persons with multiple chronic conditions in a model like the chronic care model may be particularly effective in heading off avoidable admissions. A coordinated care program that is set up in an effective manner will give patients access to the services that they need, which should prevent them from utilizing the hospital for conditions that are more appropriately treated in an outpatient setting.

H6: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions for ambulatory sensitive conditions.

H6a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions for ambulatory sensitive conditions.

H6b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.

Outpatient Hospital Encounters

Once patients are enrolled in a coordinated care program it is expected that their care will be delivered in a more organized manner, making it more efficient and effective. Since use of VCUHS outpatient services often constitutes primary care by VCC enrollees, it is expected that outpatient services will exhibit a similar relationship to primary care services.

H7: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in outpatient hospital admissions.

H7a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in outpatient hospital admissions.

H7b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in outpatient hospital admissions that than the increase for patients with just one chronic condition.

Cost of Care

Prior to enrollment in the coordinated care program, patients had received care in a very episodic manner, which means this care may be inefficient, ineffective, and costly. When patients are enrolled into a coordinated care program, it is expected that their care will be managed appropriately for the chronic condition(s) that they have, including treatments and tests. These should all be coordinated by the medical home to make sure that the patient is getting what they need to manage their condition and stay as healthy as possible (Hadley & Cunningham, 2004; Busch & Duchovny, 2005; Manning et al.,

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1987).   Once again, the impact is expected to be even stronger for persons with multiple

chronic conditions.   Therefore, care will be much more efficient and effective, and

should subsequently be reduced in cost. This leads to the following expected hypotheses:

H8: For patients with no chronic conditions, enrollment in a coordinated care

program will not be associated with a change in overall costs for utilization of health

services.

H8a: For patients with a chronic condition in one body system, enrollment in a

coordinated care program will be associated with a decrease in overall costs for

utilization of health care services.

H8b: For patients with chronic conditions in multiple body systems, enrollment in

a coordinated care program will be associated with a higher decrease in overall costs for

utilization of health care services than the decrease for patients with just one chronic

condition.

Table 4 summarizes the hypotheses proposed in this study.

Table 4.   Hypotheses

Hypothesis	Direction of Relationship
H1: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in primary care physician services utilization.	None
H1a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in primary care physician services utilization.	Increase
H1b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in their primary care physician services utilization than the increase for patients with just one chronic condition.	Increase

Table 4 (continued)

Hypothesis	Direction of Relationship
H2: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department utilization.	None
H2a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department utilization.	Decrease
H2b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department utilization than the decrease for patients with just one chronic condition.	Decrease
H3: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in non-emergent emergency department usage.	None
H3a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in emergent emergency department usage.	Increase
H3b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in non-emergent emergency department usage than the increase for patients with just one chronic condition.	Increase
H4: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department usage for ambulatory sensitive conditions.	None
H4a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department usage for ambulatory sensitive conditions.	Decrease
H4b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department usage for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.	Decrease
H5: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions.	None
H5a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions.	Decrease

Table 4 (continued)

Hypothesis	Direction of Relationship
H5b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions that than the decrease for patients with just one chronic condition.	Decrease
H6: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions for ambulatory sensitive conditions.	None
H6a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions for ambulatory sensitive conditions.	Decrease
H6b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.	Decrease
H7: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in outpatient hospital admissions.	None
H7a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in outpatient hospital admissions.	Increase
H7b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in outpatient hospital admissions that than the increase for patients with just one chronic condition.	Increase
H8: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in overall costs for utilization of health services.	None
H8a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in overall costs for utilization of health care services.	Decrease
H8b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in overall costs for utilization of health care services than the decrease for patients with just one chronic condition.	Decrease

Conclusion

In this chapter, the chronic care model was used to help explain how patients with chronic conditions will ideally receive care. This model combined with the Andersen and Aday behavioral model allows for the examination of how patients interact with the health care system and how patient behavior may be associated with the enabling resources associated with the VCC program. This, along with the review of literature, led to the hypotheses proposed for this study.

Chapter 4 will outline the research design, the population, data sources, and analytic methods that this study employed to test these hypotheses. The analytic approach uses a time series design to show how predisposing characteristics of patients along with enabling resources of the health care system help explain how patients with chronic conditions use health services, which will in turn has an impact on health outcomes.

CHAPTER 4: METHODOLOGY

In this chapter, research design, data sources and sampling, measures and variables, analytic strategy, and limitations related to this study will be discussed.   The focus of this study is to examine if and how patient utilization changes upon enrollment in a coordinated care program, and will use a time series model with panel data to do so.

This study will add to the body of knowledge about the chronic care model and how the uninsured seek out and receive care when they are enrolled into a coordinated care program. Previous studies have examined the chronic care model, and there have been many studies done on the effect of insurance, managed care, and coordinated care on health services utilization, but there are very few studies that combine these issues. Also, this study presents a unique opportunity to examine this group of patients over time, both before they are enrolled in VCC and during their enrollment.

Research Design

This study uses a time series design to be able to compare patients' utilization before and after they are enrolled in VCC.   This involves making observations or measuring patients prior to and following some type of intervention.   Time series studies are a type of quasi-experimental study design in that they do not employ the use of randomization or a control group.   However, they provide the opportunity to study phenomenon in a setting where it is not possible to set up an experiment.   In this case,

the study involves the impact of an intervention in a practical setting, so using a quasi-experimental design is necessary. Figure 7 shows a graphical representation of this study design, where the observations are represented by an "O" and the intervention is represented by an "X."

t_1 t_2

O_1 X O_2

Figure 7. Study Design

An important feature of this study is that the same enrollees will be studied in both time periods. This is known as a panel design and it allows for study subjects (in this case, VCC enrollees) to be tracked over time. By doing this, the effects of many of their demographic characteristics can be controlled for, as they do not change between the two observation periods. In this study, the observations of interest are health services utilization, and the intervention is enrollment in a coordinated care program, VCC.

There are threats to internal validity present in time series designs. These include history, maturation, testing, halo effect, instrumentation, statistical regression, mortality, and selection. Since this study involves observing patients rather than having them actively participate in the collection of information, and all enrollees are included in this study, several of these threats to validity are eliminated. The eliminated threats are testing, halo effect, instrumentation, and selection. The others – history, maturation, statistical regression, and mortality – remain to be dealt with as part of the study design.

In this study, testing is eliminated as a threat because participants are not being tested or observed directly. Halo effect is not a concern in this study because enrollees are not being directly observed. Instrumentation is not present because this study does not involve the use of an instrument such as a survey, test, or interview to collect data.

The remaining threats to internal validity are history, maturation, statistical regression, mortality, and selection. Since this study involves data which pertains to enrollees over a period of time that includes many different years, history is controlled for. Subject maturation, statistical regression, and mortality are all internal validity concerns that must be addressed.

Subject maturation can be studied by including length of enrollment in the analysis. Statistical regression is an important threat to this study. As patients are enrolled, it is expected that those with a high need for health care services (those with chronic conditions) will now be able to seek out these services. Therefore, their utilization may move away from the overall mean for all patients by increasing, instead of towards the mean by decreasing. This potentially offsets or counteracts regression to the mean.

Mortality is also a critical threat to this study because past data analysis reveals that many enrollees in the coordinated care program never return to VCC providers for further health care during their enrollment. Part of the purpose of this study is to try and explore for differences in those enrollees versus the ones who utilize VCC providers. The CCM points to the presence of one or more chronic conditions as this difference.

Table 5 provides an overview of the threats to internal validity and their relevance to this study.

Table 5.   Threats to Internal Validity

Threat	Present in Study Design	Control if Present
History	Yes	Study will involve a year prior to enrollment and the full length of enrollment
Maturation	Yes	Variables created to measure length of enrollment
Testing	No, enrollees not tested	N/A
Halo Effect	No, enrollees not directly observed	N/A
Instrumentation	No, all data collected the same way from de-identified patient medical records	N/A
Statistical Regression	Yes	If anticipated relationship is present, data will move away from mean, not towards it
Mortality	Yes	Enrollees who leave program prior to a full year of enrollment will be excluded
Selection	Yes	Only those enrollees who actually meet the VCC program criteria will be included as they are the group of interest

Data Sources

The data for this study comes from three sources.   The first is information for enrollees in the VCC program – their demographic information such as age, race/ethnicity, gender, and zip code, as well as assigned PCP. The second source of data is the utilization data for enrollees from the VCU health system. This includes the VCU

hospital and VCU physicians. In addition to this, data are also available from VCC paid claims information. This data reflects patient utilization for VCC providers that are not part of the VCU health system, such as physicians and Richmond Community Hospital.

The VCUHS utilization data contain information on all patients who are or have been enrolled in VCC. These data are comprised of the information that is collected for all patients by the health system, and is used by the health system for billing and decision support. The data set contains all the utilization information for these patients from 1998 to 2007. The VCC program was started in November of 2000, so there are pre-enrollment data available for patients who were enrolled at the start of the program. The VCUHS data contain information related to VCU hospital and physician utilization, including dates of service, length of stay for inpatient hospitalizations, cost, charges, diagnosis and DRG codes, insurance status, and treatment department.

In addition to the VCUHS data, this study also uses data from VCC paid claims information. These data are generated by Virginia Premier Health Plan as part of the claims processing service that they provide for VCC. These data come from claims for ambulatory and inpatient services submitted by VCC providers that are not affiliated with VCUHS and contain information about community based primary care physician visits and Richmond Community Hospital use, including the primary care provider and their home practice, date of service, length of stay (again for hospitalizations), cost, charges, DRG codes, ED use, and whether or not each claim is a physician or facility claim. Preliminary analysis of the data indicate that service data from the two sources are comparable and generally complete.

Study Population/Sample

This study includes all VCUHS patients who are enrolled in the VCC program

and who meet the program qualification requirements. To qualify, patients must meet

criteria based on age, income, locality, and insurance status. Patients must not have any

other insurance, and must be low-income. This means that anyone over age 65 who is a

US citizen does not qualify for this program as they are covered by Medicare. Similarly,

any low-income child should qualify for Medicaid, so enrollees should only be between

ages 19 and 64. Also, patients must reside in the Richmond area, as defined by a zip

code catchment area.

Since its inception, the VCC program has had 50,773 enrollees. Often, exceptions

are made for patients who do not technically qualify for VCC for various reasons, and

they are enrolled in the program in spite of this.   For the purposes of this study, however,

only patients who meet the program requirements will be considered. The requirements

for entry into the VCC program include being a resident of the city of Richmond and

being between 18 and 64 years of age. In addition, some patients are briefly enrolled in

the program while their financial application is under consideration, and then removed if

they do not meet the criteria for VCC.   Enrollees who will be considered for this study

must be in the program for at least one full term of enrollment, or one year. Based on

these criteria, the number of enrollees that will be in this study population is 42,004.

As this study examines the differences between patients with chronic conditions

in zero, one, and multiple body systems, it is of utmost importance to examine each of

these categories to ensure that the number of enrollees will be sufficient to conduct the

proposed analysis. Based on a classification system developed by Healthcare Cost and

Utilization Project, the number of enrollees in the study who were not treated for any

chronic conditions during their enrollment is 16,740, of the number of enrollees who

were only treated for one chronic condition during their enrollment was 9,594, and the

number of enrollees were treated for multiple chronic conditions during their enrollment

was 15,670. This is shown in Table 6.

Table 6.   Enrollees and Chronic Condition Status

	All Enrollees		Study Sample Only	
	Frequency	Percent	Frequency	Percent
No Chronic Conditions	22,729	44.77%	16,740	39.85%
Chronic Conditions in One Body System	10,973	21.61%	9,594	22.84%
Chronic Conditions in Multiple Body Systems	17,071	33.62%	15,670	37.31%
Total	50,773	100.00%	42,004	100.00%

Institutional Review Board

Since this study involves the use of patient data, even though it has been de-

identified, it must be reviewed by the VCU IRB. As the data use existing records that

result from patient interactions with the VCU Health System and the VCC program, and

the data have been de-identified, so this study has been granted exempt review by the

IRB.

Definition and Measurement of Variables

In order to examine the research questions posed in this study, different variables

relating to utilization will be examined, as well as variables that may have an impact on

utilization. These include enrollee characteristics such as medical need, VCC enrollment information, and demographic information.

Factors Impacting Use of Health Care Services

Medical Need

A person's use of health care services is generally a reaction to their need, be it real or perceived, for health care. In this case, since the focus is on patients with chronic conditions, an important part of medical need is the presence of one or more chronic conditions. Patients with chronic conditions often require regular treatment to maintain or improve their health (Hagdrup, 1997; Hwang et al., 2001; Wagner et al., 2001; Nixon et al., 2006). Chronic condition status for this study is measured by assigning enrollees to one of three groups, which are: no chronic conditions, chronic conditions in one body system, and chronic conditions in multiple body systems.

Another common way to measure medical need is by assigning enrollees a risk factor or acuity level. For the purposes of this study, case mix software developed by Johns Hopkins University will be used. This software has been validated through a variety of studies (Halling et al., 2006; Weiner et al., 1992; Sullivan et al., 2004)and takes into account disease patterns, age, and gender to better understand and predict the level of risk for use of health care services among patients (Belalcazar & Swank, 2006; Halling et al, 2006). This variable is measured on a scale from zero to one, with zero being the lowest level of risk, and one being the highest.

Enabling Factors

It is important to know how long the enrollee has been in the program as their utilization patterns may change with length of enrollment. This variable is included in the study as enrollee utilization patterns may be subject to change based on length of enrollment in the program, and is measured in years.

Integral to this study is to determine how enrollment in the program impacts utilization. Therefore, a variable must be included to show whether a record is for use of services prior to enrollment in VCC or during enrollment in VCC. Thus an indicator variable is created for this purpose, with a value of one identifying a record for utilization during enrollment and a value of zero identifying a record for utilization in the pre-enrollment period.

Socioeconomic status is often included in enabling resources for utilizing health care (Lantz et al., 1998; Schoen et al., 2000), however, one of the requirements for enrollment in the VCC program and therefore one of the characteristics of the study population is income. Since income among enrollees is already constrained, it will not be included in the analytical model.

Another important enabling resource to consider is whether or not they have been enrolled in an insurance program in the past. Insurance plans, regardless of whether it is a private plan or not, typically encourage patients to seek out routine care from a PCP instead of a hospital. Therefore, prior insurance enrollment may have an impact on utilization once a patient is enrolled in the VCC program as the enrollee will already be

familiar with PCP use. This variable is dichotomous, with a value of one indicating that an enrollee has had insurance in the past and a value of zero indicating that they have not.

Use of Health Care Services

Utilization

For this study, utilization of health care services is operationalized using several different variables. These variables include number of visits in a variety of locations, as well as the appropriateness of these visits. Numbers of visits measured include primary care physician visits, hospital emergency room visits that did not result in an overnight admission, inpatient hospital admissions, and hospital outpatient visits (exclusive of emergency room visits). All of these variables are measured as number of encounters or visits.

Since this study is interested in how health care utilization changes upon enrollment in the VCC program, it is important to examine not only the number of visits, but the appropriateness of these visits. This is done for both hospital emergency room visits and inpatient stays. Hospital emergency room visits can be examined in two manners: by identifying visits for ambulatory sensitive conditions (Andrulis, 1998; Billings et al., 1993; Palmer, 2004; Schoen et al., 2000), and by determining urgency of visits through the New York University Emergency Department use algorithm (Billings et al, 2000; Weinick & Billings, 2003). For inpatient visits, appropriateness of use can also be examined by identifying admissions for ambulatory sensitive conditions. To measure utilization for ambulatory sensitive conditions for both ED visits and inpatient hospitalizations, total number of encounters or visits will be used. To measure urgency

of ED visits, the NYU algorithm assigns each ED visit a weight in one of four categories, so four variables are created for each visit, with the sum of these variables totaling one. The categories are Non-emergent, Emergent/Primary Care Treatable, Emergent-ED Care Needed-Preventable/Avoidable, and Emergent-ED Care Needed-Not Preventable/Avoidable. In order to determine an enrollee's urgency of ED visits, the average of each of these four weights will be taken, resulting again in four variables which sum to a value of one.

<div align="center">Cost</div>

A common way to gauge resources used to provide health care services to patients and to develop a cumulative measure of resource use is to sum the cost of those services. For this study, total cost will serve to show use of health care services (Bringewatt, 2001; Center for Studying Health System Change, 2004; Ross et al., 2007). Cost is measured as the total dollars for each enrollee, both in the year before their enrollment and during their enrollment.   Since the distribution for cost is typically skewed, the natural log of cost will be considered as well.

<div align="center">Control Variables</div>

<div align="center">Enrollee Information</div>

The Andersen and Aday Behavioral Model for Access to Health Care holds that among the predisposing factors that influence use of health care services are demographic characteristics of patients. These characteristics include age (Deaton & Paxson, 1998) measured by the numeric value of the enrollee's age, race/ethnicity (Lillie-Blanton et al., 2000; Mayberry et al, 2000; Weinick et al, 2000) measured with a value of one for whites

and a value of zero for all others, and gender (Verbrugge, 1985 & 1989; Mertzel, 2000)

measured as a value of one for females and zero for males. Table 7 shows the constructs,

variables, and measures used in this study.

Table 7.   Constructs, Variables, and Measures

Construct	Variable	Measure	Source
Medical Need	Chronic Condition Status	No chronic conditions (0), Chronic conditions in one body system (1), Chronic conditions in multiple body systems (2)	HCUP Chronic Condition Indicators
	Pre-enrollment Risk	Index of patient severity on a scale of 0 to 1	Johns Hopkins Case Mix Software
VCC Resources	Length of Enrollment	Number of years	VCC Enrollment file
Utilization	Primary Care Physician Visits	Number of PCP visits	VCUHS Utilization and VA Premier claims files
	Emergency Room Visits	Number of ED visits	VCUHS Utilization and VA Premier claims files
	Emergency Room Visits for Ambulatory Sensitive Conditions	Number of ED visits for ambulatory sensitive conditions as identified by AHRQ	AHRQ Ambulatory Sensitive Condition Indicators
	Average Non-Emergent ER Visit Likelihood	Average likelihood that an enrollee visits the ED for a non-emergent condition	NYU ED Algorithm

Table 7 (continued)

Construct	Variable	Measure	Source
	Average Emergent/Primary Care Treatable ER Visit Likelihood	Average likelihood that an enrollee visits the ED for a condition that is emergent but primary care treatable	NYU ED Algorithm
	Average Emergent – ED Care Needed – Preventable/Avoidable ER Visit Likelihood	Average likelihood that an enrollee visits the ED for a condition that is emergent and requires ED treatment but could have been prevented through primary care	NYU ED Algorithm
	Average Emergent – ED Care Needed – Not Preventable/Avoidable ER Visit Likelihood	Average likelihood that an enrollee visits the ED for a condition that is emergent and requires ED treatment and could not have been prevented	NYU ED Algorithm
	Inpatient Hospitalizations	Number of inpatient hospitalizations	VCUHS Utilization and VA Premier claims files
	Inpatient Hospitalizations for Ambulatory Sensitive Conditions	Number of inpatient hospitalizations for ambulatory sensitive conditions as identified by AHRQ	AHRQ Ambulatory Sensitive Condition Indicators

Table 7 (continued)

Construct	Variable	Measure	Source
	Outpatient Hospital Visits	Number of outpatient hospital visits, including ambulatory care and specialists	VCUHS Utilization and VA Premier claims files
	Percent of Ambulatory Visits to a PCP	PCP visits per total ambulatory care visits	VCUHS Utilization and VA Premier claims files
Cost	Total Cost	Sum of costs for PCP visits, ED visits, inpatient hospitalizations, and outpatient hospital visits for each enrollee	VCUHS Utilization and VA Premier claims files
Patient Information	Age	Age of patient	VCC Enrollment file
	Race/Ethnicity	White (1), All others (0)	VCC Enrollment file
	Gender	Male (0), Female (1)	VCC Enrollment file
	Prior Enrollment in an Insurance Program	Yes (1), No (0)	VCUHS Utilization file

Preliminary Data Management and Analysis

To determine chronic condition status, risk, urgency of emergency room

utilization, and ambulatory sensitive conditions, several programs and algorithms are

utilized through a combination of statistical software packages such as SAS or SPSS.

The creation of a chronic condition status variable was done using an algorithm

developed by HCUP. This identifies visits for a chronic condition based on diagnosis,

and also identifies each visit as one of 18 body system categories including mental

disorders, diseases of the nervous system and sense organs, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, and the like. To create a variable for enrollee chronic condition status, the number of unique categories containing a chronic condition is counted for each patient. For this study, an enrollee with no chronic conditions is defined as having no visits identified as chronic by the HCUP algorithm. An enrollee with a chronic condition in one body system can have visits for acute conditions and must have at least one visit for a chronic condition, but the chronic condition visits must be in one body system as identified by the HCUP algorithm. An enrollee with chronic conditions in multiple body systems can have visits for acute conditions and must have multiple visits for chronic conditions, with the chronic condition visits being in multiple body systems as identified by the HCUP algorithm.

The HCUP tool was first developed by Hwang and colleagues in 2001 (Hwang et al., 2001) using information from the Medical Expenditure Panel Survey (MEPS). A panel of physicians reviewed diagnosis codes to determine whether they represented acute or chronic conditions. Since then, HCUP has extensively reviewed diagnosis codes not included in the MEPS data, as well as reviewing any disagreements with the panel which performed the original classification and having expert medical coders also review the classifications. The HCUP algorithm has been used in many studies, showing that it can be effective in identifying chronic conditions (Friedman et al., 2006; Bynum et al., 2004; Wheeler et al., 2004; Yu et al., 2004).

The risk variable was created by using case mix software developed by Johns Hopkins University. This software uses patient information in conjunction with

utilization information to create a risk score on a scale of zero to one for each patient.

This software has been validated through a variety of studies (Halling et al., 2006;

Weiner et al., 1992; Sullivan et al., 2004) and takes into account disease patterns, age,

and gender to better understand and predict the level of risk for use of health care services

among patients (Belalcazar & Swank, 2006; Halling et al, 2006).

Identifying ED visits and inpatient hospitalizations for ambulatory sensitive

conditions was done through the use of an algorithm developed by AHRQ, and uses

diagnosis to identify these visits (Billings, 2003). Each visit for an ambulatory sensitive

condition is assigned a score of one, and will be summed for each enrollee. This

algorithm has also been tested and used in many studies (Zhang & Mueller, 2005; Ansari,

2007; Prentice & Pizer, 2008; Warner & Ziboh, 2008).

 The NYU ED algorithm variables are created for each visit. The algorithm also

uses diagnosis, and places a weight into one of four categories that shows the likelihood

of a visit being an emergency. The four categories are non-emergent, emergent/primary

care treatable, emergent – ED care needed – preventable/avoidable, and emergent – ED

care needed – not preventable/avoidable.   Each ED visit receives a score in the four

categories that sum to a value of one, and these scores represent the likelihood that a visit

actually would be placed into this category by the health care provider. To create the

variables for this study, each of the four categories will be averaged for each enrollee to

create four variables that summarize all of the enrollee's ED visits.

The ED algorithm was developed by NYU to examine ED use in their own

hospital (Billings et al, 2000; Weinick & Billings, 2003), and has since been used by

numerous hospitals to also examine their ED use. The NYU algorithm has also been used in a variety of studies to examine patient behaviors and ED utilization (Frisse & Holmes, 2007; Begley et al., 2004; Rust et al, 2009).

Two of the data files, the utilization data from the VCU Health Center and the claims information from Virginia Premier, were received as visit-level information with one record for each encounter. However, this study is interested in the behavior of each enrollee, so the variables used in this analysis were created by combining visit information to create two records for each enrollee, one for the pre-enrollment period, and one for the enrollment period. Both periods contain the same variables. For patient information variables, the values will be the same in both periods. The value for length of enrollment in the pre-enrollment period will be equal to one year. The Enrollment Status variable will contain a value of zero for the pre-enrollment record and a value of one for the record during the patient's enrollment.

Variables related to utilization will be created by the sum of the number of visits in the pre-enrollment period and the enrollment period, as will the total cost variable. The four variables related to the NYU algorithm will be the average of the values for each enrollee's ED visits in either period.

Change variables between the pre-enrollment period and the during-enrollment period will be calculated as the difference of the two periods.

Analytic Strategy

Analysis for this study will be done in two phases. The first phase includes descriptive statistics and initial testing. In addition, variables are created for chronic

condition status, based on chronic condition indicators developed by HCUP, as well as

case mix, which is created through the use of ACG software developed by Johns

Hopkins. Other variable creation also includes totals for utilization and cost, natural log

of cost, and averages for urgency of ED use as defined by the NYU ED algorithm and is

done through SAS.

The second phase of analysis will use multivariate linear regression to examine

how utilization may be changed after a patient has been enrolled in the VCC program.

The model for this regression is:

Utilization = f(Enrollment Indicator, Chronic Condition Status, Enrollment x

Chronic Condition Status, Pre-enrollment Risk, Prior Enrollment in an Insurance

Program, Length of Enrollment, Age, Race/Ethnicity, Gender).

The results of this analysis will enable several utilization variables to be tested to

examine how they may or may not change upon enrollment in the program. By

examining different utilization variables, it will be possible to see how patient behavior

changes with respect to various types of health care services.

<center>Limitations</center>

As discussed earlier in this chapter, there are several limitations in this study

related to the design. The study design contains threats to internal validity, which have

been taken into account in the setup of the data analysis. In addition to these threats to

internal validity, this study has limited generalizability.   This study only examines the

treatment effect of enrolling patients in a coordinated care program in one health system,

and therefore it is not be possible to generalize the findings to other coordinated care

programs.   However, for coordinated care programs that share many of the

characteristics of the VCC program, it may be possible to use these findings to set

expectations for other programs or add meaning to finding for other programs.

One of the main limitations of this study is the lack of a control group in the study

design. A control group would allow for a better understanding of how enrollment in a

coordinated care program impacts utilization. With the study design that will be used, it

is possible to see how utilization for patients may change once they are enrolled in the

program. However, what is not known is how patients would continue to seek care if

they were not enrolled in the program. A control group would show how similar patients

continue to seek out care, and would help determine the impact of biases in the study.

Another major limitation is the use of administrative data from VCUHS and

Virginia Premier Health Plan. When using data from a secondary source, it is always

important to consider how the data was collected and how accurate it may (or may not)

be. These data were collected from enrollee medical records for purposes of tracking

patients and making payments to providers (in the case of VCC primary care physicians

and Richmond Community Hospital). Since it is from medical records, there is a great

deal of information about the enrollee, their medical needs, and the treatment that they

received. Also, since these data are provided by VCU Decision Support, it was possible

to ask questions about the data, its origins, and its meaning, and to gain a basic

understanding of how and why the information is collected and organized.   However, as

with all secondary data, it is impossible to know the quality and accuracy of the data.

This study is concerned with comparing patient utilization before patients are enrolled in a coordinated care program and during their enrollment.   While the data available for this study contains much of this information, there are some components that are missing that prevent being able to examine the whole picture of a patient's health care. The data contain physician and hospital utilization, but does not include information for pharmacy services and ancillary services, such as lab work. Also, the goal of the CCM and the VCC program are to improve patient outcomes, and this cannot be measured directly from the available data, as it is administrative in nature.

Since this study uses only administrative data, it is impossible to know how the data relate to what the enrollees actually do and feel. The enrollees determine for themselves how, when, and where they will utilize the health care system, and for what reasons. Without this information, it is possible to tell what patients are choosing to do, but it is impossible to tell why.

The creation of variables in this study using algorithms, models, and other tools is a limitation of this study.   Although these tools have been tested and examined through their use by researchers and health care professionals, no tool is exhaustive in its ability to provide reliable results.   Many of the algorithms used in this study are based solely on diagnosis code and do not take other factors into consideration.

CHAPTER 5: RESULTS

There were a total of 723,304 observed patient encounters for 50,773 patients

enrolled in the VCC program over the study period of 9 years. The study population was

narrowed based on VCC program requirements: an enrollee must be a resident of the city

of Richmond and between 18 and 64 years of age. In addition, some patients are briefly

enrolled in the program while their financial application is under consideration, and then

removed if they do not meet the criteria for VCC. Enrollees considered for this study

must have been in the program for at least one full term of enrollment, or one year. They

must also have had utilization information available in the pre-enrollment period. Based

on these criteria, the number of enrollees that in this study population is 20,205. For this

population, the total number of encounters was 511,415 and the study period remained 9

years. The following results include those for the descriptive analysis, the bi-variate

analysis, and the linear regression used to test the study hypotheses. Also included is an

exploratory condition-specific subanalysis for enrollees with the most common chronic

conditions.

Descriptive Analysis

Descriptive analyses were conducted to explore the characteristics of the study

population and to determine if these characteristics were different from all of the patients

enrolled in the VCC program, regardless of whether or not they met the enrollment

criteria.

Table 8 shows the characteristics of the total and study populations, as well as any

significant differences between the included and excluded enrollees. The number of

enrollees excluded from this study because their enrollment period was less than one year

was 3,939. Almost all of the characteristic variables were found to have statistically

significant differences between the enrollees included in the study and those enrollees

who were in VCC in spite of not meeting the enrollment criteria. The variables that did

not have a significant difference were age and chronic conditions in one body system.

Table 8.   Comparisons of Excluded and Study Enrollees

	All		Study		Excluded		Signifi-cance
	Average or Number	Standard Deviation or Percent	Average or Number	Standard Deviation or Percent	Average or Number	Standard Deviation or Percent	$p < 0.01$
Age	38.45	14.75	38.37	12.40	38.51	16.12	0.29
Length of Enrollment	2.04	1.94	2.71	2.29	1.40	4.93	0.00
Pre-enrollment Risk	0.05	0.10	0.06	0.11	0.04	0.08	0.00
Female	29,570.00	58.24	12,185.00	60.31	17,385.00	56.87	0.00
White	13,923.00	27.42	5,099.00	25.24	8,824.00	28.87	0.00
No Prior Insurance	34,704.00	68.35	11,324.00	56.05	23,380.00	76.49	0.00
Chronic Condition in One Body System	10,973.00	21.61	4,470.00	22.12	6,503.00	21.27	0.02
Chronic Conditions in Multiple Body Systems	17,071.00	33.62	8,699.00	43.05	8,372.00	27.39	0.00

The average length of enrollment for those enrollees included in the study was 2.71 years, while that for those excluded was 1.4 years, which is consistent with expectations. The average risk assessment score for enrollees included in the study was 0.06, versus 0.04 for those not included. This variable measures the likelihood that an enrollee will consume a relatively large amount of resources based on their past utilization. A majority of enrollees in both groups had no record of prior insurance enrollment: 56% for those included in the study population and 77% for those in the entire population of enrollees. For those enrollees who were included in the study, there were significantly less who had no chronic conditions (34.8% of those included versus 51.4% of those not included) and slightly more that had a chronic condition in one body system (22.1% and 22.2% respectively) and chronic conditions in multiple body systems (43.1% and 27.4% respectively), which again suggests that those excluded from the study were less likely to be in need of longer term chronic care.

Enrollees in the study population had a mean age of 38 years. There were more women than men (60% versus 40%), and more non-whites than whites (75% versus 25%).

Descriptive Analysis – Study Population Only

Table 9 shows demographic characteristic differences between groups of enrollees included in the study based on chronic condition status. Differences were found to be significant for all demographic variables except race/ethnicity between all three of the groups: those with no chronic conditions, those with a chronic condition in one body system, and those with chronic conditions in multiple body systems. The average age for

Table 9. Characteristics of Study Enrollees by Chronic Condition Status

	No Chronic Conditions		Chronic Conditions in One Body System		Chronic Conditions in Multiple Body Systems		Signifi-cance
	Average or Number	Standard Deviation or Percent	Average or Number	Standard Deviation or Percent	Average or Number	Standard Deviation or Percent	P
Age	33.39	11.60	37.35	12.19	42.92	11.43	0.00
Length of Enrollment	1.48	1.32	2.24	1.94	3.94	2.44	0.00
Pre-enrollment Risk	0.02	0.02	0.04	0.05	0.10	0.15	0.00
Female	3,918.00	55.70	2,591.00	58.00	5,676.00	65.20	0.00
White	1,847.00	26.30	1,090.00	24.40	2,162.00	24.90	0.04
No Prior Insurance Enrollment	4,773.00	67.80	2,454.00	54.90	4,097.00	47.10	0.00

enrollees with no chronic conditions was 33.4, 37.4 for those enrollees with a chronic condition in one body system, and 43.0 for those enrollees with chronic conditions in multiple body systems. The average length of enrollment for enrollees with no chronic conditions was 1.5 years, 2.2 for those enrollees with a chronic condition in one body system, and 3.9 for those enrollees with chronic conditions in multiple body systems.

There were more women than men in all three chronic condition groups. For enrollees with no chronic conditions, 56% of the enrollees were female versus 44% male. For enrollees with a chronic condition in one body system, 58% of the enrollees were female versus 42% percent male. For enrollees with chronic conditions in multiple body systems, 65% of the enrollees were female versus 35% male.

There were also more nonwhites than whites in all three chronic condition groups. For enrollees with no chronic conditions, 74% of the enrollees were nonwhite versus 26%

white. For enrollees with a chronic condition in one body system and for those with chronic conditions in multiple body systems, 75% of the enrollees were nonwhite versus 25% white.

Finally, all the chronic condition groups had different levels of enrollees who had no prior insurance enrollment. For enrollees with no chronic conditions, 67% of the enrollees had not been enrolled in an insurance program versus 33% who had. For enrollees with a chronic condition in one body system, 55% of the enrollees had not been enrolled in an insurance program versus 45% who had. For enrollees with chronic conditions in multiple body systems, 47% of the enrollees had not been enrolled in an insurance program versus 53% who had.

Table 10 shows correlations between the independent variables. An initial correlation analysis included all of the independent variables in order to determine the relationship between them. It is important to understand how the independent variables may be related because intercorrelations among them may affect the outcome of the regression model. The correlation analysis revealed that many of the independent variables were significantly correlated as shown in Table 10 but at relatively low levels in virtually all instances. Although most of the independent variables had some degree of correlation, none were so high to present multi-collinearity problems, and they were all retained in the linear regression so that the effects of these characteristics could be noted.

<div align="center">Utilization Analysis</div>

Table 11 shows the utilization of services by enrollees in the pre-enrollment period and the during enrollment period for the study population. This table

Table 10.   Independent Variable Correlations

	Age	Length of Enrollment	Pre-enrollment Risk	Female	White	No Prior Insurance Enrollment	Chronic Condition in One Body System	Chronic Conditions in Multiple Body Systems
Age	1.00	0.12*	0.21*	-0.05*	0.00	0.03*	-0.04*	0.32*
Length of Enrollment	0.12*	1.00	0.36*	0.11*	-0.07*	-0.12*	-0.11*	0.47*
Pre-enrollment Risk	0.21*	0.36*	1.00	0.05*	0.00	-0.06*	-0.11*	0.34*
Female	-0.05*	0.11*	0.05*	1.00	-0.06*	-0.12*	-0.03*	0.09*
White	0.00	-0.07*	0.00	-0.06*	1.00	0.12*	-0.01	-0.01
No Prior Insurance Enrollment	0.03*	-0.12*	-0.06*	-0.12*	0.12*	1.00	-0.01	-0.16*
Chronic Condition in One Body System	-0.04*	-0.11*	-0.11*	-0.03*	-0.01	-0.01	1.00	-0.46*
Chronic Conditions in Multiple Body Systems	0.32*	0.47*	0.34*	0.09*	-0.01	-0.16*	-0.46*	1.00

*Correlation is significant at the 0.01 level

Table 11.   Pre- and During VCC Enrollment Utilization Comparison

	Pre-Enrollment Mean	Standard Deviation	First Year of Enrollment Mean	Standard Deviation	Percent Change (change in mean/pre-enrollment mean)	Significance	Average Annual Mean	Standard Deviation	Percent Change	Significance
ED Visits	1.04	1.31	0.95	1.79	-9.06	0.00	0.86	1.54	-17.19	0.00
ED with ASC	0.08	0.42	0.08	0.46	-1.77	0.67	0.08	0.34	-10.71	0.00
Emergent ED Visits	0.07	0.21	0.07	0.26	0.37	0.90	0.07	0.22	-8.42	0.00
Inpatient Visits	0.14	0.47	0.17	0.62	29.19	0.00	0.16	0.54	17.63	0.00
Inpatient with ASC	0.01	0.18	0.02	0.22	55.48	0.00	0.02	0.18	37.25	0.00
Outpatient Visits	2.61	4.57	4.17	5.53	59.34	0.00	3.59	4.53	37.45	0.00
PCP Visits	0.31	1.18	1.20	2.38	288.47	0.00	1.27	2.09	312.05	0.00
Percent of Ambulatory Visits to a PCP	0.07	0.22	0.15	0.25	118.16	0.00	0.08	0.10	19.90	0.00
Total Cost	2,609.49	8,561.81	3,013.26	9,120.79	15.47	0.00	3,682.33	10,424.63	41.11	0.00
Total Encounters	4.10	5.04	6.49	7.11	58.17	0.00	8.19	7.42	99.75	0.00

includes two measures of utilization: information on enrollee utilization per year of

enrollment as well as their utilization in the first year of enrollment and their respective

percent changes.   Since enrollee utilization may change based on length of enrollment, it

is important to examine the potential differences between the first year of enrollment and

the average annual use. For the data pertaining to utilization per year of enrollment, there

were significant changes between the pre-enrollment and during enrollment periods.

Cost, total encounters, inpatient visits, inpatient visits for ASC, outpatient visits, PCP

visits, and percent of ambulatory visits that are to a PCP all increased, while ED visits,

ED visits for ASC, and emergent ED visits all decreased. For the first year of enrollment,

there were also significant changes between the pre-enrollment and during enrollment

periods. Cost and total encounters increased, as did inpatient visits, inpatient visits for

ASC, outpatient visits, PCP visits, and percent of ambulatory care visits that are to a PCP.

ED visits showed a significant decrease, while ED visits for ASC and emergent ED visits

did not show significant changes between pre-enrollment and the first year of enrollment.

In addition to examining how utilization changed in the pre and during enrollment

periods, utilization changes for the chronic condition status groups were also compared.

Table 12 examines the change between pre-enrollment utilization and utilization in the

first year of enrollment. The only differences that were not found to be significant were

the change in ED encounters for ASC and change in inpatient hospitalizations for ASC

for the first year of enrollment.

Table 13 shows the changes between the pre-enrollment utilization and the

average annual enrollment utilization and compares them for each chronic condition

Table 12. Change in Utilization Versus Chronic Condition Status – First Year of Enrollment

Dependent Variables	Enrollees With No Chronic Conditions		Enrollees with Chronic Conditions in One Body System			Enrollees with Chronic Conditions in Multiple Body Systems			
	Mean	Standard Deviation	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.47	1.30	-0.05	1.78	Y	0.19	2.10	Y	Y
Change in ED Encounters for ASC	-0.03	0.34	-0.01	0.50	N	0.03	0.60	Y	Y
Change in Emergent ED Encounters	-0.03	0.20	0.00	0.28	Y	0.02	0.38	Y	Y
Change in Inpatient Hospitalizations	-0.06	0.42	0.06	0.67	Y	0.11	0.80	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.09	0.01	0.20	N	0.02	0.27	N	N
Change in Outpatient Hospital Encounters	-0.06	3.73	1.27	4.84	Y	3.00	6.81	Y	Y

Table 12 (continued)

Dependent Variables	Enrollees With No Chronic Conditions		Enrollees with Chronic Conditions in One Body System			Enrollees with Chronic Conditions in Multiple Body Systems			
	Mean	Standard Deviation	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.10	0.96	0.73	1.91	Y	1.61	3.11	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.04	0.14	0.10	0.20	Y	0.08	0.20	Y	Y
Change in Total Encounters	-0.49	4.35	2.00	6.03	Y	4.91	8.89	Y	Y
Change in Cost	-894.15	9,932.37	447.64	12,502.10	Y	1,431.02	12,127.88	Y	Y

Table 13. Change in Utilization Versus Chronic Condition Status – Average Annual Use During Enrollment

Dependent Variables	Enrollees With No Chronic Conditions		Enrollees with Chronic Conditions in One Body System			Enrollees with Chronic Conditions in Multiple Body Systems			
	Mean	Standard Deviation	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.50	1.25	-0.14	1.57	Y	0.06	1.90	Y	Y
Change in ED Encounters for ASC	-0.03	0.33	-0.01	0.42	N	0.01	0.48	Y	N
Change in Emergent ED Encounters	-0.03	0.19	-0.01	0.25	N	0.01	0.33	Y	N
Change in Inpatient Hospitalizations	-0.06	0.41	0.04	0.62	Y	0.08	0.72	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.09	0.01	0.19	N	0.01	0.22	Y	N
Change in Outpatient Hospital Encounters	-0.17	3.61	0.83	4.55	Y	1.99	6.26	Y	Y

Table 13 (continued)

Dependent Variables	Enrollees With No Chronic Conditions Mean	Standard Deviation	Enrollees with Chronic Conditions in One Body System Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Enrollees with Chronic Conditions in Multiple Body Systems Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.08	0.90	0.68	1.80	Y	1.82	2.74	Y	Y
Change in Percent of Ambulatory Visits to a PCP	-0.03	0.21	0.02	0.23	Y	0.05	0.22	Y	Y
Change in Total Encounters	1.73	3.18	3.83	4.87	Y	6.13	7.79	Y	Y
Change in Cost	-644.71	10,385.83	1,003.48	12,975.02	Y	2,497.68	13,487.75	Y	Y

status. For each of the dependent variables, it was found that the change between the

chronic condition groups was significant (p < 0.01) with the exception of the change in

ED encounters for ASC, change in emergent ED encounters, and inpatient

hospitalizations for ASC between the enrollees with chronic conditions in one body

system and chronic conditions in multiple body systems.

Correlation Analysis

Correlations were also examined between each independent and dependent

variable in order to better understand possible relationships between these variables

without accounting for the other variables. Bivariate analysis results are shown in Table

14 reflecting utilization during the first year of enrollment. Many of these correlations

were significant as well. Age of enrollee was positively associated with increases in cost,

total encounters, outpatient hospital encounters, PCP encounters, and percent of

ambulatory care visits that were to a PCP. Length of enrollment was positively

associated with ED visits, and emergent ED visits and negatively associated with total

encounters, inpatient hospitalizations, outpatient hospital encounters, PCP encounters,

and percent of ambulatory care visits to a PCP. Pre-enrollment risk was positively

associated with all of the dependent variables with the exception of inpatient

hospitalizations for ASC.

Being female as opposed to male was positively associated with change in percent

of ambulatory visits to a PCP and was not negatively associated with any of the

dependent variables. Being white as opposed to another race/ethnicity was positively

Table 14.   Bivariate Correlations – First Year of Enrollment

	Change in Cost	Change in Total Encounters	Change in ED Encounters	Change in ED Encounters for ASC	Change in Emergent ED Encounters	Change in Inpatient Hospitalizations	Change in Inpatient Hospitalizations for ASC	Change in Outpatient Hospital Encounters	Change in Primary Care Physician Encounters	Change in Percent of Ambulatory Visits to a PCP
Age	0.03**	0.06**	0.01	0.00	0.00	0.01	0.01	0.03**	0.10**	0.04**
Length of Enrollment	-0.01	-0.02*	0.03**	0.01	0.01*	-0.02*	-0.01	-0.02*	-0.04**	-0.15**
Pre-enrollment Risk	0.08**	0.19**	0.06**	0.03**	0.04**	0.12**	-0.01	0.10**	0.27**	0.03**
Female	0.01	0.00	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.01	0.02**
White	0.00	0.02**	-0.01*	0.01	-0.01	-0.01	0.00	0.02**	0.03**	-0.02**
No Prior Insurance Enrollment	-0.01	-0.05**	-0.08**	-0.02**	-0.03**	-0.04**	-0.03**	-0.04**	0.00	-0.06**
Chronic Condition in One Body System	0.00	-0.03**	0.01	-0.01	0.00	0.01*	0.00	-0.03**	-0.04**	0.08**
Chronic Conditions in Multiple Body Systems	0.08**	0.30**	0.14**	0.05**	0.06**	0.09**	0.04**	0.22**	0.26**	0.04**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

associated with change in total encounters, change in outpatient hospital encounters, and change in PCP visits and negatively associated with change in ED encounters and change in percent of ambulatory visits to a PCP. Prior enrollment in an insurance program as opposed to no prior enrollment in an insurance program was negatively associated with changes in all of the dependent variables except for change in PCP encounters and change in cost.

Having a chronic condition in one body system as opposed to having no chronic conditions was positively associated with change in inpatient hospitalizations, and change in percent of ambulatory visits to a PCP and negatively associated with change in total encounters, change in outpatient hospital encounters, and change in PCP visits. Having chronic conditions in multiple body systems as opposed to having no chronic conditions was positively associated with changes in all of the dependent variables.

Bivariate analysis was also done to examine the relationship between the independent variables and the dependent variables for average annual use during enrollment. Many of these correlations were significant as shown in Table 15. Age of enrollee was positively associated with change in cost, change in total encounters, change in PCP encounters, and change in percent of ambulatory care visits that are to a PCP. Length of enrollment was positively associated with change in PCP encounters and change in percent of ambulatory care visits that are to a PCP and negatively associated with change in cost, change in total encounters, change in inpatient hospitalizations, change in inpatient hospitalizations for ASC, and change in outpatient hospital

Table 15. Bivariate Correlations – Average Annual Use During Enrollment

	Change in Cost	Change in Total Encounters	Change in ED Encounters	Change in ED Encounters for ASC	Change in Emergent ED Encounters	Change in Inpatient Hospitalizations	Change in Inpatient Hospitalizations for ASC	Change in Outpatient Hospital Encounters	Change in Primary Care Physician Encounters	Change in Percent of Ambulatory Visits to a PCP
Age	0.05**	0.09**	0.01	0.00	0.00	0.01	0.01	0.01	0.13**	0.05**
Length of Enrollment	-0.03**	-0.22**	-0.01	0.00	0.00	-0.04**	-0.02*	-0.11**	0.06**	0.05**
Pre-enrollment Risk	0.08**	0.21**	0.07**	0.03**	0.04**	0.11**	-0.01	0.10**	0.42**	0.12**
Female	0.01	0.03**	0.02*	0.01	-0.01	0.00	-0.02*	-0.02*	0.04**	-0.01
White	0.00	0.03**	-0.02*	0.00	0.00	-0.01	0.00	0.02*	0.03**	0.06**
Prior Insurance Enrollment	0.03**	-0.11**	-0.08**	-0.02**	-0.03**	-0.04**	-0.02**	-0.03**	0.00	0.18**
Chronic Condition in One Body System	0.00	-0.02**	0.01	0.00	0.00	0.01	0.00	-0.02*	-0.07**	0.01
Chronic Conditions in Multiple Body Systems	0.10**	0.29**	0.13**	0.04**	0.06**	0.09**	0.04**	0.17**	0.34**	0.12**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

encounters. Pre-enrollment risk was positively associated with all of the dependent variables with the exception of change in inpatient hospitalizations for ASC.

Being female as opposed to male was positively associated with change in total encounters, change in ED encounters, and change in PCP visits and negatively associated with change in inpatient hospitalizations for ASC and change in outpatient hospital encounters. Being white as opposed to another race/ethnicity was positively associated with change in total encounters, change in outpatient hospital encounters, change in PCP visits, and change in percent of ambulatory visits to a PCP and negatively associated with change in ED encounters. Prior enrollment in an insurance program as opposed to no prior enrollment in an insurance program was positively associated with change in cost and change in percent of ambulatory visits to a PCP and negatively associated with change in total encounters, change in ED encounters, change in ED encounters for ASC, change in emergent ED encounters, change in inpatient hospitalizations, change in inpatient hospitalizations for ASC, and change in outpatient hospital encounters.

Having a chronic condition in one body system as opposed to having no chronic conditions was negatively associated with change in ED encounters, change in inpatient hospitalizations, and change in outpatient hospital encounters. Having chronic conditions in multiple body systems as opposed to having no chronic conditions was positively associated with changes in all of the dependent variables.

Linear Regression Analysis

The linear regression analyses included models to examine which factors influenced measures of utilization including ED encounters, ED encounters for

ambulatory sensitive conditions, emergent ED encounters, inpatient hospitalizations, inpatient hospitalizations for ambulatory sensitive conditions, outpatient hospital encounters, primary care physician encounters, percent of ambulatory encounters that are to a primary care physician, total encounters, and cost. These models included the independent variables of chronic condition status, pre-enrollment risk, enrollment status, length of enrollment, prior enrollment in an insurance program, age, race/ethnicity, and gender. Models were run using utilization in the pre-enrollment period and the first year of enrollment as well as utilization in the pre-enrollment period and average annual utilization.

ED Encounters – First Year of Enrollment

For the dependent variable of ED encounters, the regression results showed that several of the independent variables had a significant impact on ED encounters (r^2 = 0.06, p < 0.01). Contrary to hypotheses, the interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in ED encounters. Consistent with expectations, enrollment status was associated with a decrease in ED encounters indicating VCC enrollees experienced a reduction in ED usage. A chronic condition in one body system and chronic conditions in multiple body systems was associated with an increase in ED encounters. Age and being white versus another race/ethnicity also were also associated with a decrease in ED use.   Pre-enrollment risk, being male versus female, and lack of prior insurance enrollment all were associated with an increase in ED encounters. Length of enrollment

did not have a significant impact, and a chronic condition in one body system was also not significant. This is shown in Table 16.

Table 16. ED Encounters, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.60	0.01	42.59	0.00
Enrollment Status	-0.10	0.01	-8.67	0.00
Chronic Condition in One Body System	0.02	0.01	1.31	0.19
Chronic Conditions in Multiple Body Systems	0.15	0.01	10.66	0.00
Enrollment Status x Chronic Condition in One Body System	0.43	0.02	20.39	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.63	0.02	33.90	0.00
Length of Enrollment	0.00	0.00	0.35	0.72
Pre-enrollment Risk	0.48	0.05	10.43	0.00
Age	-0.01	0.00	-25.28	0.00
Male	0.12	0.01	14.82	0.00
White	-0.08	0.01	-9.28	0.00
No Prior Insurance Enrollment	0.28	0.01	32.25	0.00

$r^2 = 0.06$

ED Encounters for ASC – First Year of Enrollment

For the dependent variable of ED encounters for ASC, the regression results showed that several of the independent variables had a significant impact on how ED encounters for ASC changed ($r^2 = 0.01$, $p < 0.01$). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in ED encounters for ASC. Enrollment status was associated with a decrease in ED encounters for ASC. A chronic condition in one body system and chronic conditions in multiple body systems were associate with an increase in ED encounters for ASC, as did age, being male versus female, and pre-enrollment risk. Being white versus another race/ethnicity were associated with a decrease in ED encounters for ASC. Length of

enrollment and lack of prior insurance enrollment did not have a significant impact on

ED encounters for ASC. This is shown in Table 17.

Table 17.   ED Encounters for ASC, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.05	0.00	12.41	0.00
Enrollment Status	-0.01	0.00	-3.78	0.00
Chronic Condition in One Body System	0.01	0.00	2.84	0.01
Chronic Conditions in Multiple Body Systems	0.04	0.00	9.87	0.00
Enrollment Status x Chronic Condition in One Body System	0.04	0.01	7.36	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.06	0.01	12.16	0.00
Length of Enrollment	0.00	0.00	0.18	0.86
Pre-enrollment Risk	-0.03	0.01	-2.64	0.01
Age	0.00	0.00	-9.56	0.00
Male	0.02	0.00	8.91	0.00
White	-0.02	0.00	-7.86	0.00
No Prior Insurance Enrollment	0.03	0.00	11.14	0.00

$r^2 = 0.01$

Emergent ED Encounters – First Year of Enrollment

For the dependent variable of emergent ED encounters, the regression results

showed that several of the independent variables had a significant impact on how

emergent ED encounters changed ($r^2 = 0.004$, $p < 0.01$).   The interactions of being

enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in emergent ED encounters.   Contrary to expectations,

enrollment status, a chronic condition in one body system, and chronic conditions in

multiple body systems did not have a significant impact on emergent ED encounters.

Pre-enrollment risk, age, being male versus female, and lack of prior insurance

enrollment were also associated with an increase in emergent ED encounters. Length of

enrollment was associated with a decrease in emergent ED encounters. Being white

versus another race/ethnicity did not have a significant impact on emergent ED

encounters. This is shown in Table 18.

Table 18.   Emergent ED Encounters, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.12	0.03	4.05	0.00
Enrollment Status	-0.03	0.02	-1.26	0.21
Chronic Condition in One Body System	-0.01	0.03	-0.25	0.80
Chronic Conditions in Multiple Body Systems	0.03	0.03	0.97	0.33
Enrollment Status x Chronic Condition in One Body System	0.15	0.04	3.39	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.39	0.04	9.95	0.00
Length of Enrollment	-0.01	0.00	-2.07	0.04
Pre-enrollment Risk	0.53	0.10	5.60	0.00
Age	0.00	0.00	-3.97	0.00
Male	0.04	0.02	2.26	0.02
White	0.00	0.02	0.10	0.92
No Prior Insurance Enrollment	0.09	0.02	5.07	0.00

$r^2 = 0.004$

Inpatient Hospitalizations – First Year of Enrollment

For the dependent variable of inpatient hospitalizations, the regression

results showed that several of the independent variables had a significant impact on how

inpatient hospitalizations changed ($r^2 = 0.05$, $p < 0.01$). The interactions of being

enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in inpatient hospitalizations. Consistent with expectations,

enrollment status, a chronic condition in one body system, and chronic conditions in

multiple body systems were all associated with a decrease in inpatient hospitalizations.

Pre-enrollment risk, age, being male versus female, being white versus another

race/ethnicity, and lack of prior insurance enrollment were also associated with an

increase in inpatient hospitalizations.   As expected, length of enrollment was associated

with a decrease in inpatient hospitalizations. This is shown in Table 19.

Table 19.   Inpatient Hospitalizations, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	-0.03	0.01	-6.34	0.00
Enrollment Status	-0.03	0.00	-6.41	0.00
Chronic Condition in One Body System	-0.02	0.01	-4.34	0.00
Chronic Conditions in Multiple Body Systems	-0.03	0.00	-5.90	0.00
Enrollment Status x Chronic Condition in One Body System	0.17	0.01	22.04	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.21	0.01	31.13	0.00
Length of Enrollment	-0.01	0.00	-9.92	0.00
Pre-enrollment Risk	0.27	0.02	16.34	0.00
Age	0.00	0.00	10.56	0.00
Male	0.09	0.00	30.89	0.00
White	0.01	0.00	3.60	0.00
No Prior Insurance Enrollment	0.12	0.00	37.19	0.00

$r^2 = 0.05$

Inpatient Hospitalizations for ASC – First Year of Enrollment

For the dependent variable of inpatient hospitalizations for ASC, the regression

results showed that several of the independent variables had a significant impact on how

inpatient hospitalizations changed ($r^2 = 0.009$, $p < 0.01$). The interactions of being

enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in inpatient hospitalizations for ASC. Enrollment status,

chronic conditions in multiple body systems, and length of enrollment were also

associated with an increase in inpatient hospitalizations for ASC. Age, being male versus

female, lack of prior insurance enrollment were also associated with an increase in

inpatient hospitalizations for ASC. Pre-enrollment risk was associated with a decrease in

inpatient hospitalizations for ASC. A chronic condition in one body systems and being

white versus another race/ethnicity did not have a significant impact on inpatient

hospitalizations for ASC. This is shown in Table 20.

Table 20.   Inpatient Hospitalizations for ASC, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.00	0.00	-2.48	0.01
Enrollment Status	-0.01	0.00	-4.49	0.00
Chronic Condition in One Body System	0.00	0.00	-0.59	0.56
Chronic Conditions in Multiple Body Systems	0.00	0.00	2.28	0.02
Enrollment Status x Chronic Condition in One Body System	0.02	0.00	8.26	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.03	0.00	13.17	0.00
Length of Enrollment	0.00	0.00	-4.29	0.00
Pre-enrollment Risk	-0.04	0.01	-7.97	0.00
Age	0.00	0.00	5.78	0.00
Male	0.01	0.00	6.36	0.00
White	0.00	0.00	0.05	0.96
No Prior Insurance Enrollment	0.02	0.00	15.71	0.00

$r^2 = 0.009$

Outpatient Hospital Encounters – First Year of Enrollment

For the dependent variable of outpatient hospital encounters, the regression results

showed that all of the independent variables had a significant impact on how outpatient

encounters changed ($r^2 = 0.22$, $P < 0.01$). As hypothesized, the interactions of being

enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in outpatient hospital encounters. Enrollment status and a

chronic condition in one body system were associated with a decrease in outpatient

hospital encounters, while chronic conditions in multiple body systems were associated

with an increase in outpatient hospital encounters. Pre-enrollment risk, age, being white

versus another race/ethnicity, and lack of prior insurance enrollment were also associated

with an increase in outpatient encounters. Length of enrollment was associated with a

decrease in outpatient hospital encounters, as was being male versus female. This is

shown in Table 21.

Table 21.   Outpatient Hospital Encounters, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.53	0.04	12.03	0.00
Enrollment Status	-0.20	0.04	-5.23	0.00
Chronic Condition in One Body System	-0.35	0.05	-7.55	0.00
Chronic Conditions in Multiple Body Systems	0.40	0.04	9.47	0.00
Enrollment Status x Chronic Condition in One Body System	2.19	0.07	33.24	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	4.52	0.06	77.41	0.00
Length of Enrollment	-0.02	0.00	-4.95	0.00
Pre-enrollment Risk	0.85	0.14	5.93	0.00
Age	0.01	0.00	15.71	0.00
Male	-0.59	0.03	-22.97	0.00
White	0.41	0.03	14.39	0.00
No Prior Insurance Enrollment	1.64	0.03	59.79	0.00

$r^2 = 0.22$

Primary Care Physician Encounters – First Year of Enrollment

For the dependent variable of change in primary care physician encounters, the

regression results showed that many of the independent variables had a significant impact

on how PCP encounters changed ($r^2 = 0.26$, P < 0.01). As hypothesized, the interactions

of being enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in PCP encounters, as were enrollment status, pre-enrollment

risk, and age. A chronic condition in one body system and chronic conditions in multiple

body systems were associated with a decrease in PCP encounters, as did length of

enrollment, and being male versus female. Being white versus another race/ethnicity and

lack of prior insurance enrollment were not found to have a significant impact on PCP

encounters. This is shown in Table 22.

Table 22.   PCP Encounters, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.05	0.02	2.60	0.01
Enrollment Status	0.08	0.02	5.42	0.00
Chronic Condition in One Body System	-0.09	0.02	-4.46	0.00
Chronic Conditions in Multiple Body Systems	-0.17	0.02	-9.56	0.00
Enrollment Status x Chronic Condition in One Body System	1.04	0.03	38.18	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	2.42	0.02	100.20	0.00
Length of Enrollment	-0.05	0.00	-24.79	0.00
Pre-enrollment Risk	2.98	0.06	50.16	0.00
Age	0.00	0.00	10.32	0.00
Male	-0.10	0.01	-9.36	0.00
White	-0.01	0.01	-0.51	0.61
No Prior Insurance Enrollment	0.01	0.01	0.96	0.34

$r^2 = 0.26$

Percent of Ambulatory Encounters to a PCP – First Year of Enrollment

For the dependent variable percent of ambulatory encounters to a PCP, the

regression results showed that several of the independent variables had a significant

impact on how these encounters changed ($r^2 = 0.17$, $p < 0.01$). As expected, the interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in percent of ambulatory encounters to a PCP, as was enrollment status. Length of enrollment, pre-enrollment risk, age, and lack of prior insurance enrollment were also associated with an increase in percent of ambulatory encounters to a PCP. Being male versus female and being white versus another race/ethnicity were associated with a decrease in percent of ambulatory encounters to a PCP. A chronic condition in one body system and chronic conditions in multiple body systems were not found to have a significant impact on percent of ambulatory encounters to a PCP. This is shown in Table 23.

Table 23.   Percent of Ambulatory Encounters to a PCP, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	0.03	0.00	13.28	0.00
Enrollment Status	0.04	0.00	18.17	0.00
Chronic Condition in One Body System	0.00	0.00	-0.77	0.44
Chronic Conditions in Multiple Body Systems	0.00	0.00	-1.36	0.17
Enrollment Status x Chronic Condition in One Body System	0.17	0.00	49.48	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.19	0.00	61.03	0.00
Length of Enrollment	0.00	0.00	-14.22	0.00
Pre-enrollment Risk	0.13	0.01	17.27	0.00
Age	0.00	0.00	6.04	0.00
Male	-0.01	0.00	-9.32	0.00
White	-0.02	0.00	-10.62	0.00
No Prior Insurance Enrollment	0.01	0.00	7.06	0.00

$r^2 = 0.17$

Total Encounters – First Year of Enrollment

For the dependent variable of total encounters, the regression results showed that all of the independent variables had a significant impact on how total encounters changed ($r^2 = 0.32$, $p < 0.01$).   The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in total encounters, as was chronic conditions in multiple body systems. Enrollment status, a chronic condition in one body system, length of enrollment, and being male versus female were associated with a decrease in total encounters. Pre-enrollment risk, age, being white versus another race/ethnicity, and lack of prior insurance enrollment were also associated with an increase in total encounters.   This is shown in Table 24.

Table 24.   Total Encounters, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	1.14	0.05	21.40	0.00
Enrollment Status	-0.24	0.05	-5.34	0.00
Chronic Condition in One Body System	-0.44	0.06	-7.79	0.00
Chronic Conditions in Multiple Body Systems	0.35	0.05	6.77	0.00
Enrollment Status x Chronic Condition in One Body System	3.83	0.08	47.79	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	7.78	0.07	109.66	0.00
Length of Enrollment	-0.07	0.01	-13.37	0.00
Pre-enrollment Risk	4.57	0.17	26.27	0.00
Age	0.01	0.00	10.77	0.00
Male	-0.48	0.03	-15.24	0.00
White	0.33	0.03	9.55	0.00
No Prior Insurance Enrollment	2.05	0.03	61.48	0.00

$r^2 = 0.32$

Cost – First Year of Enrollment

For the dependent variable of cost, the regression results showed that all of the

independent variables had a significant impact on how cost changed ($r^2 = 0.05$, $p < 0.01$).

Contrary to hypotheses, the interactions of being enrolled in a coordinated care program

and both chronic condition statuses were associated with an increase in cost. However,

enrollment status, a chronic condition in one body system and chronic conditions in

multiple body systems were associated with a decrease in cost, as was length of

enrollment. Pre-enrollment risk, age, being male versus female, being white versus

another race/ethnicity, and lack of prior insurance enrollment were also associated with

an increase in cost.   This is shown in Table 25.

Table 25.   Cost, First Year of Enrollment

	Coefficient	Standard Error	t	Significance
Constant	-308.51	95.97	-3.21	0.00
Enrollment Status	-480.94	82.58	-5.82	0.00
Chronic Condition in One Body System	-380.70	102.64	-3.71	0.00
Chronic Conditions in Multiple Body Systems	-502.84	93.76	-5.36	0.00
Enrollment Status x Chronic Condition in One Body System	2,613.50	144.97	18.03	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	3,792.71	128.26	29.57	0.00
Length of Enrollment	-105.91	9.97	-10.62	0.00
Pre-enrollment Risk	3,546.00	314.33	11.28	0.00
Age	17.46	1.95	8.95	0.00
Male	1,367.41	56.47	24.22	0.00
White	421.88	62.20	6.78	0.00
No Prior Insurance Enrollment	2,392.20	60.36	39.63	0.00

$r^2 = 0.05$

Tables 26 and 27 provide an overview of the regressions for changes in utilization between the pre-enrollment period and the first year of enrollment. Table 26 shows the r^2 values for the models and their significance. Table 27 shows which of the independent variables had a significant impact on the dependent variables, as well as the direction of their relationship.

Table 26. Model Significance Regression Results, First Year Utilization

	r^2	Significance
ED Encounters	0.060	0.00
ED Encounters for ASC	0.010	0.00
Emergent ED Encounters	0.004	0.00
Inpatient Hospitalizations	0.050	0.00
Inpatient Hospitalizations for ASC	0.009	0.00
Outpatient Hospital Encounters	0.220	0.00
Primary Care Physician Encounters	0.260	0.00
Percent of Ambulatory Encounters to a PCP	0.170	0.00
Total Encounters	0.320	0.00
Cost	0.050	0.00

Linear regression analyses were also run using the average annual utilization for enrollees, which shows how enrollee utilization differs based on length of enrollment.

ED Encounters – Average Annual Utilization

For the dependent variable of ED encounters, the regression results showed that all of the independent variables had a significant impact on how ED encounters changed ($r^2 = 0.05$, $P < 0.01$). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in ED encounters. As expected, enrollment status was associated with a decrease in ED encounters. Contrary to expectations, a chronic condition in one body system and chronic conditions

Table 27. Independent Variable Significance in Regression Results, First Year Utilization

Independent Variables	Enroll-ment Status	Chronic Condition in One Body System	Chronic Conditions in Multiple Body Systems	Enrollment Status x Chronic Condition in One Body System	Enrollment Status x Chronic Conditions in Multiple Body Systems	Length of Enroll-ment	Pre-enroll-ment Risk	Age	Male	White	No Prior Insurance Enrollment
ED Encounters	D(ecrease)	N(o Change)	I	I	I	N	I	D	I	D	I
ED Encounters for ASC	D	I(ncrease)	I	I	I	N	D	I	I	D	I
Emergent ED Encounters	N	N	N	I	I	D	I	I	I	N	I
Inpatient Hospitalizations	D	D	D	I	I	D	I	I	I	I	I
Inpatient Hospitalizations for ASC	D	N	I	I	I	I	D	I	I	N	I
Outpatient Hospital Encounters	D	D	I	I	I	D	I	I	D	I	I
Primary Care Physician Encounters	I	D	D	I	I	D	I	I	D	N	N
Percent of Ambulatory Encounters to a PCP	I	N	N	I	I	I	I	I	D	D	I
Total Encounters	D	D	I	I	I	D	I	I	D	I	I
Cost	D	D	D	I	I	D	I	I	I	I	I

in multiple body systems all had a positive impact on ED encounters. Pre-enrollment

risk, being male versus female, and lack of prior insurance enrollment were all associated

with an increase in ED encounters. Length of enrollment, age, and being white versus

another race/ethnicity were associated with a decrease in ED encounters. This is shown

in Table 28.

Table 28. ED Encounters, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	1.41	0.03	49.78	0.00
Enrollment Status	-0.47	0.02	-19.77	0.00
Chronic Condition in One Body System	0.06	0.03	2.27	0.02
Chronic Conditions in Multiple Body Systems	0.20	0.02	8.17	0.00
Enrollment Status x Chronic Condition in One Body System	0.41	0.04	10.85	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.73	0.03	21.58	0.00
Length of Enrollment	-0.07	0.00	-13.89	0.00
Pre-enrollment Risk	0.83	0.07	12.29	0.00
Age	-0.01	0.00	-21.54	0.00
Male	0.19	0.01	13.44	0.00
White	-0.18	0.02	-11.26	0.00
No Prior Insurance Enrollment	0.06	0.01	3.84	0.00

$r^2 = 0.05$

ED Encounters for ASC – Average Annual Utilization

For the dependent variable of ED encounters for ASC, the regression results

showed that several of the independent variables had a significant impact on how ED

encounters for ASC changed ($r^2 = 0.01$, $P < 0.01$). The interactions of being enrolled in

a coordinated care program and both chronic condition statuses were associated with an

increase in ED encounters for ASC. Enrollment status was associated with a decrease

ED encounters for ASC. A chronic condition in one body system and chronic conditions in multiple body systems were both associated with an increase in change in ED Encounters for ASC, along with length of enrollment, age, and being male versus female. Being white versus another race/ethnicity was associated with a decrease in ED encounters for ASC. Pre-enrollment risk and lack of prior insurance enrollment were not significant. This is shown in Table 29.

Table 29.   ED Encounters for ASC, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.10	0.01	12.52	0.00
Enrollment Status	-0.03	0.01	-4.57	0.00
Chronic Condition in One Body System	0.03	0.01	3.86	0.00
Chronic Conditions in Multiple Body Systems	0.07	0.01	10.03	0.00
Enrollment Status x Chronic Condition in One Body System	0.02	0.01	2.35	0.02
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.05	0.01	5.32	0.00
Length of Enrollment	0.00	0.00	-2.64	0.01
Pre-enrollment Risk	-0.03	0.02	-1.37	0.17
Age	0.00	0.00	-7.81	0.00
Male	0.03	0.00	8.78	0.00
White	-0.03	0.00	-7.50	0.00
No Prior Insurance Enrollment	0.01	0.00	1.36	0.18

$r^2 = 0.01$

Emergent ED Encounters – Average Annual Utilization

For the dependent variable of emergent ED encounters, the regression results showed that several of the independent variables had a significant impact on how emergent ED encounters changed ($r^2 = 0.005$, $p < 0.01$). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in emergent ED encounters. Enrollment status and a chronic

condition in one body system were not significant. Chronic conditions in multiple body

systems was associated with an increase in change in emergent ED encounters, as did

pre-enrollment risk. Consistent with expectations, length of enrollment was associated

with a decrease in emergent ED encounters, along with age. Being male versus female,

being white versus another race/ethnicity, and lack of prior insurance enrollment had no

significant impact. This is shown in Table 30.

Table 30.   Emergent ED Encounters, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.33	0.06	5.62	0.00
Enrollment Status	-0.01	0.05	-0.24	0.81
Chronic Condition in One Body System	0.04	0.06	0.78	0.43
Chronic Conditions in Multiple Body Systems	0.12	0.05	2.39	0.02
Enrollment Status x Chronic Condition in One Body System	0.16	0.08	2.01	0.04
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.43	0.07	6.07	0.00
Length of Enrollment	-0.08	0.01	-7.56	0.00
Pre-enrollment Risk	0.90	0.14	6.41	0.00
Age	-0.01	0.00	-4.26	0.00
Male	0.06	0.03	1.96	0.05
White	-0.05	0.03	-1.50	0.13
No Prior Insurance Enrollment	0.04	0.03	1.21	0.23

$r^2 = 0.005$

Inpatient Hospitalizations – Average Annual Utilization

For the dependent variable of inpatient hospitalizations, the regression results

showed that several of the independent variables had a significant impact on how

inpatient hospitalizations changed ($r^2 = 0.05$, $p < 0.010$). The interactions of being

enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in inpatient hospitalizations, as did a chronic condition in one body system and chronic conditions in multiple body systems. Enrollment status was associated with a decrease in inpatient hospitalizations, as was length of enrollment. Pre-enrollment risk, age, being male versus female, and lack of prior insurance enrollment were all associated with an increase in inpatient hospitalizations. Being white versus another race/ethnicity was not significant. This is shown in Table 31.

Table 31.   Inpatient Hospitalizations, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.01	0.01	1.37	0.17
Enrollment Status	-0.04	0.01	-5.03	0.00
Chronic Condition in One Body System	0.02	0.01	2.21	0.03
Chronic Conditions in Multiple Body Systems	0.03	0.01	3.46	0.00
Enrollment Status x Chronic Condition in One Body System	0.13	0.01	9.58	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.24	0.01	19.72	0.00
Length of Enrollment	-0.04	0.00	-21.44	0.00
Pre-enrollment Risk	0.07	0.02	2.91	0.00
Age	0.00	0.00	6.90	0.00
Male	0.11	0.01	21.38	0.00
White	0.00	0.01	-0.19	0.85
No Prior Insurance Enrollment	0.09	0.01	16.60	0.00

$r^2 = 0.05$

Inpatient Hospitalizations for ASC – Average Annual Utilization

For the dependent variable of inpatient hospitalizations for ASC, the regression results showed that several of the independent variables had a significant impact on how inpatient hospitalizations for ASC changed ($r^2 = 0.007$, $p < 0.01$). The interactions of

being enrolled in a coordinated care program and both chronic condition statuses were

associated with an increase in inpatient hospitalizations for ASC, as were a chronic

condition in one body system and chronic conditions in multiple body systems.

Enrollment status was not significant. Length of enrollment, being male versus female,

and lack of prior insurance enrollment were all associated with an increase in inpatient

hospitalizations for ASC. Pre-enrollment risk was associated with a decrease in inpatient

hospitalizations for ASC. Age and being white versus another race/ethnicity were not

significant. This is shown in Table 32.

Table 32.   Inpatient Hospitalizations for ASC, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.00	0.00	0.30	0.76
Enrollment Status	0.00	0.00	-0.65	0.52
Chronic Condition in One Body System	0.01	0.00	2.42	0.02
Chronic Conditions in Multiple Body Systems	0.02	0.00	5.22	0.00
Enrollment Status x Chronic Condition in One Body System	0.01	0.00	2.64	0.01
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.03	0.00	6.36	0.00
Length of Enrollment	0.00	0.00	-6.80	0.00
Pre-enrollment Risk	-0.03	0.01	-3.94	0.00
Age	0.00	0.00	1.40	0.16
Male	0.01	0.00	3.83	0.00
White	0.00	0.00	-0.68	0.50
No Prior Insurance Enrollment	0.01	0.00	5.26	0.00

$r^2 = 0.007$

Outpatient Hospital Encounters – Average Annual Utilization

For the dependent variable of outpatient hospital encounters, the

regression results showed that all of the independent variables except enrollment status

had a significant impact on how outpatient hospital encounters changed ($r^2 = 0.18$, p <

0.01). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in outpatient hospital encounters, as were a chronic condition in one body system and chronic conditions in multiple body systems. Pre-enrollment risk, age, being white versus another race/ethnicity, and lack of prior insurance enrollment were all associated with an increase outpatient hospital encounters. As anticipated, length of enrollment was associated with a decrease in outpatient hospital encounters, as was being male versus female. This is shown in Table 33.

Table 33.   Outpatient Hospital Encounters, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	1.04	0.08	12.29	0.00
Enrollment Status	0.04	0.07	0.53	0.60
Chronic Condition in One Body System	0.26	0.08	3.21	0.00
Chronic Conditions in Multiple Body Systems	1.56	0.07	21.88	0.00
Enrollment Status x Chronic Condition in One Body System	1.33	0.11	11.79	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	3.23	0.10	31.98	0.00
Length of Enrollment	-0.43	0.01	-29.24	0.00
Pre-enrollment Risk	2.01	0.20	9.94	0.00
Age	0.02	0.00	13.20	0.00
Male	-0.94	0.04	-21.96	0.00
White	0.55	0.05	11.38	0.00
No Prior Insurance Enrollment	1.13	0.04	26.23	0.00

$r^2 = 0.18$

Primary Care Physician Encounters – Average Annual Utilization

For the dependent variable of primary care physician encounters, the regression results showed that several of the independent variables had a significant

impact on how PCP encounters changed ($r^2 = 0.27$, $p < 0.01$). As hypothesized, the interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in PCP encounters, as was enrollment status. A chronic condition in one body system was not significant, while chronic conditions in multiple body systems was associated with a decrease in PCP encounters along with pre-enrollment risk, age, and lack of prior insurance enrollment. Length of enrollment was associated with a decrease in PCP encounters, as was being male versus female. Being white versus another race/ethnicity did not have a significant impact. This is shown in Table 34.

Table 34.   PCP Encounters, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.18	0.03	5.96	0.00
Enrollment Status	0.16	0.03	6.23	0.00
Chronic Condition in One Body System	0.01	0.03	0.21	0.84
Chronic Conditions in Multiple Body Systems	-0.11	0.03	-4.22	0.00
Enrollment Status x Chronic Condition in One Body System	0.73	0.04	17.76	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	2.15	0.04	58.82	0.00
Length of Enrollment	-0.17	0.01	-30.78	0.00
Pre-enrollment Risk	3.90	0.07	53.29	0.00
Age	0.00	0.00	3.81	0.00
Male	-0.12	0.02	-7.74	0.00
White	-0.03	0.02	-1.87	0.06
No Prior Insurance Enrollment	0.17	0.02	10.67	0.00

$r^2 = 0.27$

Percent of Ambulatory Encounters to a PCP – Average Annual Utilization

For the dependent variable of percent of ambulatory encounters to a primary care physician, the regression results showed that many of the independent variables had a significant impact on how percent of ambulatory encounters to a PCP changed ($r^2 = 0.14$, $p < 0.01$). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in percent of ambulatory encounters to a PCP, as was enrollment status. A chronic condition in one body system and chronic conditions in multiple body systems were not significant, along with length of enrollment. Pre-enrollment risk, age, and lack of prior insurance enrollment also were associated with an increase in percent of ambulatory encounters to a PCP. Being male versus female and being white versus another race/ethnicity both were associated with a decrease in percent of ambulatory encounters to a PCP. This is shown in Table 35.

Total Encounters – Average Annual Utilization

For the dependent variable of total encounters, the regression results showed that all of the independent variables had a significant impact on how total encounters changed ($r^2 = 0.28$, $p < 0.01$). The interactions of being enrolled in a coordinated care program and both chronic condition statuses were associated with an increase in encounters, as were a chronic condition in one body system and chronic conditions in multiple body systems. Enrollment status was associated with a decrease in total encounters, as was length of enrollment and being male versus female. Pre- enrollment risk, age, being white versus another race/ethnicity, and lack of prior insurance enrollment were all associated with an increase in total encounters. This is shown in Table 36.

Table 35.   Percent of Ambulatory Encounters to a PCP, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	0.04	0.00	9.78	0.00
Enrollment Status	0.02	0.00	4.74	0.00
Chronic Condition in One Body System	0.01	0.00	1.24	0.21
Chronic Conditions in Multiple Body Systems	-0.01	0.00	-1.58	0.12
Enrollment Status x Chronic Condition in One Body System	0.12	0.01	20.02	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	0.16	0.01	30.07	0.00
Length of Enrollment	0.00	0.00	1.55	0.12
Pre-enrollment Risk	0.22	0.01	20.30	0.00
Age	0.00	0.00	2.47	0.01
Male	-0.01	0.00	-5.62	0.00
White	-0.02	0.00	-9.73	0.00
No Prior Insurance Enrollment	0.04	0.00	16.52	0.00

$r^2 = 0.14$

Table 36.   Total Encounters, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	2.64	0.10	26.91	0.00
Enrollment Status	-0.31	0.08	-3.83	0.00
Chronic Condition in One Body System	0.34	0.09	3.70	0.00
Chronic Conditions in Multiple Body Systems	1.67	0.08	20.19	0.00
Enrollment Status x Chronic Condition in One Body System	2.60	0.13	19.77	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	6.35	0.12	54.01	0.00
Length of Enrollment	-0.71	0.02	-40.90	0.00
Pre-enrollment Risk	6.81	0.24	28.94	0.00
Age	0.01	0.00	7.02	0.00
Male	-0.76	0.05	-15.17	0.00
White	0.33	0.06	5.92	0.00
No Prior Insurance Enrollment	1.43	0.05	28.66	0.00

$r^2 = 0.28$

Cost – Average Annual Utilization

For the dependent variable of cost, the regression results showed that several of

the independent variables had a significant impact on how cost changed ($r^2 = 0.05$, p <

0.01). The interactions of being enrolled in a coordinated care program and both chronic

condition statuses were associated with an increase in cost, as were a chronic condition in

one body system and chronic conditions in multiple body systems. Enrollment status did

not have a significant impact on cost. Length of enrollment was associated with a

decrease in cost. Age, being male versus female, being white versus another

race/ethnicity, and lack of prior insurance enrollment were also associated with an

increase in cost. Pre-enrollment risk did not have a significant impact. This is shown in

Table 37.

Table 37.   Cost, Average Annual Utilization

	Coefficient	Standard Error	t	Significance
Constant	485.20	178.00	2.73	0.01
Enrollment Status	-290.30	148.39	-1.96	0.05
Chronic Condition in One Body System	355.89	168.77	2.11	0.03
Chronic Conditions in Multiple Body Systems	470.35	150.14	3.13	0.00
Enrollment Status x Chronic Condition in One Body System	1,923.96	238.07	8.08	0.00
Enrollment Status x Chronic Conditions in Multiple Body Systems	3,336.44	213.05	15.66	0.00
Length of Enrollment	-978.28	31.38	-31.17	0.00
Pre-enrollment Risk	403.10	426.24	0.95	0.34
Age	34.35	3.80	9.05	0.00
Male	1,345.43	90.43	14.88	0.00
White	368.22	101.20	3.64	0.00
No Prior Insurance Enrollment	1,941.13	90.73	21.39	0.00

$r^2 = 0.05$

Tables 38 and 39 provide an overview of the regressions for utilization in the pre-enrollment period and the average annual utilization during enrollment. Table 38 shows the r^2 values for the models using average annual utilization during enrollment and their significance. Table 39 shows which of the independent variables had a significant impact on the dependent variables, as well as the direction of their relationship. For the key independent variables of enrollment status, a chronic condition in one body system, and chronic conditions in multiple body systems, the significance and direction of their relationship with the dependent variables is the same in these models using average annual utilization during enrollment as it is in the models using utilization in the first year of enrollment. The significance and the direction of the relationships with the dependent variables and both age and gender are also the same in both sets of models. Length of enrollment, pre-enrollment risk, being white versus another race/ethnicity, and lack of prior insurance enrollment are all very similar in the two sets of models.

Table 38. Model Significance Regression Results, Average Annual Utilization

	r^2	Significance
ED Encounters	0.050	0.00
ED Encounters for ASC	0.010	0.00
Emergent ED Encounters	0.005	0.00
Inpatient Hospitalizations	0.050	0.00
Inpatient Hospitalizations for ASC	0.007	0.00
Outpatient Hospital Encounters	0.180	0.00
Primary Care Physician Encounters	0.270	0.00
Percent of Ambulatory Encounters to a PCP	0.140	0.00
Total Encounters	0.280	0.00

Table 39.   Independent Variable Significance in Regression Results, Average Annual Utilization

Independent Variables	Enrollment Status	Chronic Condition in One Body System	Chronic Conditions in Multiple Body Systems	Enrollment Status x Chronic Condition in One Body System	Enrollment Status x Chronic Conditions in Multiple Body Systems	Length of Enrollment	Pre-enrollment Risk	Age	Male	White	No Prior Insurance Enrollment
ED Encounters	D(ecrease)	I	I	I	I	D	I	D	I	D	I
ED Encounters for ASC	D	I	I	I	I	I	N	I	I	D	N
Emergent ED Encounters	N(o Change)	N	I	I	I	D	I	D	I	N	N
Inpatient Hospitalizations	D	I	I	I	I	D	I	I	I	N	I
Inpatient Hospitalizations for ASC	N	I	I	I	I	I	D	N	I	N	I
Outpatient Hospital Encounters	N	I	I	I	I	D	I	I	D	I	I
Primary Care Physician Encounters	I(ncrease)	N	D	I	I	D	I	I	D	N	I
Percent of Ambulatory Encounters to a PCP	I	N	N	I	I	N	I	I	D	D	I
Total Encounters	D	I	I	I	I	D	I	I	D	I	I
Cost	D	I	I	I	I	D	N	I	I	I	I

Condition Specific Analyses

The enrollees in the VCC program have a wide variety of different chronic

conditions, including some enrollees who are diagnosed with multiple chronic conditions.

Different chronic conditions may be associated with different levels of change in

utilization measures. The top five most common chronic conditions in the study

population are hypertension, mental illness, diabetes, heart disease, and arthritis, as

shown in Table 40. Each of these conditions was examined separately to determine how

being diagnosed with each condition interacts with chronic condition status to effect

change in utilization. An enrollee may be diagnosed with more than one of the

conditions.

Table 40. Chronic Conditions

Condition	Number	Percent
Hypertension	6136	30.37
Mental Illness	4427	21.91
Diabetes	2900	14.35
Heart Disease	2327	11.52
Arthritis	2202	10.90

Hypertension – First Year of Enrollment

Table 41 shows how utilization changed in the first year of enrollment for

enrollees with hypertension who have a chronic condition in one body system and those

who have chronic conditions in multiple body systems as compared to enrollees with no

chronic conditions. Change in ED encounters, change in inpatient hospitalizations,

change in outpatient hospital encounters, change in PCP encounters, change in percent of

ambulatory encounters to a PCP, change in total encounters, and change in cost all show

Table 41. Change in Utilization Versus Chronic Condition Status for Enrollees with Hypertension – First Year of Enrollment

Dependent Variables	Enrollees with Hypertension			Enrollees with Hypertension and a Chronic Condition in Another Body Systems			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with Hypertension
Change in ED Encounters	-0.19	1.61	Y	0.17	2.04	Y	Y
Change in ED Encounters for ASC	-0.01	0.25	N	0.03	0.60	Y	Y
Change in Emergent ED Encounters	-0.01	0.33	N	0.02	0.38	Y	Y
Change in Inpatient Hospitalizations	-0.01	0.67	Y	0.08	0.76	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.13	N	0.02	0.24	N	N
Change in Outpatient Hospital Encounters	0.51	4.71	Y	2.81	6.97	Y	Y

Table 41 (continued)

Dependent Variables	Enrollees with Hypertension			Enrollees with Hypertension and a Chronic Condition in Another Body Systems			
	Mean	SD	Significant from Enrollees with No Chronic Conditions	Mean	SD	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with Hypertension
Change in Primary Care Physician Encounters	1.19	2.17	Y	1.82	3.32	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.22	0.35	Y	0.14	0.29	Y	Y
Change in Total Encounters	1.51	6.28	Y	4.88	9.22	Y	Y
Change in Cost	-4.32	9,825.29	Y	1,174.65	10,509.72	Y	Y

significant differences between enrollees with no chronic conditions, enrollees with hypertension and a chronic condition in one body system, and enrollees with hypertension and chronic conditions in multiple body systems. Change in inpatient hospitalizations for ASC did not show any significant differences between the chronic condition status groups. Change in ED encounters for ASC and change in emergent ED encounters showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 41.

Mental Illness – First Year of Enrollment

Table 42 shows how utilization changed for enrollees with mental illness who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions.   Change in ED encounters, change in outpatient hospital encounters, change in PCP encounters, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with mental illness and a chronic condition in one body system, and enrollees with mental illness and chronic conditions in multiple body systems. Change in inpatient hospitalizations for ASC did not show any significant differences between the chronic condition status groups. Change in ED encounters for ASC, change in emergent ED encounters, change in inpatient hospitalizations, and change in percent of ambulatory encounters to a PCP showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 42.

Table 42. Change in Utilization Versus Chronic Condition Status for Enrollees with Mental Illness – First Year of Enrollment

Dependent Variables	Enrollees with Mental Illness			Enrollees with Mental Illness and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	0.06	2.11	Y	0.36	2.58	Y	Y
Change in ED Encounters for ASC	-0.01	0.38	N	0.04	0.68	Y	Y
Change in Emergent ED Encounters	0.01	0.27	N	0.04	0.45	Y	Y
Change in Inpatient Hospitalizations	0.12	0.90	Y	0.16	0.97	Y	N
Change in Inpatient Hospitalizations for ASC	0.00	0.11	N	0.02	0.31	N	N
Change in Outpatient Hospital Encounters	1.03	5.14	Y	3.14	7.46	Y	Y

Table 42 (continued)

Dependent Variables	Enrollees with Mental Illness			Enrollees with Mental Illness and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.64	2.22	Y	1.66	3.53	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.09	0.29	Y	0.11	0.27	Y	N
Change in Total Encounters	1.85	6.53	Y	5.33	9.96	Y	Y
Change in Cost	285.85	10,991.91	Y	1,608.74	11,626.63	Y	Y

Diabetes – First Year of Enrollment

Table 43 shows how utilization changed for enrollees with diabetes who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions. Change in ED encounters, change in outpatient hospital encounters, change in PCP encounters, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with diabetes and a chronic condition in one body system, and enrollees with diabetes and chronic conditions in multiple body systems. Change in ED encounters for ASC, change in emergent ED encounters, change in inpatient hospitalizations, change in inpatient hospitalizations for ASC, and change in percent of ambulatory encounters to a PCP showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 43.

Heart Disease – First Year of Enrollment

Table 44 shows how utilization changed for enrollees with heart disease who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions. Change in outpatient hospital encounters, change in percent of ambulatory encounters to a PCP, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with heart disease and a chronic condition in one body system, and enrollees with heart disease and chronic conditions in multiple body systems. Change in ED encounters for ASC, change in emergent ED encounters, and change in inpatient hospitalizations for ASC did not show any significant differences

Table 43. Change in Utilization Versus Chronic Condition Status for Enrollees with Diabetes – First Year of Enrollment

Dependent Variables	Enrollees with Diabetes			Enrollees with Diabetes and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.21	1.53	Y	0.18	1.87	Y	Y
Change in ED Encounters for ASC	-0.04	0.59	N	0.02	0.60	Y	Y
Change in Emergent ED Encounters	-0.03	0.22	N	0.03	0.34	Y	Y
Change in Inpatient Hospitalizations	-0.03	0.63	Y	0.12	0.85	Y	Y
Change in Inpatient Hospitalizations for ASC	0.02	0.41	Y	0.02	0.35	Y	N
Change in Outpatient Hospital Encounters	0.08	4.79	Y	2.97	7.56	Y	Y

Table 43 (continued)

Dependent Variables	Enrollees with Diabetes			Enrollees with Diabetes and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.71	2.21	Y	1.78	3.47	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.17	0.34	Y	0.12	0.28	Y	N
Change in Total Encounters	0.56	6.46	Y	5.05	9.74	Y	Y
Change in Cost	-1,262.40	9,936.90	Y	1,128.42	11,063.62	Y	Y

Table 44.   Change in Utilization Versus Chronic Condition Status for Enrollees with Heart Disease – First Year of Enrollment

Dependent Variables	Enrollees with Heart Disease			Enrollees with Heart Disease and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.21	1.44	Y	0.22	2.29	Y	Y
Change in ED Encounters for ASC	-0.03	0.27	N	0.04	0.70	Y	Y
Change in Emergent ED Encounters	-0.01	0.47	N	0.04	0.52	Y	Y
Change in Inpatient Hospitalizations	0.01	1.14	Y	0.16	1.03	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.23	N	0.02	0.29	N	N
Change in Outpatient Hospital Encounters	0.09	5.52	Y	3.16	7.88	Y	Y
Change in Primary Care Physician Encounters	1.11	2.17	Y	1.65	3.57	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.18	0.28	Y	0.11	0.25	Y	Y

Table 44 (continued)

Dependent Variables	Enrollees with Heart Disease			Enrollees with Heart Disease and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Total Encounters	1.00	7.14	Y	5.19	10.33	Y	Y
Change in Cost	-1,126.47	21,123.85	Y	1,874.36	14,919.67	Y	Y

between the chronic condition status groups. Change in ED encounters, change in inpatient hospitalizations, and change in PCP encounters showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 44.

Arthritis – First Year of Enrollment

Table 45 shows how utilization changed for enrollees with arthritis who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions.   Change in ED encounters, change in inpatient hospitalizations, outpatient hospital encounters, change in PCP encounters, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with arthritis and a chronic condition in one body system, and enrollees with arthritis and chronic conditions in multiple body systems. Change in ED encounters for ASC, change in emergent ED encounters, change in inpatient hospitalizations for ASC, and change in percent of ambulatory encounters to a PCP showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 45.

Table 46 shows a summary of how the independent variables change in the first year of enrollment between enrollees with no chronic conditions, enrollees with one of the common chronic conditions, and enrollees with one of the chronic conditions and one or more chronic conditions in other body systems. Enrollees with multiple chronic conditions often show changes in more of the utilization variables than enrollees with only one of the conditions.

Table 45. Change in Utilization Versus Chronic Condition Status for Enrollees with Arthritis – First Year of Enrollment

Dependent Variables	Enrollees with Arthritis			Enrollees with Arthritis and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.14	1.51	Y	0.09	2.01	Y	Y
Change in ED Encounters for ASC	0.00	0.29	Y	0.00	0.43	Y	N
Change in Emergent ED Encounters	0.00	0.26	Y	0.02	0.31	Y	N
Change in Inpatient Hospitalizations	0.00	0.45	Y	0.07	0.65	Y	Y
Change in Inpatient Hospitalizations for ASC	-0.01	0.20	N	0.01	0.20	N	Y
Change in Outpatient Hospital Encounters	1.22	5.21	Y	2.97	7.29	Y	Y

Table 45 (continued)

Dependent Variables	Enrollees with Arthritis			Enrollees with Arthritis and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.78	1.99	Y	1.67	3.33	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.10	0.28	Y	0.11	0.27	Y	N
Change in Total Encounters	1.86	6.59	Y	4.80	9.49	Y	Y
Change in Cost	-224.33	12,345.79	Y	1,066.41	11,847.36	Y	Y

Table 46.   Chronic Condition Specific Analysis Overview – First Year of Enrollment

Dependent Variables	Hypertension		Mental Illness		Diabetes		Heart Disease		Arthritis	
	Hyper-tension Only	Chronic Conditions in Multiple Body Systems	Mental Illness Only	Chronic Conditions in Multiple Body Systems	Dia-betes Only	Chronic Conditions in Multiple Body Systems	Heart Disease Only	Chronic Conditions in Multiple Body Systems	Arthritis Only	Chronic Conditions in Multiple Body Systems
Change in ED Encounters	I(ncrease)	I	I	I	I	I	I	I	I	I
Change in ED Encounters for ASC	N(o Change)	I	N	I	N	I	N	I	I	N
Change in Emergent ED Encounters	N	I	N	I	N	I	N	I	I	N
Change in Inpatient Hospitalizations	I	I	I	N	I	I	I	I	I	I
Change in Inpatient Hospitalizations for ASC	N	N	N	N	N	N	N	N	N	I
Change in Outpatient Hospital Encounters	I	I	I	I	I	I	I	I	I	I

Table 46 (continued)

Dependent Variables	Hypertension		Mental Illness		Diabetes		Heart Disease		Arthritis	
	Hyper-tension Only	Chronic Conditions in Multiple Body Systems	Mental Illness Only	Chronic Conditions in Multiple Body Systems	Dia-betes Only	Chronic Conditions in Multiple Body Systems	Heart Disease Only	Chronic Conditions in Multiple Body Systems	Arthritis Only	Chronic Conditions in Multiple Body Systems
Change in Primary Care Physician Encounters	I	I	I	I	I	I	I	I	I	I
Change in Percent of Ambulatory Visits to a PCP	I	D(ecrease)	I	N	I	N	I	I	I	N
Change in Total Encounters	I	I	I	I	I	I	I	I	I	I
Change in Cost	I	I	I	I	D	I	D	I	I	I

Hypertension – Average Annual Utilization

Table 47 shows how utilization changed for enrollees with hypertension who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions. Change in ED encounters, change in inpatient hospitalizations, change in outpatient hospital encounters, change in PCP encounters, change in percent of ambulatory encounters to a PCP, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with hypertension and a chronic condition in one body system, and enrollees with hypertension and chronic conditions in multiple body systems. Change in emergent ED encounters and change in inpatient hospitalizations for ASC did not show any significant differences between the chronic condition status groups. Change in ED encounters for ASC showed some differences between enrollees with varying chronic condition statuses.

Mental Illness – Average Annual Utilization

Table 48 shows how utilization changed for enrollees with mental illness who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions. Change in ED encounters, change in outpatient hospital encounters, change in PCP encounters, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with mental illness and a chronic condition in one body system, and enrollees with mental illness and chronic conditions in multiple body systems. Change in inpatient hospitalizations for ASC did not show any

Table 47.   Change in Utilization Versus Chronic Condition Status for Enrollees with Hypertension – Average Annual Use

Dependent Variables	Enrollees with Hypertension			Enrollees with Hypertension and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.19	1.61	Y	0.17	2.04	Y	Y
Change in ED Encounters for ASC	-0.01	0.25	N	0.03	0.60	Y	Y
Change in Emergent ED Encounters	-0.01	0.33	N	0.02	0.38	N	N
Change in Inpatient Hospitalizations	-0.01	0.67	Y	0.08	0.76	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.13	N	0.02	0.24	N	N
Change in Outpatient Hospital Encounters	0.51	4.71	Y	2.81	6.97	Y	Y

Table 47 (continued)

Dependent Variables	Enrollees with Hypertension			Enrollees with Hypertension and a Chronic Condition in Another Body System				
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	1.19	2.17	Y	1.82	3.32	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.22	0.35	Y	0.14	0.29	Y	Y
Change in Total Encounters	1.51	6.28	Y	4.88	9.22	Y	Y
Change in Cost	280.95	9,901.80	Y	2,116.41	11,510.36	Y	Y

Table 48. Change in Utilization Versus Chronic Condition Status for Enrollees with Mental Illness – Average Annual Use

Dependent Variables	Enrollees with Mental Illness			Enrollees with Mental Illness and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	0.06	2.11	Y	0.36	2.58	Y	Y
Change in ED Encounters for ASC	-0.01	0.38	N	0.04	0.68	Y	Y
Change in Emergent ED Encounters	0.01	0.27	N	0.04	0.45	Y	N
Change in Inpatient Hospitalizations	0.12	0.90	Y	0.16	0.97	Y	N
Change in Inpatient Hospitalizations for ASC	0.00	0.11	N	0.02	0.31	N	N
Change in Outpatient Hospital Encounters	1.03	5.14	Y	3.14	7.46	Y	Y

Table 48 (continued)

Dependent Variables	Enrollees with Mental Illness			Enrollees with Mental Illness and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.64	2.22	Y	1.66	3.53	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.09	0.29	Y	0.11	0.27	Y	N
Change in Total Encounters	1.85	6.53	Y	5.33	9.96	Y	Y
Change in Cost	660.84	11,829.80	Y	2,468.55	12,030.87	Y	Y

significant differences between the chronic condition status groups. Change in ED

encounters for ASC, change in emergent ED encounters, change in inpatient

hospitalizations, and change in percent of ambulatory encounters to a PCP showed some

differences between enrollees with varying chronic condition statuses, and are shown in

Table 48.

Diabetes – Average Annual Utilization

Table 49 shows how utilization changed for enrollees with diabetes who have a

chronic condition in one body system and those who have chronic conditions in multiple

body systems as compared to enrollees with no chronic conditions.   Change in ED

encounters, change in inpatient hospitalizations, change in outpatient hospital encounters,

change in PCP encounters, change in total encounters, and change in cost all show

significant differences between enrollees with no chronic conditions, enrollees with

diabetes and a chronic condition in one body system, and enrollees with diabetes and

chronic conditions in multiple body systems. Change in inpatient hospitalizations for

ASC did not show any significant differences between the chronic condition status

groups. Change in ED encounters for ASC, change in emergent ED encounters, and

change in percent of ambulatory encounters to a PCP showed some differences between

enrollees with varying chronic condition statuses, and are shown in Table 49.

Heart Disease – Average Annual Utilization

Table 50 shows how utilization changed for enrollees with heart disease who have

a chronic condition in one body system and those who have chronic conditions in

multiple body systems as compared to enrollees with no chronic conditions.   Change in

Table 49.   Change in Utilization Versus Chronic Condition Status for Enrollees with Diabetes – Average Annual Use

Dependent Variables	Enrollees with Diabetes			Enrollees Diabetes and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.21	1.53	Y	0.18	1.87	Y	Y
Change in ED Encounters for ASC	-0.04	0.59	N	0.02	0.60	Y	Y
Change in Emergent ED Encounters	-0.03	0.22	N	0.03	0.34	Y	Y
Change in Inpatient Hospitalizations	-0.03	0.63	Y	0.12	0.85	Y	Y
Change in Inpatient Hospitalizations for ASC	0.02	0.41	N	0.02	0.35	N	N
Change in Outpatient Hospital Encounters	0.08	4.79	Y	2.97	7.56	Y	Y
Change in Primary Care Physician Encounters	0.71	2.21	Y	1.78	3.47	Y	Y

Table 49 (continued)

Dependent Variables	Enrollees with Diabetes			Enrollees Diabetes and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Percent of Ambulatory Visits to a PCP	0.17	0.34	Y	0.12	0.28	Y	N
Change in Total Encounters	0.56	6.46	Y	5.05	9.74	Y	Y
Change in Cost	-1,301.63	9,811.58	Y	2,360.94	12,795.54	Y	Y

Table 50. Change in Utilization Versus Chronic Condition Status for Enrollees with Heart Disease – Average Annual Use

Dependent Variables	Enrollees with Heart Disease			Enrollees with Heart Disease and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.21	1.44	Y	0.22	2.29	Y	Y
Change in ED Encounters for ASC	-0.03	0.27	N	0.04	0.70	Y	Y
Change in Emergent ED Encounters	-0.01	0.47	N	0.04	0.52	Y	Y
Change in Inpatient Hospitalizations	0.01	1.14	Y	0.16	1.03	Y	Y
Change in Inpatient Hospitalizations for ASC	0.00	0.23	N	0.02	0.29	N	N
Change in Outpatient Hospital Encounters	0.09	5.52	Y	3.16	7.88	Y	Y
Change in Primary Care Physician Encounters	1.11	2.17	Y	1.65	3.57	Y	Y

Table 50 (continued)

Dependent Variables	Enrollees with Heart Disease			Enrollees with Heart Disease and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Percent of Ambulatory Visits to a PCP	0.18	0.28	Y	0.11	0.25	Y	Y
Change in Total Encounters	1.00	7.14	Y	5.19	10.33	Y	Y
Change in Cost	-179.00	20,730.85	Y	3,685.15	16,995.69	Y	Y

ED encounters, change in inpatient hospitalizations, change in outpatient hospital encounters, change in PCP encounters, change in percent of ambulatory encounters to a PCP, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with heart disease and a chronic condition in one body system, and enrollees with heart disease and chronic conditions in multiple body systems. Change in inpatient hospitalizations for ASC did not show any significant differences between the chronic condition status groups. Change in ED encounters for ASC and change in emergent ED encounters showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 50.

Arthritis – Average Annual Utilization

Table 51 shows how utilization changed for enrollees with arthritis who have a chronic condition in one body system and those who have chronic conditions in multiple body systems as compared to enrollees with no chronic conditions. Change in ED encounters, change in inpatient hospitalizations, change in outpatient hospital encounters, change in PCP encounters, change in total encounters, and change in cost all show significant differences between enrollees with no chronic conditions, enrollees with arthritis and a chronic condition in one body system, and enrollees with arthritis and chronic conditions in multiple body systems. Change in ED encounters for ASC and change in inpatient hospitalizations for ASC did not show any significant differences between the chronic condition status groups. Change in emergent ED encounters and change in percent of ambulatory encounters to a PCP showed some differences between enrollees with varying chronic condition statuses, and are shown in Table 51.

Table 51.   Change in Utilization Versus Chronic Condition Status for Enrollees with Arthritis – Average Annual Use

Dependent Variables	Enrollees with Arthritis			Enrollees with Arthritis and a Chronic Condition in Another Body System				
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in ED Encounters	-0.14	1.51	Y	0.09	2.01	Y	Y
Change in ED Encounters for ASC	0.00	0.29	N	0.00	0.43	N	N
Change in Emergent ED Encounters	0.00	0.26	N	0.02	0.31	Y	N
Change in Inpatient Hospitalizations	0.00	0.45	Y	0.07	0.65	Y	Y
Change in Inpatient Hospitalizations for ASC	-0.01	0.20	N	0.01	0.20	N	N
Change in Outpatient Hospital Encounters	1.22	5.21	Y	2.97	7.29	Y	Y

Table 51 (continued)

Dependent Variables	Enrollees with Arthritis			Enrollees with Arthritis and a Chronic Condition in Another Body System			
	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Mean	Standard Deviation	Significant from Enrollees with No Chronic Conditions	Significant from Enrollees with One Chronic Condition
Change in Primary Care Physician Encounters	0.78	1.99	Y	1.67	3.33	Y	Y
Change in Percent of Ambulatory Visits to a PCP	0.10	0.28	Y	0.11	0.27	Y	N
Change in Total Encounters	1.86	6.59	Y	4.80	9.49	Y	Y
Change in Cost	184.17	13,355.03	Y	2,057.81	11,242.51	Y	Y

Table 52 shows a summary of how the independent variables change on average during enrollment between enrollees with no chronic conditions, enrollees with one of the common chronic conditions, and enrollees with one of the chronic conditions and one or more chronic conditions in other body systems. Many of these relationships are the same for average annual enrollment as the first year of enrollment with the exceptions of change in emergent ED encounters for enrollees with hypertension and a chronic condition in another body system, change in emergent ED encounters for enrollees with mental illness and a chronic condition in another body system, change in cost for enrollees with heart disease, change in percent of ambulatory visits to a PCP for enrollees with heart disease and a chronic condition in another body system, and change in ED encounters for ASC and change in emergent ED encounters for enrollees with arthritis.

Summary of Results

In summary, the initial t-testing shows that there are many significant changes in pre-enrollment utilization and utilization during the first year of enrollment with respect to chronic condition status groups. The only dependent variables that did not change between the two time periods were ED encounters for ASC and inpatient hospitalizations for ASC. There were also many significant changes between the pre-enrollment utilization and the annual during enrollment utilization. For each of the dependent variables, it was found that the change between the chronic condition groups was significant with the exception of the change in ED encounters for ASC, change in emergent ED encounters, and inpatient hospitalizations for ASC between the enrollees

Table 52.   Chronic Condition Specific Analysis Overview – Average Annual Use

Dependent Variables	Hypertension		Mental Illness		Diabetes		Heart Disease		Arthritis	
	Hyper-tension Only	Chronic Conditions in Multiple Body Systems	Mental Illness Only	Chronic Conditions in Multiple Body Systems	Dia-betes Only	Chronic Conditions in Multiple Body Systems	Heart Disease Only	Chronic Conditions in Multiple Body Systems	Arthritis Only	Chronic Conditions in Multiple Body Systems
Change in ED Encounters	I(ncrease)	I	I	I	I	I	I	I	I	I
Change in ED Encounters for ASC	N(o Change)	I	N	I	N	I	N	I	N	N
Change in Emergent ED Encounters	N	N	N	N	N	I	N	I	N	N
Change in Inpatient Hospitalizations	I	I	I	N	I	I	I	I	I	I
Change in Inpatient Hospitalizations for ASC	N	N	N	N	N	N	N	N	N	N
Change in Outpatient Hospital Encounters	I	I	I	I	I	I	I	I	I	I

Table 52 (continued)

Dependent Variables	Hypertension		Mental Illness		Diabetes		Heart Disease		Arthritis	
	Hyper-tension Only	Chronic Conditions in Multiple Body Systems	Mental Illness Only	Chronic Conditions in Multiple Body Systems	Dia-betes Only	Chronic Conditions in Multiple Body Systems	Heart Disease Only	Chronic Conditions in Multiple Body Systems	Arthritis Only	Chronic Conditions in Multiple Body Systems
Change in Primary Care Physician Encounters	I	I	I	I	I	I	I	I	I	I
Change in Percent of Ambulatory Visits to a PCP	I	D(ecrease)	I	N	I	N	I	D	I	N
Change in Total Encounters	I	I	I	I	I	I	I	I	I	I
Change in Cost	I	I	I	I	D	I	I	I	I	I

with chronic conditions in one body system and chronic conditions in multiple body systems.

The regression results showed that there were increases between all of the utilization variables and the two interaction terms comprised of enrollment and chronic condition status. This was true both for utilization the first year of enrollment and average annual utilization. Many of the other independent variables such as enrollment status and chronic condition status also significantly impact the utilization variables in a majority of the regressions.

Finally, the condition specific analyses revealed that common conditions lead to increased utilization for enrollees with chronic conditions during enrollment in VCC as compared to enrollees with no chronic conditions for most measures of utilization. The most notable exception to this is change in inpatient hospitalizations for ASC, which show no significant change for any of the common chronic conditions. Also, change in ED encounters for ASC and change in emergent ED encounters have mixed results, with enrollees who have just one chronic condition often showing no significant change while enrollees with multiple chronic conditions often reflect an increase.

CHAPTER 6: DISCUSSION

The purpose of this study was to use the Chronic Care Model in conjunction with the behavioral model for access to health care to assess the role of a coordinated care program in the treatment of chronic conditions in an indigent population.   In this chapter, the results of the statistical analysis will be discussed as they relate to the hypotheses pertaining to enrollment in a coordinated care program and chronic condition status. This chapter also will include study limitations and areas for future research.

The VCC program reflects many elements of the Chronic Care Model, such as providing enrollees with a medical home, which encourages enrollees to seek out more appropriate care. This increased appropriateness is expected to be manifested in an increase in PCP and outpatient hospital encounters and a decrease in ED use and inpatient hospitalizations, especially for ambulatory sensitive conditions. It is expected that these changes in utilization will be more pronounced for enrollees with chronic conditions.

Discussion of Findings by Hypothesis

Findings from the hypothesis testing are shown below, detailed by type of utilization and cost.

Primary Care Physician Utilization

The first set of study hypotheses are related to primary care physician utilization, and are further broken down by chronic condition status.   Enrollees with no chronic

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conditions were not expected to have any change in PCP utilization, while enrollees with

a chronic condition in one body system were expected to have an increase in PCP use and

enrollees with chronic conditions in multiple body systems were expected to have an

even greater increase.

The results of this study, shown in Table 53, support two of the PCP use

hypotheses for the analysis done on the data pertaining to both the first year of enrollment

and average annual enrollment in the program. Once enrolled in the coordinated care

program, enrollees with a chronic condition in one body system show an increase in PCP

utilization and enrollees with chronic conditions in multiple body systems showed an

even greater increase, consistent with the findings of Rothman and Wagner (2003) and

Ross et al. (2007) which showed an increase in PCP usage in conjunction with

implementing Chronic Care Model.

Table 53.   PCP Utilization Hypotheses

Hypothesis	Proposed Direction	Supported
H1: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in primary care physician services utilization.	None	No, significant increase
H1a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in primary care physician services utilization.	Increase	Yes, significant increase
H1b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in primary care physician services utilization than the increase for patients with just one chronic condition.	Increase	Yes, significant increase

The only finding concerning PCP use that was contrary to expectations was that for enrollees with no chronic conditions. It was expected that there would be no change in PCP use for these enrollees; however, they do show a slight significant increase. This may be due to some enrollees utilizing a PCP for preventative measures and are staying relatively healthy, or for acute, non-emergent reasons during their enrollment even though they do not have ongoing chronic needs.

Analysis was also done to determine how the percent of ambulatory visits to a PCP changes based on both enrollment and chronic condition status. Consistent with expectations based on literature that shows enrollment in such a program will increase PCP use (Rothman & Wagner, 2003; Oswald, 2001), this percentage increased upon enrollment in VCC, and was significantly increased as indicated by the interaction of enrollment status and chronic condition status.

Emergency Department Utilization

The second set of study hypotheses are in regard to emergency department use, and are also broken down by chronic condition status. For the first year of enrollment, the only chronic condition group that showed a decrease in ED use was the group of enrollees with no chronic conditions. It was hypothesized that this group would show no change. The enrollees with a chronic condition in one body system and chronic conditions in multiple body systems both showed significant increases in ED encounters, in which enrollment status and chronic condition status together played a significant impact. This may be a result of enrollees using more services in general as they are enrolled, which has been shown to be the case in prior studies. It does raise questions as

to why increased PCP did not lead to substitution of primary care visits for ED visits as has been demonstrated in other research that has shown reduced ED use in coordinated care programs (Chan and Owens, 2004; Tsai et al, 2007) Average annual use of ED services shows the same results. These results are shown in Table 54.

Table 54.   ED Encounter Hypotheses

Hypothesis	Proposed Direction	Supported
H2: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department utilization.	None	No, significant decrease
H2a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department utilization.	Decrease	No, significant increase
H2b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department utilization than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

Emergent ED Encounters

The third set of hypotheses deals with emergent ED encounters. It was expected that enrollees with chronic conditions would use the ED more appropriately, resulting in an increase in emergent ED use. As hypothesized, enrollees with chronic conditions in multiple body systems show an increase in emergent ED use. This increase is impacted positively by enrollment status together with chronic condition status, consistent with hypotheses. It was hypothesized that enrollees with no chronic conditions would have no change in emergent ED use, but they showed a decrease, as did emergent ED use for enrollees with a chronic condition in one body system. These results are somewhat

varied as to what was expected from the literature, that emergent ED use would increase

as patients seek out non-emergent health care from their PCP instead (Clancy et al., 2003;

Hupke et al., 2004; Stroebel et al., 2005). A summary of the hypotheses is found in Table

55.

Table 55. Emergent ED Hypotheses

Hypothesis	Proposed Direction	Supported
H3: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergent emergency department usage.	None	No, significant decrease
H3a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in emergent emergency department usage.	Increase	No, significant decrease
H3b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in emergent emergency department usage than the increase for patients with just one chronic condition.	Increase	Yes, significant increase

ED Encounters for ASC

The fourth set of hypotheses regards ED encounters for ambulatory sensitive

conditions. For enrollees with no chronic conditions, it was expected that there would be

no change in ED encounters for ASC. For enrollees with chronic conditions, it was

expected that there would be a decrease in ED encounters for ASC. There was a decrease

among enrollees with no chronic conditions and an increase among enrollees with

chronic conditions in one and multiple body systems. The regressions show that

enrollment status combined with chronic condition status have a positive impact on ED

encounters for ASC, contrary to hypotheses, and are the same in the first year of

enrollment and for average annual use. As indicated in the initial ED use analyses, VCC

enrollment has not produced reductions in ED as anticipated.   The hypotheses are shown

in Table 56.

Table 56.   ED Encounters for ASC Hypotheses

Hypothesis	Proposed Direction	Supported
H4: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department usage for ambulatory sensitive conditions.	None	No, significant decrease
H4a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department usage for ambulatory sensitive conditions.	Decrease	No, significant increase
H4b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department usage for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

Inpatient Hospitalizations

        Enrollees in the coordinated care program who have a chronic condition in one or

more body systems were hypothesized to have a decrease in inpatient hospitalizations.

During the first year of enrollment, both groups showed an increase in inpatient

hospitalizations, partially impacted by enrollment status combined with chronic condition

status. Since it was expected that inpatient hospitalizations would decrease (VonKorf et

al., 1997; Nixon et al., 2006), these findings raise the same questions as the increases in

ED use. Additionally, enrollees with no chronic conditions were not expected to have a

change in inpatient hospitalizations, but showed a significant decrease.   Average annual

use of inpatient hospitalizations showed the same results as the first year of enrollment,

with increases in inpatient hospitalizations for enrollees with chronic conditions. These

results are summarized in Table 57.

Table 57.   Inpatient Hospitalization Hypotheses

Hypothesis	Proposed Direction	Supported
H5: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions.	None	No, significant decrease
H5a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions.	Decrease	No, significant increase
H5b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions that than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

Inpatient Hospitalizations for ASC

Inpatient hospitalizations for ASC were expected to show similar results to

inpatient hospitalizations in general, with the exception of enrollees with no chronic

conditions, who showed no change in inpatient hospitalizations for ASC as hypothesized.

However, the analysis results for inpatient hospitalizations for ASC showed the same

relationships as all inpatient hospitalizations, both in the first year of enrollment and

average annual use, and are summarized in Table 58. Once again, the unexpected

increase raises questions as to why an increase in PCP use is not found in conjunction

with a decrease in other services, which may be explained by an increase in overall

service use upon enrollment.

Table 58.   Inpatient Hospitalizations for ASC Hypotheses

Hypothesis	Proposed Direction	Supported
H5: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions for ASC.	None	Yes, no change
H5a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions for ACS.	Decrease	No, significant increase
H5b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in inpatient hospital admissions for ASC that than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

Outpatient Hospital Encounters

Outpatient hospital encounters were expected to have no change based on enrollment and chronic condition status for enrollees with no chronic conditions and increases for both chronic condition groups, much like the change in PCP use (VonKorf et al., 1997; Ross et al, 2007). Enrollees with no chronic conditions showed decreases in outpatient hospital encounters both in the first year of enrollment and the average annual enrollment. Consistent with hypotheses, enrollees in both chronic condition status groups showed increases in outpatient hospital encounters based on enrollment status combined with chronic condition status. The hypothesis results are shown in Table 59.

Total Cost

It was hypothesized that for enrollees with no chronic conditions, their total cost would not change upon enrollment, and that for enrollees with chronic conditions in one and multiple body systems would show a decrease in cost (Hadley & Cunningham, 2004;

Table 59.   Outpatient Hospital Encounters Hypotheses

Hypothesis	Proposed Direction	Supported
H7: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in outpatient hospital admissions.	None	No, significant decrease
H7a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in outpatient hospital admissions.	Increase	Yes, significant increase
H7b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in outpatient hospital admissions that than the increase for patients with just one chronic condition.	Increase	Yes, significant increase

Busch & Duchovny, 2005; Manning et al., 1987). The hypothesis for enrollees with no

chronic conditions was not confirmed in the first year or for the average enrollment use

as total cost showed a significant decrease. The hypotheses for enrollees with chronic

conditions in one and multiple body systems were also not confirmed, as total cost went

up based on enrollment status and chronic condition status, and was again the same in the

first year of enrollment and for average annual use. These results are shown in Table 60.

Table 60 – Total Cost Hypotheses

Hypothesis	Proposed Direction	Supported
H8: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in overall costs for utilization of health services.	None	No, significant decrease
H8a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in overall costs for utilization of health care services.	Decrease	No, significant increase
H8b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in overall costs for utilization of health care services than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

Overall Summary of Results

The results of this study show that enrollment in a coordinated care program combined with chronic condition status has a significant impact on utilization of health care services, some of these impacts being expected and some of them not. Increases in PCP, percentage of care provided by PCP, and outpatient hospital encounters for enrollees with chronic conditions in one body system and in multiple body systems show that the program may be encouraging enrollees with chronic conditions to seek out more appropriate care (Oswald, 2001; Ross et al, 2007; Rothman & Wagner, 2003; VonKorf et al., 1997).

However, ED use and inpatient hospitalizations also show increases significantly impacted by the combination of enrollment status and chronic condition status, indicating that the program may not be as effective as possible in ensuring that care is being rendered in the most appropriate manner on a timely basis. For enrollees with chronic conditions in one and multiple body systems, increases in ED use may reveal that their complex medical needs are not entirely being met by VCC as it is structured and operates today. It is important to recognize that VCC lacks many elements of the CCM, discussed below, and is not yet achieving some of the impacts that might have been anticipated. Also, results showing increases in inpatient hospitalizations show that enrollment in VCC is not keeping the patients out of the hospital, indicating that they may have medical needs that are not being met, or that they are putting off seeking out care until they are very sick.

Total cost also increases significantly with enrollment and chronic condition statuses. This is important to consider because an increase in cost from pre-enrollment to during enrollment shows that enrollees are using more resources after they are enrolled, a phenomenon known as moral hazard. Additionally, many of the other utilization variables also show increases from the pre-enrollment period to the during enrollment period, contradicting some of the hypotheses. These increases are another indication that enrollees are seeking out more care in general as they are enrolled. An overall increase in utilization may have at least two possible explanations: that enrollees are using more care once they are enrolled simply because they have access, or that enrollees are using more care once they are enrollee as a result of a great deal of unmet medical need in the pre-enrollment period. Table 61 shows a summary of the hypothesis testing results.

Table 61.   Hypotheses

Hypothesis	Proposed Direction	Supported
H1: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in primary care physician services utilization.	None	No, significant increase
H1a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in their primary care physician services utilization.	Increase	Yes, significant increase
H1b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in their primary care physician services utilization than the increase for patients with just one chronic condition.	Increase	Yes, significant increase
H2: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department utilization.	None	No, significant decrease

Table 61 (continued)

Hypothesis	Proposed Direction	Supported
H2a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department utilization.	Decrease	No, significant increase
H2b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department utilization than the decrease for patients with just one chronic condition.	Decrease	No, significant increase
H3: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergent emergency department usage.	None	No, significant decrease
H3a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergent emergency department usage.	Decrease	No, significant increase
H3b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergent emergency department usage than the decrease for patients with just one chronic condition.	Decrease	No, significant increase
H4: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in emergency department usage for ambulatory sensitive conditions.	None	No, significant decrease
H4a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in emergency department usage for ambulatory sensitive conditions.	Decrease	No, significant increase
H4b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in emergency department usage for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.	Decrease	No, significant increase
H5: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change the rate of inpatient hospital admissions.	None	No, significant decrease

Table 61 (continued)

Hypothesis	Proposed Direction	Supported
H5a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in their inpatient hospital admissions.	Decrease	No, significant increase
H5b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in their inpatient hospital admissions that than the decrease for patients with just one chronic condition.	Decrease	No, significant increase
H6: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in inpatient hospital admissions for ambulatory sensitive conditions.	None	Yes, no change
H6a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in inpatient hospital admissions for ambulatory sensitive conditions.	Decrease	No, significant increase
H6b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in their inpatient hospital admissions for ambulatory sensitive conditions than the decrease for patients with just one chronic condition.	Decrease	No, significant increase
H7: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change the rate of outpatient hospital admissions.	None	No, significant decrease
H7a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with an increase in their outpatient hospital admissions.	Increase	Yes, significant increase
H7b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher increase in their outpatient hospital admissions that than the increase for patients with just one chronic condition.	Increase	Yes, significant increase
H8: For patients with no chronic conditions, enrollment in a coordinated care program will not be associated with a change in overall costs for utilization of health services.	None	No, significant decrease

Table 61 (continued)

Hypothesis	Proposed Direction	Supported
H8a: For patients with a chronic condition in one body system, enrollment in a coordinated care program will be associated with a decrease in overall costs for utilization of health care services.	Decrease	No, significant increase
H8b: For patients with chronic conditions in multiple body systems, enrollment in a coordinated care program will be associated with a higher decrease in overall costs for utilization of health care services than the decrease for patients with just one chronic condition.	Decrease	No, significant increase

A prior study done by Retchin et al, (2009) concludes that rates of ED use and hospitalizations both decrease based on enrollment in VCC. This study somewhat supports those conclusions. For enrollees with no chronic conditions, this study produces the same results as the prior study. However, enrollees with no chronic conditions account for about 40 percent of the population of this study, with the rest of the study population having at least one chronic condition. Enrollees with chronic conditions in one or more body systems show differing results. In the regression results, the main effect of enrollment on ED use was negative but the interaction term of enrollment x chronic conditions displayed the opposite sign. This is not surprising, as it was hypothesized that enrollees with chronic conditions would have a varied experience from enrollees with no chronic conditions, based on their need for complex medical care that may be best managed by a medical home. Demonstrating lower ED use across the entire VCC population would be difficult if the program were to be targeted primarily toward enrollees with chronic conditions.

Implications

VCC, as a version of the Chronic Care Model, contains elements of the model including the delivery system design, access to community resources, encouraging patient self-management, and the use of clinical information to aid in program decisions. The components of the program, as measured by enrollment status, combined with chronic condition status lead to the changes found in this study. Some of the changes were expected as results of being enrolled in the program, such as increased use of PCP services and increased use of outpatient services.

This study also produced results that were not anticipated, such as the increase in ED encounters, the increase in inpatient hospitalizations, and the increase in cost. This may be due to the limited nature of VCC as compared to the Chronic Care Model. There are several other components of the model that are not used by VCC, including some characteristics of the health care organization, decision support, and clinical information systems. Some of the other Chronic Care Model components are employed by VCC in a way that cannot be measured, such as Community Resources and Policies and Self-Management Support. By adding or measuring these components, VCC may be able to show more consistent results in improving access to appropriate patient care.

The results of this study show that enrollment in the coordinated care program combined with chronic care status have a significant impact on utilization of health care services, and for enrollees with a chronic condition in one or more body systems typically lead to an increase of services, regardless of the type of service. It is important to recognize that this may be a result of the relatively high level of unmet medical need

among the indigent population that qualifies for enrollment in VCC, resulting in an increased use of health care services once patients are enrolled in the program (Busch & Duchovny, 2005; Manning et al., 1987; Schoen & DesRoches, 2000). The increase in cost may also reflect this possible increase in meeting enrollee needs. It may be that better managed care eventually results in lower cost, but this may be difficult to determine when dealing with a population that faces many challenges in addition to accessing health care.

Many of the regressions show results that are different for enrollment status and chronic condition status as compared with the interaction term that is enrollment status and chronic condition status combined. This study is concerned primarily with the interaction of enrollment status and chronic condition status because this is how the impact of enrollment in the program on enrollees with chronic conditions is measured. Simply examining enrollment status or chronic condition status shows a different impact on the utilization variables than the interaction terms because it does not take their impact on each other into account.

Those enrolled in the program with no chronic conditions show different results than those who have chronic conditions. In many cases, they show decreases in utilization where the chronic condition groups show increases, such as for ED encounters, inpatient hospitalizations, and cost. This may be due to the nature of the program being more suited to those with chronic conditions, and not responsive to those without chronic conditions that only need acute care and do not need access to the services provided by VCC. Enrollees who only require acute care will not have any reason to be engaged in

the program, and will therefore not have their needs met as well by a program that

focuses on providing a medical home for ongoing care, a way to access community

services, or self-management support, but will have their needs met through episodic

care.   An alternative explanation may be that VCC is helping the enrollees with no

chronic conditions stay healthy, so that they have less need for health care services.

The significance of the results of this study show that implementing some of the

elements of the Chronic Care Model have an impact on how enrollees of such a program

seek out care. The VCC program is a limited application of the Chronic Care Model and

this study shows that the program does impact utilization, so it might be surmised that a

more complete or full application of the Chronic Care Model may have an even greater

impact on utilization of health care services.

Limitations

There are limitations that apply to this study from the data, the variable creation,

and the analytical methodology which were discussed previously in Chapter Four that

include the lack of a control group and the lack of information pertaining to possible

utilization outside of VCC. A control group would make it possible to compare changes

in utilization of those enrolled in VCC to how utilization may change in patients who are

not enrolled in VCC but seek out care through the VCU Health System. Without a

control group, it is only possible to look back on utilization and compare it the pre-

enrollment period to the enrollment period, but it is unknown what utilization would have

been for these patients might have been had they not been enrolled in VCC.

Another limitation mentioned in Chapter 4 is other sources of care. In the VCC program, enrollees have access to limited health care providers in the Richmond area. There are many other providers who are not a part of the VCC program from whom the enrollees could seek care from if they wished. This care is not measured in any way by the VCC program. However, for enrollees with chronic conditions who need complex care, VCC is the only resource available to them that can provide this care. Additionally, many of the local providers are familiar with the VCC program, so when they come into contact with an enrollee, they often refer them back to VCC for care, making it likely that VCC enrollees receive a bulk, if not all of their care, through participating providers.

The selected utilization variables also limit the results of this study. This study includes PCP encounters, ED use, inpatient hospitalizations, outpatient hospital use, and cost. There are, of course, many other aspects to health care that are not included in these utilization measures, such as lab work and tests, pharmaceuticals, and so on. Having these measures of utilization would provide a more complete picture of utilization and these aspects may change upon enrollment in the program and they would be good additions to future studies conducted of the VCC program.

In the analysis, the utilization variable cost has a quite high standard deviation. Further analysis revealed that cost does vary greatly from enrollee to enrollee. While this does raise some concern, it is an important reflection of the varying levels of utilization among the enrollees, and may be a result of the high level of variation in need for health services based upon health status.

The independent variable length of enrollment presents a limitation. Length of enrollment is measured in years, as that is the standard contract period for VCC enrollment. There are few enrollees who leave the program in the midst of a contract year, yet their length of enrollment is measured to the full year. Enrollees who were not enrolled for a full year were not included in this study, however, enrollees who were enrolled for at least one full year and any part of an additional year were. Additionally, there are enrollees who are enrolled for a full contract year but do not actively participate in the program for the full term. There is no way to know if this is caused by an enrollee electing to exit the program and not informing anyone or if it is caused by an enrollee simply not needing services for the remainder of their contract period.

A methodological limitation of this study is the multiple comparisons of dependent variables. Separate comparisons or hypothesis tests do not allow for possible correlation between the dependent variables and can potentially lead to higher significance levels in the results. There are analytical means to correct for this, but they have not been employed in this study. This may be a possible area of future research (Cupples et al, 1984).

While many of the regressions showed that the utilization variables were significantly impacted by the interaction of enrollment status and chronic condition status, the amount of variation in the utilization variables explained by the independent variables (the r^2 value) is often quite low. This means that the independent variables did not largely impact the overall amounts of utilization in the regressions that have low r^2, including ED encounters for ASC, emergent ED encounters, and inpatient

hospitalizations for ASC. The low r^2 values taken with the significant coefficients for the independent variables mean that the independent variables were not a major predictor of utilization, however, they are associated with a significant impact in utilization.

Finally, while this study measures use of health services, it does not measure health status or patient satisfaction. In the behavioral model for access to health care, predisposing characteristics interact with enabling resources to impact use of health services, which in turn ideally will lead to improved health outcomes. This study has shown that use of health care services is impacted by the predisposing characteristics and the enabling resources that are a part of the study. In the administrative data, there is no way to measure health outcomes or patient satisfaction. However, there have been several initiatives considered for implementation by the VCC program to measure both of these aspects.

Future Research

For future research, it would be beneficial to try and more completely capture enrollee utilization. To start, more complete VCC utilization information could be obtained. Ideally, all enrollee information, both within and outside of VCC would be included to be as complete as possible. This information would make it possible to not only better understand enrollee utilization, but pre-enrollment utilization as well, and to therefore how utilization changes upon enrollment. This may be possible by collecting data from the enrollees directly.

In addition to collecting information about use of health care services outside of the reaches of VCC, another possible area of research that would use information

gathered directly from the enrollees is to gather information from them about their health status, such as through a survey or interview. This would make it possible to determine if health status changes based on enrollment.

It may also be beneficial to delve further into studying the effects of enrollment on certain chronic conditions. Some chronic conditions may require more care coordination and use of PCP services to keep patients with these conditions healthier. By identifying conditions that are impacted more by the effect of being enrolled in the program, it may be possible to target enrollment to these patients, creating a more efficient program.

A more detailed analysis of ED utilization may reveal if enrollee use of ED services increases because enrollees are using the ED more often in the nights and on the weekends. It may be that enrollees are using their PCP more during the weekdays, but are still going to (or being referred to) the ED in the evenings or on the weekends. It may also be possible to determine which PCP practices may be referring enrollees to the ED, and make program changes as needed.

Another interesting area of study would be to examine some quality standards surrounding enrollee utilization in both periods. If, in the pre-enrollment period enrollees are not receiving standard levels of care but they are in the enrollment period, then a feasible explanation for the increases in care between the two periods would be that enrollee care is improving in quality. If, however, enrollees are receiving standard care in both periods, then increases in utilization may be a result of moral hazard. Better understanding of quality could lend more meaning to the study results.

In conclusion, this study shows that a program that uses even limited components of the Chronic Care Model has a significant impact on how patients use health care, especially for those patients with chronic conditions, through the use of correlations and linear regressions. It was found that PCP and outpatient encounters increased, as did ED use, inpatient hospitalizations, and cost.   The increases in PCP and outpatient encounters were expected, as per prior research using the Chronic Care Model, but the other increases were not. Implementing more or all of the components of the model may lead to additional changes to and improvements in utilization.

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