



University of Kentucky
UKnowledge

University of Kentucky Doctoral Dissertations

Graduate School

2009

AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF WITHIN FACILITY AND SECONDARY HEALTHCARE SERVICES BY KENTUCKY STATE PRISON INMATES

Sandra Jane Winter
University of Kentucky, sjwint2@email.uky.edu

[Right click to open a feedback form in a new tab to let us know how this document benefits you.](#)

Recommended Citation

Winter, Sandra Jane, "AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF WITHIN FACILITY AND SECONDARY HEALTHCARE SERVICES BY KENTUCKY STATE PRISON INMATES" (2009). *University of Kentucky Doctoral Dissertations*. 790.

https://uknowledge.uky.edu/gradschool_diss/790

This Dissertation is brought to you for free and open access by the Graduate School at UKnowledge. It has been accepted for inclusion in University of Kentucky Doctoral Dissertations by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.

ABSTRACT OF DISSERTATION

Sandra Jane Winter

The Graduate School
University of Kentucky
2009

AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF
WITHIN FACILITY AND SECONDARY HEALTHCARE SERVICES
BY KENTUCKY STATE PRISON INMATES

ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
Martin School of Public Policy and Administration
at the University of Kentucky

By
Sandra Jane Winter

Lexington, Kentucky

Director: Dr. J. S. Butler, Professor,
Martin School of Public Policy and Administration
Lexington, Kentucky

2009

Copyright © Sandra Jane Winter 2009

ABSTRACT OF DISSERTATION

AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF WITHIN FACILITY AND SECONDARY HEALTHCARE SERVICES BY KENTUCKY STATE PRISON INMATES

The inmate population is increasing, aging and generally in poorer health than the non-incarcerated population. Providing healthcare to inmates is constitutionally mandated, and expensive. Little published research exists to assist corrections health policy makers strategically plan for future inmate healthcare needs. This research provides an extensive description of the healthcare utilization patterns of a sample of 577 male and female inmates incarcerated at state-operated prisons in Kentucky during the period January 1, 2007, to December 31, 2007 and who have at least one of the chronic conditions of diabetes, hypertension or hyperlipidemia. The primary outcome measures were a count of the number of encounters documented in the inmate's electronic health record by 1) medical doctors and advanced registered nurse practitioners (medical care utilization) and 2) psychiatrists and psychologists (mental healthcare utilization), and 3) a dichotomous variable indicating if the inmate had received care from a health provider located outside the prison. The explanatory variables included demographic variables, health status variables, health risk factors, sentence-related variables, facility characteristics, inmate to corrections and medical staff ratios and quality of care indicators. Differences in healthcare utilization between various groups of inmates were tested using Pearson's chi-squared test for categorical variables and Student t-test for continuous variables. In the bivariate analysis increasing age, being female, having comorbidities, having a diagnosis of mental illness, being obese, not adhering to diet, exercise and medications, refusing or missing treatment, being at a facility with more corrections or medical staff and having better quality of care were all associated with greater healthcare utilization. Negative binomial regression was used to analyze the count outcomes, and multivariate logistic regression analysis was used to analyze the dichotomous outcome. Regression analysis revealed that the number of problems an inmate had recorded in their electronic health record and increasing age were the two greatest predictors of within facility and secondary healthcare utilization. Carrying out case management and disease management for inmates with comorbidities may have benefits for Departments of Corrections and inmates.

Keywords: healthcare utilization, in-patient hospital stays, prison inmates, chronic diseases, Kentucky

Sandra Jane Winter

July 27 2009

AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF WITHIN FACILITY
AND SECONDARY HEALTHCARE SERVICES BY KENTUCKY STATE INMATES

By

Sandra Jane Winter

Dr. J. S. Butler, PhD
Director of Dissertation
and Director of Graduate Studies

Date

DISSERTATION

Sandra Jane Winter

The Graduate School
University of Kentucky
2009

AN EMPIRICAL ANALYSIS OF THE UTILIZATION PATTERNS OF WITHIN FACILITY
AND SECONDARY HEALTHCARE SERVICES BY KENTUCKY STATE INMATES

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
Martin School of Public Policy and Administration
at the University of Kentucky

By

Sandra Jane Winter

Lexington, Kentucky

Director: Dr. J. S. Butler, Professor,
Martin School of Public Policy and Administration
Lexington, Kentucky

2009

Copyright © Sandra Jane Winter 2009

Dedication

To my family, near and far

Acknowledgements

This dissertation would not have been possible without the help and support of my teachers at the University of Kentucky, my colleagues at the Kentucky Corrections Health Services Network, my associates at the Kentucky Department of Corrections, my friends and my family.

Although I learned a great deal from all the professors with whom I had contact at the University of Kentucky, I would like specifically to acknowledge Dr JS Butler who patiently dispensed advice on econometric matters, Dr Eugenia Toma who was attentive and encouraging, Dr Sarah Wackerbarth who recognized in me potential I did not know existed and Dr Heather Bush who contributed greatly to my understanding of biostatistics. I also acknowledge Dr Jeff Talbert and Dr Aaron Yelowitz, my committee members. I thank Sarah Lee of the Martin School of Public Policy and Administration for the administrative support she constantly provided.

I am particularly grateful to Dr Philip Roeder who was a steadfast mentor and source of advice and encouragement during the four years I was associated with the Kentucky Corrections Health Services Network. I also acknowledge Jean Kennedy, Peace Jessa and Philip Curd with whom I worked over the past few years, each of whom contributed to my personal and academic growth. Dr Anthony Baxter of Correctcare Integrated Health, LLC provided much needed data for this research.

My understanding and knowledge of the issues surrounding the healthcare of prison inmates was enhanced through my dealings with Dr Scott Haas, Brigid Adams, Tammy Morgan and Deb William of the Kentucky Department of Corrections. I am grateful for the time and knowledge they shared with me.

I owe a debt of gratitude to the many friends who supported and encouraged me during good and bad times: Madison Gates, Amanda Sokan, Johan and Miemie

Dorfling, Wim and Catherine de Villiers and the many other South Africans living in Lexington. The humor and camaraderie of my class mates, Robin Rhea, John Foster and Josh Poulette made the years of study much more bearable. I could not have managed without the help of two special friends in particular, Alison Connell and Linda Kimsey, both of whom patiently read and re-read my dissertation and offered suggestions that culminated in a better finished product. They showed constant faith in my ability to get things done, particularly when I was in doubt. Thank you both.

I am grateful to my parents who gave me such a solid start in life and to my children who have put up with the many inconveniences arising from having their mother go back to school. Finally, I thank my husband, who has encouraged and supported me in many different ventures over the course of a quarter century and has never lost faith in me.

For we are God's masterpiece. He has created us anew in Christ Jesus,
so we can do the good things he planned for us long ago.

Ephesians 2 v 10 (NLT)

Table of Contents

Acknowledgements	iii
List of Tables	ix
List of Figures	xi
Chapter 1 - Introduction	1
Background	1
Research Purpose	3
Dissertation Layout	4
Chapter 2 - The Demand for Healthcare	6
A Generalized Equation for the Demand for Health	6
Differences in Health Care Demands between the Incarcerated and the Non- Incarcerated Population	7
The price of, and demand for, healthcare	7
Price of substitutes and complements	9
Type of health care - prevention, detection, treatment	9
Quantity and quality of healthcare services available	10
Health status	11
Demographics such as age, race and gender	12
Socioeconomic variables such as income, education and occupation	12
Health beliefs and individual preferences	12
Time costs involved in seeking healthcare	14
Chapter 3 - Factors Affecting Healthcare Utilization in the Non-incarcerated Population	15
Variations in the Provision of Healthcare	15
Healthcare Utilization: Patterns and Costs	18
Studies in the Non-Incarcerated Population of Factors that affect Healthcare Cost and Utilization	19
Demographic Factors	19
Health Status Factors	23
Health Risk Factors	27
The Morbidity and Mortality Burden of Cardiovascular Disease and Diabetes	29
Cardiovascular disease	30
Diabetes Mellitus	30
Chapter 4 – Prison Inmates in the United States	32
Incarceration Rates in the United States	32
The Social Construction of Offenders	34
A Profile of Prison and Jail Inmates in the United States	34
The Financial Costs of Incarcerating Prison and Jail Inmates in the United States	35
Health Status of Prison and Jail Inmates in the United States	35
Physical Health	35
Mental Health	37
Substance Abuse	38
Aging Prison Inmates	39
Causes of Death	40
Studies of Healthcare Utilization in the Incarcerated Population	41
Potential Organizational Reasons for Differences in Healthcare Utilization Between the Non-Incarcerated and the Incarcerated Population	46

Challenges Faced by Correctional Healthcare Providers	46
Externalities and Marginal Benefits of Providing Healthcare to Inmates	47
Chapter 5 – The Kentucky Setting	52
Overview of Prisons Operated by the Kentucky Department of Corrections	52
Abbreviations of Facility Names	54
Inmate Classification and Assignment Process	54
Kentucky Inmate Characteristics	55
The Provision of Healthcare to Kentucky State Prison Inmates	55
Kentucky Inmate Incarceration Costs	56
Kentucky Department of Corrections Medical Staffing	57
Chapter 6 – Statistical Methodology	59
Previous Research by the Kentucky Corrections Health Services Network	59
Research Purpose	61
Institutional Review Board Approval	62
Study Design	62
Sample Selection	62
Source of Data	63
Variables	63
Primary Outcome Variables	63
Explanatory Variables	63
Individual Level Variables	64
Demographic variables	64
Health status variables	64
Health risk factor variables	65
Sentence variables	66
Institutional Level Variables	66
Facility Identification	66
Inmate to Staff Ratio	67
Quality of Care Variables	67
Missing Data	68
Secondary Outcome Variables	69
Generation of Hypotheses	69
Individual Level Hypotheses	69
Facility Level Hypotheses	70
Statistical Analysis	71
Chapter 7 - Descriptive Statistics	74
Description of Sample Inmate Population	74
Description of Facilities	79
Within Facility Healthcare Utilization	85
Secondary Care Utilization	87
Inpatient and Observation Care	88
Ambulatory Care, Ambulance Transportation and Emergency Department Visits	88
Disease Classifications of Secondary Care	88
Cost of Secondary Care	89
Chapter 8 - Statistical Analysis	91
Primary Data Analysis	91
Testing for Differences in Within Facility and Secondary Care Health Service Utilization at the Individual Level	91
Demographic Variables	91

Health Status Variables	92
Health Risk Behavior Variables.....	94
Sentence Related Variables.....	95
Testing for Differences in Within Facility and Secondary Care Health Service	
Utilization at the Facility Level	96
Inmate to staff ratios	98
Inmate to Total Corrections Staff Ratio.....	98
Inmate to Total Medical Staff Ratio.....	99
Quality of Care Indicators.....	100
Minimum Number of Chronic Care Visits	100
HEDIS Quality Score.....	101
Volume of Care Indicator.....	101
Summary.....	102
Regression analysis.....	103
Documented Encounters with Medical Providers.....	103
Documented Encounters with Mental Health Providers	105
Odds of Receiving Secondary Care.....	108
Secondary Analysis of Data	110
Analysis of Alternative Outcome Variables	110
Additional Facility Level Analysis.....	110
Analysis of Inmates Who Incurred the Most Expensive Secondary Care.....	110
Bivariate Analysis of Variables by Disease State.....	112
Chapter 9 – Interpretation of Results	114
Interpretation of Bivariate Analysis	114
Documented Encounters with Medical Providers.....	114
Documented encounters with Mental Health Providers	115
Secondary Care	115
Interpretation of Regression Analysis.....	116
Documented Encounters with Medical Providers.....	116
Documented Encounters with Mental Health Providers	117
Odds of Receiving Secondary Care.....	117
Comparisons of Research Results with Relevant Data from the Non-Incarcerated	
Population.....	118
The Relationship Between Number of Staff, Quality of Care Variables and Secondary	
Care Costs.....	119
Chapter 10 - Discussion, Policy Implications, Future Research Opportunities and	
Conclusions.....	121
Discussion	121
Data Collection, Analysis and Reporting.....	121
Structure, Process and Outcomes	121
Electronic Health Record Systems.....	122
A Useful Data Collection and Analysis Tool: The Balanced Score Card.....	123
Collaboration Between Departments of Corrections and Academic Research	
Institutions	124
Healthcare Utilization and Cost Control Strategies	124
Privatization of the Provision of Correctional Healthcare Services	124
The Use of Telemedicine	126
Inmate Co-Pays for Medical Care	126
Shifting the Cost of Inmate Care to Medicaid/Medicare.....	128
Unintended Consequences of Improving Healthcare Quality.....	128

Policy Implications for the Kentucky Department of Corrections.....	129
Case Management for Inmates with Multiple Comorbidities	129
Improving Elder Care	130
Providing Health Education	131
Using Inmates as Community Healthcare Workers.....	132
Limitations and Opportunities for Further Research	133
Conclusion	134
Bibliography	136
Vita.....	147

List of Tables

Table 4-1: A Comparison of the Prevalence of Selected Medical Conditions in the United States Population and the State Prison Population.....	37
Table 4-2: A Comparison of Causes of Death in the Non-Incarcerated and Incarcerated Population	40
Table 5-1: State Prisons operated by the Kentucky Department of Corrections (2007) ..	52
Table 5-2: Privately operated state prisons in Kentucky (2007)	53
Table 5-3: Abbreviations of Kentucky State-operated Prison Names	54
Table 5-4: Primary and Secondary Costs of Medical Care per Inmate (excludes mental health)	56
Table 5-5: Kentucky Department of Corrections Adult Prison Medical Staffing (2007) ..	58
Table 6-1: Comparison of the Prevalence Rates of High Blood Pressure, Hyperlipidemia and Diabetes in the United States, in Kentucky and in the Kentucky Inmate Population	60
Table 6-2: Comparison of Selected HEDIS Quality of Care Indicators Measured in the Kentucky Department of Corrections, Commercial Insurers, Medicaid and Medicare Populations	60
Table 6-3: Variance and Mean of Documented Within Facility Encounters	72
Table 7-1: Age, Race and Gender Distribution of Sample Population	74
Table 7-2: Demographic Information of Sample Inmate Population	75
Table 7-3: Health Status Information of Sample Inmate Population	77
Table 7-4: Modifiable Risk Factor Information of Sample Inmate Population	78
Table 7-5: Sentence Characteristics Information of Sample Inmate Population	79
Table 7-6: Location of Inmates for Duration of Study Period by Facility	80
Table 7-7: Facilities Described by Gender, Security Classification, Inmate Size and Total Staff.....	81
Table 7-8: Inmate to Staff Ratios by Facility.....	82
Table 7-9: Number of Chronic Care Visits Received by the Sample Population.....	82
Table 7-10: Percentage of Inmates who Received the Minimum Number of Recommended Chronic Care Visits by Facility for All Three Conditions	83
Table 7-11: HEDIS Process Measures Received by Inmates by Facility.....	84
Table 7-12: Descriptive Statistics of Quality of Care Indicators by Facility	85
Table 7-13: Analysis of Number of Provider Visits by Type of Provider.....	86
Table 7-14: Analysis of Number of Non-Provider Visits by Type of Provider	87
Table 7-15: Number of Inmates with Inpatient and Observation Stays.....	88
Table 7-16: Cost of Secondary Care per Inmate.....	90
Table 8-1: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Demographic Variables	92
Table 8-2: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Health Status.....	94
Table 8-3: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Health Risk Factors	95
Table 8-4: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Sentence Related Variables	96

Table 8-5: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care by Facility	98
Table 8-6: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Inmate to Staff Ratios	99
Table 8-7: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Quality of Care Indicators	100
Table 8-8: Negative Binomial Regression Results: Medical Care Utilization	104
Table 8-9: Negative Binomial Regression Results: Mental Healthcare Utilization	107
Table 8-10: Logistic Regression Results: Odds of Receiving Secondary Care	109
Table 8-11: Disease Classifications, Procedures, Number of Inmates and Cost of Secondary Care for Inmates with more than \$10,000 of Secondary Care Costs.....	111
Table 9-1: Inmate to Medical Staff Ratio, Quality of Care Variables, Percentage and Cost of Inmates Receiving Secondary Care.....	120

List of Figures

Figure 2-1: Distortions in the Demand for Healthcare Resulting from Moral Hazard	8
Figure 3-1: Welfare Losses to Society Resulting from Variations in the Use of Medical Care	17
Figure 4-1: Number of Inmates per 100,000 of National Population (2006)	32
Figure 4-2: Number of persons under correctional supervision in the United States (1980 - 2007).....	33
Figure 4-3: Percentage of Inmates Meeting Substance Dependence or Abuse Criteria who Participated in Treatment or Other Programs since Admission	39
Figure 4-4: The Undersupply of Inmate Healthcare	48
Figure 4-5: "Flat of the Curve" Medicine	49
Figure 5-1: Map Showing Kentucky State Prison Facilities	53
Figure 5-2: Proportion of KyDOC Healthcare Expenditures for the fiscal year ending June 30 2006.....	57
Figure 6-1: Distribution of Within Facility Encounters with Healthcare providers	71
Figure 7-1: Venn Diagram Indicating the Presence of Co-Morbidities in the Sample Inmate Population	76
Figure 7-2: Frequency of ICD9 Codes Documented for Inmates who Received Secondary Care	89

Chapter 1 - Introduction

Background

The provision of healthcare is a complex matter that can take many forms, be carried out by various types of providers and take place in different settings. The role of health policy makers and administrators is to ensure that an appropriate quantity and quality of healthcare is provided to the population in a timely and cost-effective fashion. This involves consideration of the prevailing healthcare priorities and needs, as well as available resources. Healthcare services include preventive, diagnostic and treatment procedures. These services are delivered by medical professionals such as surgeons, physicians, advanced registered nurse practitioners, physician assistants, psychiatrists, psychologists, dentists, pharmacists, optometrists and physical therapists, and by medical support staff such as nurses, phlebotomists and medical records and administrative staff. Healthcare services can be provided at home, at the providers' offices or at hospitals and nursing care facilities. This dissertation will focus on a previously under-researched facet of the provision of healthcare services, specifically, the healthcare that is provided to prison inmates.

The number of individuals in the United States of America under correctional supervision (which includes individuals on probation and parole, and individuals incarcerated in jails and prisons) has increased 400 percent from 1.8 million in 1980 to 7.3 million in 2007 (Bureau of Justice Statistics, 2009). Over this period, the prison population has increased by 473 percent from 319,598 in 1980 to 1,512,576 in 2007. There are two primary factors associated with the dramatic increase in the incarcerated population are: 1) tougher sentencing legislation enacted in the 1980's and 1990's as a result of the "war on drugs" which began in the 1970s under the administration of President Richard Nixon and has continued under subsequent administrations, and 2) the move toward community based care for people with mental illness, which began in the late 1950s and has continued to date. Insufficient and inadequate community based mental health service provision has resulted in jails and prisons becoming the primary providers of psychiatric care for many individuals (Torrey, 1995).

There are a number of negative consequences of high incarceration rates. In the recent past, rapidly increasing incarceration rates led to prison overcrowding. Prison overcrowding increases the risk of the spread of infectious disease and may exacerbate mental illness, as well as increasing the potential for disciplinary infractions and inmate-

upon-inmate violence (Mullen, 1985). High incarceration rates have resulted in an increasing number of individuals facing the collateral consequences of incarceration, in other words, the unintended costs of prison or jail sentencing. These unintended costs include disenfranchisement, not being able to receive federal aid such as welfare benefits, student loans and public housing, loss of parental rights, social stigma and reduced employment opportunities (Travis, 2007; Cooper 2007). Large numbers of closely confined inmates may pose a public health risk for the 2.2 million incarcerated inmates and the approximately 750,000 corrections staff (Gibbons & Katzenbach, 2006). Inmates have high rates of infectious diseases such as Hepatitis B and C, tuberculosis and HIV (Hammett, Harmon & Rhodes, 2002). In addition, almost 95 percent of inmates will eventually be released to their communities, many of which are under-resourced in terms of healthcare service capacity (American Correctional Association, Government and Public Affairs, 2009). Costs of incarceration of state prison and jail inmates are borne by state and local government and funded by taxpayers. Greater numbers of sicker inmates have placed considerable strain on state budgets.

The US Supreme Court interpretation of the Eighth Amendment requires that states provide healthcare to prison inmates that is appropriate to prevent mortality, disease and permanent disability (Estelle vs. Gamble, 1976). This requirement carries with it considerable expense. Increases in inmate healthcare expenditure have been attributed to longer prison stays by inmates; the treatment of an increasing number of inmates who have infectious diseases, mental illness and substance abuse problems; an aging inmate population who have increased medical needs due to chronic and age related conditions; rising pharmaceutical expenditure and mismanagement of the provision of healthcare by Departments of Corrections (Kinsella, 2004). Inmate healthcare accounts for, on average, ten percent of state corrections budgets. In 2001, total state corrections expenditure was \$38,155,000,000 of which \$3,688,000,000 was healthcare expenditure (Kinsella, 2004).

While incarcerated, inmates receive the majority of their health care within the prison as opposed to at outside facilities such as hospitals. Little published work is available that examines inmate healthcare utilization patterns within and outside correctional facilities. This may be because corrections-based research efforts are often hampered by: 1) lack of adequate and accurate data, 2) inadequate health information technology which relies on paper medical charts which are difficult to analyze and

impede epidemiological research 3) onerous Institutional Review Board processes required to conduct research on this vulnerable population group, 3) scarce government or non-government funding and 4) preconceived notions regarding the worthiness of the incarcerated population. These notions range from “out of sight, out of mind” to ethically based concerns surrounding the provision of healthcare to “deviants” of society, while millions of uninsured individuals in America face considerable barriers to accessing healthcare. Whatever one’s views, from a state and local government perspective, maintaining the corrections population, including healthcare provision is consuming an increasing share of public resources, and these trends are likely to continue in the foreseeable future. To make sound policy decisions, more detailed information is needed regarding the factors that affect healthcare utilization and costs in the corrections setting.

Research Purpose

The long term objective of this cross-sectional study is to provide information to Correctional healthcare policy makers and administrators that can be used to plan, implement and administer cost effective inmate healthcare services of appropriate quality in an efficient manner. This study will use a unique cross-sectional data set to examine aspects of healthcare utilization of a sample of 577 male and female prison inmates with diabetes, hypertension and/or hyperlipidemia who were incarcerated at twelve state operated prisons in Kentucky in 2007. The purpose of this study is to

- 1) Describe the sample inmate population in terms of
 - a. Individual inmate characteristics (demographic factors, health status variables, health risk factors and criminal offense related characteristics) and
 - b. Facility level characteristics (inmate to staff ratios and quality of care features)
- 2) Analyze the healthcare utilization for this sample of inmates that takes place for the period January 1 2007 to December 31 2007
 - a. Within the prison facilities categorized by type of medical professional and support staff and
 - b. Outside the prison facilities, which includes inpatient and ambulatory care, and the associated costs of this outside care
- 3) Compare healthcare utilization by various sub-groups of the sample inmate population, looking specifically at within facility documented encounters with medical

- and mental health providers, and at those inmates who received secondary care at facilities located outside the prisons, and
- 4) Identify factors associated with variations in within facility and secondary care utilization by this sample of inmates using appropriate regression analysis techniques.

For the purposes of this study, within facility utilization comprises encounters between inmates and medical professionals and support staff that are documented in the patient's electronic health record and take place at the prison. Secondary care utilization refers to the healthcare services an inmate receives outside the prison, for example at community hospitals, academic teaching institutions and not for profit hospitals, and comprises inpatient and ambulatory care.

As previously mentioned, healthcare for prison inmates is expensive. As the inmate population increases and ages, expenditure on inmate healthcare services is likely to continue to consume a sizeable portion of state and federal Corrections budgets. A better understanding of the characteristics of within facility and secondary care utilization patterns should be useful to leaders who formulate policy and make decisions regarding the organization and delivery of inmate healthcare. In a setting of scarce human and financial resources, information on the factors associated with healthcare utilization can be used to develop targeted programs that provide an appropriate quality and quantity of healthcare services. As well as informing decision makers and leaders, this dissertation will add to a body of literature that is at present sparse. The growing prison population that is aging and has considerable health needs is an important, but under-researched topic. Improving the value of healthcare services provided to inmates is beneficial not only to the inmates themselves, but also to the taxpaying public who ultimately bear the financial burden. There are also potential public health benefits as most prison inmates are eventually released from prison and return to their communities. Improving inmate healthcare can potentially reduce the spread of infectious diseases both within prison and in the community.

Dissertation Layout

Chapter two will present a generalized demand for health equation and discuss theoretical reasons why healthcare demands of the incarcerated and the non-incarcerated may differ. Chapter three will discuss factors affecting healthcare utilization in the non-incarcerated population, including demographics, health status and health risk

behaviors. Variations in the provision of healthcare will also be discussed. Details regarding the considerable morbidity and mortality burden of cardiovascular disease and diabetes mellitus will be presented. Chapter four will present information regarding prison inmates in the United States, incarceration rates, financial costs of incarceration and the health status of prison and jail inmates. Chapter four will also review the few existing published studies of healthcare utilization by inmates. Potential organizational reasons for differences in healthcare utilization between the non-incarcerated and the incarcerated population will be discussed, along with the potential existence of externalities and marginal benefits of providing healthcare to prison inmates. Chapter five will introduce the setting for this research – Kentucky state operated prisons. Chapter six will describe the statistical methodology that will be employed in this research. Chapter seven will present descriptive statistics of the sample population, at both the individual and facility level and describe the within facility and secondary healthcare utilization patterns of the sample inmate population. Chapter eight will present the results of the statistical analysis, including tests conducted to determine differences in utilization between various groups of inmates, and negative binomial and logistic regression analysis of factors that were hypothesized to be associated with within facility and secondary healthcare utilization. Chapter nine will interpret the results of the statistical analysis. Chapter ten will discuss the policy implications that flow from the data, and will suggest limitations of the study, many of which also constitute opportunities for further research.

Chapter 2 - The Demand for Healthcare

In a landmark paper produced in the early 1970's, Michael Grossman suggested that "health can be viewed as a durable capital stock that produces an output of healthy time. It is assumed that individuals inherit an initial stock of health that depreciates with age and can be increased with investment" (Grossman, 1972, pg 223). Health itself is not a commodity that can be purchased. Instead, the demand for health results in a derived demand for healthcare services (Phelps, 2003). In terms of basic economic theory, a person's utility (U) can be expressed as a function of their stock of health (H) and a bundle of goods (X) they could purchase.

$$\text{Utility} = U(H,X)$$

In a simple model, health, in turn, can be considered a function of medical care (m), disease state (d) and lifestyle (l). Lifestyle choices could positively affect health, for example, eating a healthy diet and exercising, or negatively affect health, for example smoking and abusing drugs and/or alcohol (Phelps, 2003).

$$H = g(m, d, l+, l-)$$

A Generalized Equation for the Demand for Health

The quantity of healthcare demanded by individuals is the result of a complex multi-factorial decision-making process. The literature on factors affecting the quantity of healthcare demanded (Q_{HCD}) can generally be summarized in the following equation:

$$Q_{HCD} = f(P_{HC}, P_{SC}, S_{HC}, Q_{HCS}, QTY_{HC}, HS, D, SE, HB, TC)$$

Q_{HCD} = Quantity of healthcare demanded

P_{HC} = Price of health care

P_{HC} will vary depending on whether or not an individual has health insurance. If the individual does not have health insurance, the full price of healthcare will be paid by the individual. If the individual does have health insurance, the cost of healthcare would be the cost of premiums + any deductibles, co-pays and co-insurance.

P_{SC} = Price and availability of substitutes and complements

S_{HC} = Type of health care services, for example, prevention, detection or treatment of chronic or acute conditions

Q_{HCS} = Quantity of healthcare services available, for example number of doctors or clinics

QTY_{HC} = Quality of services provided

HS = Health status

D = Demographics such as age, race and gender

SE = Socioeconomic variables such as income, education and occupation

HB = Health beliefs and individual preferences

TC = Time costs involved in seeking healthcare

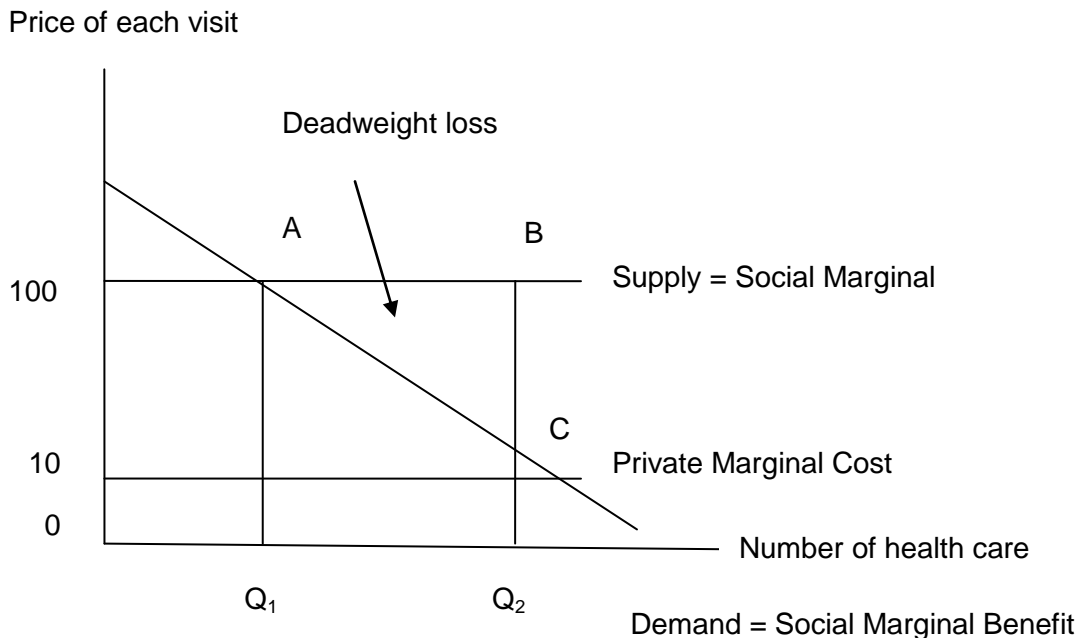
As the empirical focus of this dissertation is on the healthcare utilization of prison inmates, it is appropriate to consider how the demand for healthcare may differ between the incarcerated and the non-incarcerated populations.

Differences in Health Care Demands between the Incarcerated and the Non-Incarcerated Population

The price of, and demand for, healthcare

The most important difference in the quantity of healthcare demanded by the incarcerated population as opposed to the non-incarcerated population is that the price inmates' face is likely to be substantially less than the price of healthcare faced by the non-incarcerated. This results in the problem of moral hazard which occurs when an individual (in this case an inmate) utilizes health services differently to a non-incarcerated person because he/she does not bear the full price of the medical treatment. This phenomenon is illustrated graphically in Figure 1. In this example, the marginal cost of providing healthcare is \$100. We assume there is a downward sloping demand for healthcare, in other words, one is prepared to pay less for more healthcare due to diminishing marginal returns. In this example, because the individual has insurance the private marginal cost of healthcare is the \$10 co-pay. If the individual had to pay the full cost of healthcare, he would demand the quantity produced at Q_1 which occurs where the social marginal cost intersects with the social marginal benefit. Due to the insurance, this individual only has to pay \$10, so demands healthcare at point Q_2 where the private marginal cost intersects the social marginal benefit. There is, therefore, an oversupply of healthcare that is represented by the deadweight loss triangle of ABC (Gruber, 2005).

Figure 2-1: Distortions in the Demand for Healthcare Resulting from Moral Hazard



Source: Gruber, 2004.

Previous studies indicate that inmates utilize health care at a higher rate than the non-incarcerated population. In a British study published in the *Journal of Epidemiology and Community Health* in 2001, Marshall, Simpson and Stevens (2000) reported that male prisoners consult doctors three times and health care workers 77 times more frequently than a demographically equivalent community population. This study also reported that female inmates consulted doctors three times and healthcare workers 197 times more frequently than a demographically equivalent community population. In an earlier study Lindquist and Lindquist (1999), found that age and female gender were the most consistent demographic predictors of health status and medical care utilization in the incarcerated population.

Many prisons and jails are now charging co-pays to try to reduce frivolous overutilization of healthcare by inmates. "Medical co-pays are operational in 77 percent of the systems, ranging from 50 cents per outpatient visit or dental appointment to \$5 for self-initiated visits" (Hill, 2001). Unless inmates are receiving financial assistance from non-incarcerated friends or family members, then the co-pays will most likely come from earnings that inmates receive from work assignments in prison. Inmates are required to

work (unless they are medically excused) for which they receive a minimal wage of a few dollars a day. In practice, however, if an inmate were unable to pay the co-pay it is most likely that care would still be provided, especially in a situation where the illness could result in death or permanent disability.

Price of substitutes and complements

The price of substitutes and complements may affect the choice of provider for the non-incarcerated population, however, inmates typically are not faced with the same choices as the non-incarcerated. If the same healthcare services are offered by a number of providers at the same cost, a healthcare consumer might be indifferent about which provider to choose. The providers would thus be perfect substitutes for each other. Alternatively, a healthcare consumer may choose to seek the services of a healthcare provider who specializes in alternative medical therapies such as acupuncture, or naturopathy, rather than chose an allopathic provider. Although the managed health care practices that were most popular in the 1980's as a means of containing healthcare costs did place restrictions on the type of healthcare services and providers that could be utilized, the choice options are still greater than the options faced by inmates who have little choice regarding the healthcare services they receive.

Type of health care - prevention, detection, treatment

As disease and screening techniques become more sophisticated, an increase in healthcare utilization may occur due to both *direct* increases from more screenings themselves, and *indirect* increases resulting from earlier detection which creates more opportunities for healthcare consumption. In the past, many cancers were not detected until the late stage of the disease by which time treatment was palliative rather than curative. Inmates are literally a captive population so it may be that there are more opportunities for regular detection screenings and preventive interventions, for example, annual procedures such as physicals, electrocardiograms, eye exams, Papanicolaou tests, colonoscopies and laboratory tests, than would occur in the non-incarcerated population. Many cost-effectiveness estimations have been calculated comparing the costs of commonly used medical interventions divided by the resultant outcome (often measured in terms of increased Quality Adjusted Life Years) (Phelps, 2003). Cost effectiveness studies can compare individuals across various population groups such as hypertension screening on males versus females (the extensive margin) or compare rates of use within a specific population group such as breast cancer screenings on

older versus younger females (the intensive margin). In general, the literature suggests that although the use of preventive screenings can be costly, the benefits outweigh the costs (Phelps, 2003).

There are two main accreditation bodies for prison related issues both of which advocate increased prevention and screening services for inmates, thereby possibly increasing demand and utilization of these services. The recommended healthcare guidelines of these two bodies use community based standards, modified to accommodate the particular challenges presented in providing healthcare to incarcerated individuals. The American Correctional Association (ACA) covers all aspects of the correctional justice system such as food, security and healthcare. Regarding healthcare the “ACA standards provide health services guidance in establishing and maintaining constitutionally acceptable health services systems and cover the general areas of care and treatment, health records, administration, personnel and medical-legal issues” (ACA, 2008). The National Commission on Correctional Health Care (NCCHC) has developed standards that cover “inmate care and treatment; health care services and support; governance and administration; safety; personnel and training; health promotion; special needs and services; health records; and medical-legal issues” (NCCHC, 2008). Specific guidelines are provided for the treatment of asthma, diabetes, epilepsy, high blood cholesterol, high blood pressure, HIV and schizophrenia. Both the ACA and the NCCHC guidelines specify recommended utilization patterns for different types of conditions. In the more controlled corrections environment where financial and time costs are not a barrier to receiving healthcare, inmates may receive more preventive healthcare services which may increase healthcare utilization for this population compared to the non-incarcerated.

Quantity and quality of healthcare services available

In the United States, 70 percent of private health insurance for individuals is purchased through the workplace (Feldstein, 2007). This results in demand side inefficiency for many non-incarcerated individuals because employer-provided health insurance shields employees from the true cost of their healthcare which, in turn, distorts their demand for healthcare. Inmates are also shielded from the true cost of their healthcare because the government pays for their healthcare. Supply side inefficiency takes the form of restrictions on free entry into the market, for example licensure requirements for healthcare personnel and Certificates of Need for healthcare

institutions. The lack of information healthcare consumers have when seeking healthcare and the inequality of medical knowledge between provider and patient also contributes to market inefficiencies. Notwithstanding these factors, the non-incarcerated population has greater opportunity to shop around for the combination of price, quantity and quality of healthcare services that is suitable for them than does the incarcerated population.

The growing incarcerated population and shrinking state corrections budgets have compromised both the quantity and quality of healthcare services provided to inmates. In 2000, 10 percent of all the state operated and privately operated prisons were operating under a court order to make improvements to either their mental health treatment of inmates, or their medical facilities (Stephan & Karberg, 2003). In 2005, the California Department of Corrections and Rehabilitation (CDCR) was placed in receivership when a judge found that one inmate a week died due to due to negligence, malpractice or deficiency in the CDCR healthcare delivery system (Udesky, 2005). Donohoe (2006) presents compelling information regarding the poor quality of healthcare services at both privately run and state-operated prisons and jails. Many corrections healthcare facilities lack an adequate supply of appropriately trained personnel. In addition, many prison facilities operate with old and outdated equipment. Few Departments of Corrections have the necessary health information systems to manage their incarcerated populations effectively. These factors reduce the efficiency of healthcare provision in the corrections environment.

Health status

There is little anyone can do regarding genetic predisposition, or random chance, for contracting particular illnesses. Health status can, however, also be affected by modifiable lifestyle factors such as alcohol, tobacco and drug use; nutritional choices; physical fitness; sexual activity; stress management; regular periodic health assessments and worksite activities (for example, wearing protective clothing, lifting heavy weights correctly etc). The leading causes of death in the non-incarcerated population in 2000 were tobacco (435,000 deaths; 18.1% of total US deaths), poor diet and physical inactivity (400,000 deaths; 16.6%), and alcohol consumption (85,000 deaths; 3.5%) (Mokdad, Marks, Stroup & Gerberding, 2004).

Previous literature indicates that, relative to the non-incarcerated population, inmates have higher rates of mental illness (James & Glaze, 2006), substance abuse

(Mumola & Karberg, 2006) and communicable diseases such as HIV/AIDs, sexually transmitted diseases, hepatitis B and C and tuberculosis (NCCHC, Report to Congress, 2002). These conditions, as well as high rates of chronic diseases are exacerbated by high-risk health behaviors, lack of access to continuous medical care and low socioeconomic status prior to incarnation.

Demographics such as age, race and gender

As individuals age, they tend to be less healthy and so utilize healthcare services more frequently. Males and females have different healthcare requirements in terms of sexual and reproductive health. Health status also differs by race and ethnicity, for example, the Centers for Disease Control and Prevention (CDC) Office of Minority Health and Health Disparities reports that blacks are also more likely to die from heart disease and strokes than other racial groups, and American Indians and Alaska natives have a higher prevalence of diabetes compared to other racial groups (CDC Office of Minority Health and Health Disparities website). The inmate population is disproportionately minority, male, aging and increasingly female, which will affect healthcare utilization and cost patterns.

Socioeconomic variables such as income, education and occupation

In the non-incarcerated population, education and low socioeconomic status have both been associated with poorer health outcomes (Sorlie, Backlund & Keller, 1995). Only 59 percent of inmates have a high school diploma or equivalent and only one third were working in the month before their current arrest (Harlow, 2003). In 1997, 17 percent of all inmates were unemployed on admission to prison, compared to only 4.9 percent of the national population (Harlow, 2003). In the United States, “70 percent of private health insurance is purchased through the workplace” (Feldstein, 2007, pg 73). Individuals who are uninsured have lower than average incomes (Gruber, 2004). These factors are likely to have an effect on healthcare utilization and costs.

Health beliefs and individual preferences

Demand for healthcare is affected by an individual’s health beliefs and preferences. Health beliefs and preferences will influence when an individual seeks treatment, from whom and for what. It will also influence how compliant an individual will be with the prescribed therapeutic regimen. Individuals who believe in the general

efficacy of healthcare will have a higher willingness to pay than those who distrust the healthcare system (Phelps, 2003).

Inmates cannot be forced to receive health care unless refusal constitutes a threat to the general inmate population (Washington v Harper, 1990; Parker & Paine, 1999). In an environment where almost all personal decision-making has been curtailed, some inmates may exercise their right to choose not to comply with medical treatment, for example, not taking the psychotropic medications prescribed for mental illness. This may be problematic for departments of corrections for two reasons: 1) inmates with untreated mental illness are potentially dangerous to themselves and others, and 2) psychotropic medications are expensive and medications offered but not taken result in substantial waste.

An inmate may have incentives to demand healthcare not only because he/she is ill, but also for a variety of other reasons that may not be as relevant for the non-incarcerated population. These reasons may include:

- prescriptions for psychotropic medications
- getting out of work duties
- getting out of physical activity requirement
- special diets
- preferential bed and dorm assignments
- transf to healthcare facilities outside the prison
- transfer to other prisons
- contact with health care providers who may treat them differently than they are treated by correctional officers.

Anecdotal evidence suggests that even before sentencing, inmates may use their health status to attempt to alter the sentencing outcomes. Examples include:

- refusing to take psychotropic medications that would render them psychologically fit to stand trial
- entering pleas of insanity or claiming amnesia to reduce sentencing

- becoming pregnant for females in the hopes that this would sway the jury toward leniency.

Time costs involved in seeking healthcare

For a non-incarcerated individual, time is a scarce commodity. Seeking healthcare involves time spent to travel to the healthcare provider, waiting time, provider contact time and finally time spent complying with the treatment regimen. This is time that might otherwise be spent working or in more pleasurable pursuits. The opportunity cost of seeking healthcare is thus the foregone opportunities of engaging in some other pursuit. For an incarcerated individual, time is about the only thing they have in abundance. Their opportunity costs are thus substantially different.

As mentioned previously, the desire to be healthy results in a derived demand for health care services. The following chapter will examine previous research on relevant factors that affect the utilization and cost of healthcare services in the non-incarcerated population. Data regarding the health status and what little is known of the healthcare utilization of the incarcerated population will be presented in Chapter Four.

Chapter 3 - Factors Affecting Healthcare Utilization in the Non-incarcerated Population

Prior to examining selected factors that affect the utilization and cost of healthcare services it is appropriate to mention that, unlike in manufacturing processes which can be standardized to a high degree of accuracy, the complexities of the provision of healthcare have resulted in considerable variation, not only within the United States, but also in other developed countries, even when controlling for observable differences such as socio-demographic, health status and socioeconomic variables (Saleh, Hannan & Ting, 2005; Berwick, 2003; McGlynn et al, 2003; Young, Klap, Sherbourne & Wells, 2001; Legoretta, Christian-Herman, Hasan, Evans & Leung, 2000; Clark, Fradkin, Hiss, Lorenz, Vinicar & Warren-Boulton, 2000). For example, despite the existence of comprehensive evidence based chronic care management guidelines for a number of chronic conditions that affect millions of people, such as diabetes, asthma, congestive heart failure and depression the use of these standards varies greatly (Rundall et al, 2002; Kirkman, Williams, Caffrey & Marrero, 2002; Schoepflin & Thrailkill, 1999). In fact, health care quality falls far short of its potential nationally (Kerr, McGlynn, Adams, Keeseey & Asch, 2004).

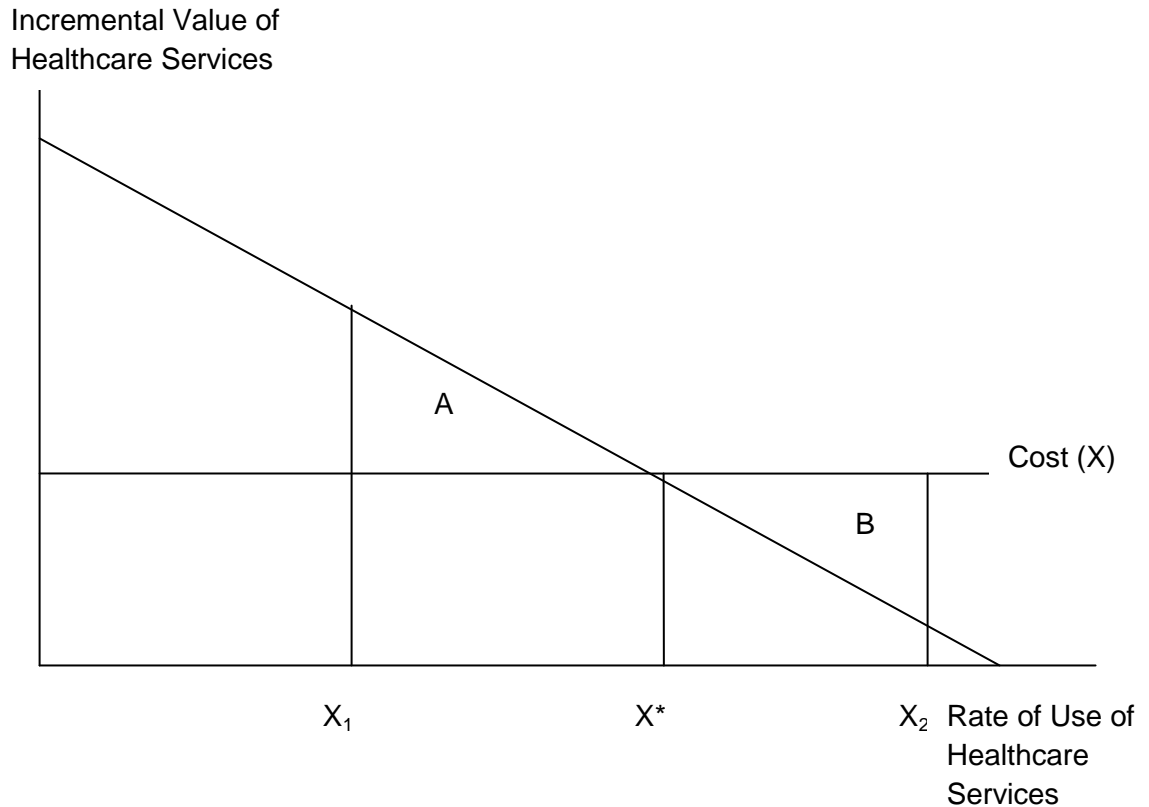
Variations in the Provision of Healthcare

Variations in the provision of medical care are usually reported by economists in terms of a coefficient of variation (COV). A low COV implies strong medical agreement about the way to use a specific medical procedure, while a high COV implies considerable disagreement (Phelps, 2003). Differences in individual provider “styles” can result in differences in the consumption of medical care by patients. Variation in the provision of care can affect the quality of care offered in three ways - by overuse (the unnecessary use of a service), under use (the failure to provide a needed service), misuse (missed or delayed diagnoses) or variation in the provision of health care services. Greater consistency in the provision of effective care can result in improvements to quality of care provided, which in turn can result in improved patient outcomes and more effective utilization of resources (Phelps, 2003).

The unnecessary use of a service can be the result of the practice of “defensive medicine” to avoid litigation, an over-reliance on hospital and specialist care or an inadequate infrastructure to support the management of chronically ill patients (Dartmouth Atlas Project Topic Brief, 2005). A large number of studies conducted by the

RAND Corporation in the 1990's indicate that significant proportions, estimated to be around one third or more, of all procedures that are performed in the United States are of questionable benefit. (RAND, 1998) Overuse of care represents unnecessary risk to patients and an inefficient use of health care resources. The underutilization of effective care can include discontinuity of care and health care delivery systems that inadequately support clinical decision making at the point of care. The Dartmouth Atlas Project Topic Brief of 2005 reported that in 2001, fewer than half of Medicare enrollees with diabetes received annual eye exams, and between 30 percent and 90 percent of Medicare enrollees did not receive annual blood screening tests, both of which are predictors of future complications. Under use of care represents a foregone opportunity to improve the health care of individuals. Misuse of care often arises when the values and preferences of the patients are not considered by health care providers, or when health care delivery systems are not effectively utilized in diagnosis and treatment. In economic terms, variations in the use of medical care result in the loss of welfare to society as a whole. For example, Phelps (2003) suggests that the annual welfare loss from variations in the use of coronary bypass surgery is \$0.75 billion. Welfare losses resulting from variations in the use of medical care are illustrated and explained in Figure 2 on the following page.

Figure 3-1: Welfare Losses to Society Resulting from Variations in the Use of Medical Care



Source: Phelps, 2003.

X^* represents the average rate of use of a particular procedure between 2 locations

X_1 represents underutilization of the procedure in one location

X_2 represents over utilization of the procedure in another location

Triangle A represents the welfare loss arising from underutilization

Triangle B represents the welfare loss arising from over utilization

Only variations in judgment by providers at locations X_1 and X_2 lead to differences in the rate of provision of the particular procedure. In location X_1 where the procedure is underutilized, patients would be willing to pay more for the procedure than it costs to produce. The loss they suffer is represented by triangle A. Consumers in location X_2 spend more on each unit of care above X^* than it is worth to them, represented by triangle B. Variations in care can be the result of taxes, subsidies, supply restrictions or imperfect information. Information asymmetry exists because providers are more knowledgeable about medical treatment than patients, and patients may not share all

relevant health related information with their providers. If patients were fully informed and behaved optimally, they would set their consumption at the point where marginal value equals marginal cost in other words, at point X*. Phelps estimates that the annual welfare losses due to medical practice variations caused by imperfect information alone may amount to billions of dollars and suggests that investment in careful studies to assess the outcomes of medical and surgical interventions could yield substantial returns (Phelps, 2003).

Even in areas such as the management of diabetes, where generally accepted clinical treatment guidelines exist, a number of large, well conducted studies have indicated that deficits in adherence to recommended processes for basic care exist and that these deficits pose serious threats to the health of the American public. A study by McGlynn et al. (2003) of over 6,000 individuals drawn from 12 metropolitan areas in the United States found that only 54.9 percent of the study sample received the recommended quality of medical care across a broad spectrum of medical services including alcohol dependence, asthma, breast cancer, cerebrovascular disease, colorectal cancer, congestive heart failure, coronary artery disease, diabetes, headache, hip fracture, hyperlipidemia, hypertension, acute lower back pain, preventive services and sexually transmitted diseases. An analysis of data from the 2001 Behavioral Risk Factor Surveillance System revealed substantial variation in awareness of medical conditions, the prevalence of health behaviors, and the use of preventive services at the state level, and at the individual level along demographic lines (Ahluwalia, Mack, Murphy, Mokdad & Bales, 2003).

It is possible that using standardized treatment protocols for chronic conditions such as those that are embedded in the electronic health record used by the Kentucky Department of Corrections may reduce variation in the provision of care.

Having established that healthcare is variable and complex, the following section will present information on healthcare utilization patterns and costs in the non-incarcerated population. A discussion of the few studies that have been conducted in the incarcerated population will be presented in the following chapter.

Healthcare Utilization: Patterns and Costs

In a 2003 report published by the National Center for Health Statistics, it was suggested that an examination of healthcare utilization may be useful “as the basis for

projecting future health care needs, to forecast future health care expenditures, or as the basis for projecting increased personnel training or supply initiatives.” (Bernstein, Hing, Moss, Allen, Siller & Tiggler, 2003, pg 1). This report states that “on average, 72 percent of Americans visit an office-based setting for ambulatory care 6.5 times during a year” (pg 24). Studies have been conducted and reported in the academic literature regarding factors that affect healthcare utilization and cost. A substantial number of these studies discuss the effect of having insurance on both healthcare utilization and cost. Although an important determinant, health insurance will not be the focus of attention for this research because of the constitutional mandate that requires Departments of Corrections to provide the appropriate quantity and quality of healthcare that will 1) prevent death, 2) prevent disease and 3) prevent permanent disability. A review of some of the factors that are likely to affect healthcare utilization by inmates is presented below.

Studies in the Non-Incarcerated Population of Factors that affect Healthcare Cost and Utilization

Demographic Factors

Age: Increasing age has been associated with increasing healthcare utilization and cost. The National Center for Health Statistics reports that in 2000 individuals aged over 64 years of age had significantly more visits per population for both physician office visits and outpatient department visits (Bernstein, Hing, Moss, Allen, Siller & Tiggler, 2003). A study of the last years of life of a 0.1 percent sample of Medicare beneficiaries found that variation in end of life healthcare utilization was affected more by age than by gender (Bird, Shugarman & Lynn, 2002). In a study of 201 medical patients of a Midwestern primary care clinic Elhai, Voorhees, Ford, Min and Frueh (2009) found increasing age was one of the factors associated with greater mental health treatment utilization. Other factors included greater depression severity, perceived need for treatment and lower income. Increasing age was associated with increased healthcare costs in a study of 443 at-risk drinkers from six South-eastern states (Nietert, French, Kirchner & Xiaotong, 2004). A study by Taylor, Larson and Correa-de-Araujo (2006) found that almost one third of older women who report being in fair or poor health spent 10 percent or more of their income on health.

Race: A considerable volume of published research documents persistent disparities in access to healthcare services that exists along racial and ethnic grounds. The National

Center for Health Statistics reports that in 2000, white individuals had about a 48 percent higher rate of office based physician visits than black people, but black people had a much higher rate of utilization of hospital outpatient department visits (Bernstein, Hing, Moss, Allen, Siller & Tiggler, 2003). A two year study of Medicare beneficiaries conducted in 1997 and 1998 studied 21 quality of care indicators for four minority groups (African Americans, American Indian/Alaska Natives, Asian/Pacific Islanders and Hispanics) and a group of individuals who were enrolled in both Medicare and Medicaid. Each group was compared with the national average of all Medicare enrollees who had data on the particular quality indicators relevant to the study (Hebb, Fitzgerald & Weihong, 2003). The quality of care indicators included utilization of primary and secondary prevention health services and treatment outcome measures for acute myocardial infarction, congestive heart failure, stroke and pneumonia. The study found that overall, almost three quarters of the quality indicators for the disadvantaged groups of interest were below the national average. Disparities in care were found particularly in the outpatient setting with 87 percent of the indicators for the disadvantaged groups being below the national average. Two thirds of the inpatient indicators were below the national average for the disadvantaged groups when compared to the national average. By population group, Hispanics appeared to exhibit the greatest disparity with 95 percent of the quality of care indicators being below the national average. For African Americans, three quarters of the indicators were below the national average, for Asian and Pacific Islanders, 52 percent of the indicators were below average and for American Indians/Alaska Natives, 43 percent of the indicators were below the national average. In a study of disparities in the referral of elderly patients for coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PCTA) and hip or joint replacement over the period 1997 to 2001, Basu and Mobley (2008) found evidence of increasing disparities for African Americans relative to whites in lower utilization of CABG and PTCA and increasing disparities for other races relative to whites in lower utilization of hip or joint replacement. The authors note that this is despite focused efforts of the Department of Health and Human Services to reduce racial and ethnic disparities over this period. A study of over 5,000 individuals enrolled in a diabetes disease management program of a managed care organization found that, despite preventive services being universally available to members, compared to whites, blacks and Hispanics had lower utilization of six out of eight preventive services during the period June 2003 to June 2004 (Welch et al, 2006). A study of women's healthcare

utilization and expenditures in 2000 found that, compared to white women, black and Hispanic women had lower utilization of preventive health services and ambulatory care visits. Compared to black women, white and Hispanic women were found to pay more out-of-pocket for healthcare services (Taylor, Larson & Correa-de-Araujo, 2006). A study of over 3,500 Medicare beneficiaries conducted in 2003 and 2004 found that compared to whites, African Americans were significantly less likely to report positive attitudes toward influenza vaccination (Lindley, Wortley, Winston & Bardenheier, 2006), which may account for the finding that only half the African Americans surveyed had received an influenza vaccination in the past year, compared to 79 percent of whites even after controlling for demographic and healthcare utilization variables.

Gender: Numerous studies have reported that women have higher health care utilization and costs than men. A study of 590 new patients who were randomly assigned to different primary care physicians at a university medical center found that women had higher physician visits and diagnostic tests than men (Bertakis, Azari, Helms, Callahan & Robbins, 2000). Compared to the men in the study, women were also found to have lower levels of education and income and poorer self-reported health status. Total care, primary care and specialty care costs, and costs of emergency treatment and diagnostic services were all higher for these women than men, even after controlling for socio-demographic factors, health status and clinic assignment. A study of 21,277 diabetic patients found that despite having significantly fewer visits to physicians, and fewer tests of urine, lipids and creatinine compared to women, men had better health outcomes, as measured by lower LDL cholesterol, triglycerides and HbA1c results (Shalev, Chodick, Heymann & Kokia, 2005). Being female was associated with increased healthcare utilization and costs in a study of 443 at-risk drinkers from six South-eastern states (Nietert, French, Kirchner & Xiaotong, 2004). In a study that used pooled data from the 1996-2000 Medical Expenditure Panel Survey to examine the effects of rurality and gender on the mental health treatment of over 32,000 individuals, rural men were found to receive less mental health treatment than rural women (Hauenstein, Petterson, Merwin, Rovnyak, Heise & Wagner, 2006). A 22 year longitudinal prospective study reported by Green and Pope (1999) examined possible underlying causes of increased healthcare utilization by females. Female gender was positively associated with greater healthcare utilization over the 22 year period, even after controlling for self-reported health status, mental and physical symptoms, health knowledge, illness behaviors and health concerns. Attitudinal and behavioral factors

measured at baseline were still found to be predictive of healthcare utilization at the end of the study period, 22 years later. Health knowledge was not found to be predictive of healthcare utilization. There are a number of studies, however, that indicate that the effect of gender on utilization varies with the type of healthcare service. For example, a study of over 4 million individuals utilizing the Veterans Health Administration system found that women had 1.3 percent more outpatient encounters, 10.9 percent fewer inpatient stays and 2.8 percent lower total cost of care than men after adjusting for age and medical and mental health conditions (Frayne et al., 2007). Another study using data from the 1998-2000 Health and Retirement Study found that after controlling for socio-demographic, health status and socioeconomic differences, female Medicare beneficiaries had 17 percent reduced odds of utilizing hospital services and 15 percent reduced odds of utilizing outpatient surgery, but 27 percent increased odds of utilizing home health care and 45 percent increased odds of utilizing physician services (Song, Chang, Manheim & Dunlop, 2006).

Education: Education may have an effect on healthcare utilization through the pathway of health literacy. Paasche-Orlow and Wolf (2007) have suggested a causal pathway linking health literacy and health outcomes. In this model, health literacy has been suggested to have an effect on access and utilization of healthcare services, patient-provider relationships and self-care. Paasche-Orlow and Wolf also suggest that reduced health literacy may be associated with delay in seeking care, feelings of shame, negative attitudes regarding providers and poorer treatment outcomes. All of these factors may reduce utilization of healthcare services. In an empirical examination of 317 patients with chronic heart failure, the results of hierarchical linear regression analyses found that less education and lower cognitive ability were both associated with reduced health literacy, after controlling for health status and demographic variables (Morrow, et al. 2006). A study of over 1,000 individuals from Canada, all with a diagnosis of diabetes, found that after controlling for various socio-demographic, socioeconomic and health status variables, higher levels of education were statistically significantly linked to increased utilization of ophthalmologic testing, and to having a specialist healthcare provider (as opposed to a family doctor) be their most responsible provider of care (Alguwaihes & Shah, 2009). Education was also associated with self-care, specifically, smokers were less educated, and individuals who followed a meal plan were more educated.

Marital Status: Compared to married individuals, individuals who have never been married, or are widowed or divorced, have been found to have higher morbidity and mortality (Johnson, Backlund, Sorlie, Loveless, 2000). Data on almost 300,000 individuals aged 45 years and older from the National Longitudinal Mortality Study were used in Cox proportional hazard models to examine marital status and mortality. Non-married individuals had statistically significantly increased relative risk of mortality compared to married individuals for both genders and white and black race groups, after controlling for various socioeconomic factors. A study from the Netherlands that used data from the Longitudinal Study on Socio-Economic Differences in the Utilization of Health Services to examine marital status and healthcare utilization found that being married as opposed to being widowed or divorced is associated with less healthcare utilization, although this association was mediated by level of education and health status (Joung, Van der Meer & Mackenbach, 1995).

Health Status Factors

Diabetes Mellitus: Having a diagnosis of diabetes has been associated with increased healthcare utilization and cost. The National Centre for Health Statistics indicates that in 2.6 percent of all office-based physician visits, the primary diagnosis was diabetes (CDC, Diabetes Faststats, 2009). Diabetes was the primary diagnosis in 0.6 percent of outpatient department visits and 1.7 percent of short-stay hospital visits. Although these percentages seem small, an examination of the economic cost of diabetes helps to put the burden of this growing epidemic in proportion. According to the American Diabetes Association (ADA), "The total annual economic cost of diabetes in 2007 was estimated to be \$174 billion" (ADA, 2009). This estimate includes direct expenditure on diabetes care (\$27 billion), diabetes related complications (\$58 billion) and excess general medical expenditure (\$31 billion). Additionally, \$58 billion in indirect costs are due to absenteeism, reduced productivity, employment-related disability, and premature mortality. The ADA suggests that \$1 of every \$5 that is spent on healthcare is attributable to diabetes and that individuals with diabetes spent almost 2½ times as much on healthcare compared to individuals without diabetes. A study by Laditka, Mastanduno and Laditka (2001) suggests that Type 1 diabetics have higher healthcare utilization rates and incur greater costs than individuals with Type 2 diabetes. The economic costs presented do not take into account additional costs such as the burden of disease to patients and caregivers. A number of studies show that improved glycemic control is associated with reductions in both the utilization and cost of healthcare

services by individuals with diabetes (Wagner, Sandhu, Newton, McCulloch & Ramsey, Grothaus, 2001; Menzin, Langley-Hawthorne, Friedman, Boulanger & Cavanaugh, 2001). Factors associated with increased healthcare utilization and expenditure among individuals with diabetes include abdominal fat, a BMI greater than 28, high cholesterol, hypertension, coronary heart disease and stroke (Fox & Grandy, 2008).

Hypertension: Having a diagnosis of hypertension has been associated with increased healthcare utilization and cost. According to the National Health Statistics Report, 2008, essential hypertension was the primary diagnosis of four percent of all visits to physician's offices (CDC, Hypertension Faststats, 2009). This is second only to routine infant or child health checks. Essential hypertension was responsible for 3.8 percent of all outpatient department visits. Essential hypertension is the primary diagnosis in 0.84 percent of all hospital stays. Estimates of the national cost of hypertension vary slightly. Using an epidemiologic approach and various sources of data, Hodgson and Cai (2001) estimated the direct cost of hypertension treatment in 1998 to be \$22.8 billion. Using an economic modeling approach and data from the Medical Expenditure Panel Survey (MEPS), Balu and Thomas (2006) estimated the total incremental annual direct expenditures in 2001 to be \$54.0 billion, after controlling for socio-demographic factors and health status variables. They also estimate that for individuals with hypertension, the average incremental annual direct expenditure per person is \$1,131. This is less than an estimate by Trogdon, Finkelstein, Nwaise & Tangka, (2007) who used the MEPS data from 2000-2003 to arrive at an attributable annual amount per individual with hypertension of \$1,598. In a study of 1,000 hypertensive patients from New Mexico that was conducted in 1996 and 1997, Paramore, et al. (2001) found that as blood pressure increased, so too did healthcare utilization and cost. Ruilope, et al (2008) reviewed a number of studies that suggested that better medication compliance could improve health outcomes and reduce healthcare cost and utilization for hypertensive patients. They suggested that fixed-dose combinations, which are a combination of drugs in one tablet, could improve medication adherence through reduced pill burden.

Hyperlipidemia: Having a diagnosis of hyperlipidemia is a risk factor for heart disease, which may result in poorer health status and increased healthcare utilization and expenditure. A study by Natarajan and Nietert (2004) of over 15,000 individuals used the 1996 Medical Expenditure Panel Survey to study the effect of a combination of hypertension, diabetes and hypercholesterolemia on healthcare utilization and health

status. They found that individuals with more than one of the above three chronic conditions (comorbidities) had poorer health status, which resulted in increased healthcare utilization for various services. For individuals with hypercholesterolemia, having additional comorbidities was associated with an increased likelihood of emergency room visits and hospitalizations. For individuals with hypertension, having additional comorbidities was associated with an increased likelihood of hospitalizations and outpatient visits, and for individuals with diabetes, having additional comorbidities was associated with an increased likelihood of outpatient visits. Overall, diabetes had the largest effect on both health status and healthcare utilization. As in the case of diabetes and hypertension, non-adherence to medication has been associated with increased healthcare utilization and cost for individuals with hypercholesterolemia. A study by Sung, Nichol, Venturini, Bailey, McCombs & Cody (1998) found that medication adherence is negatively affected by being female, having comorbidities, feeling healthy and having to take more pills (pill burden).

Mental illness: Mental illness has been associated with increased healthcare utilization, not only for mental health services, but also for medical services. A study of 2,440 adults using the Medical Expenditure Panel Survey found that individuals with obesity, physical illness (asthma, diabetes, heart disease, hypertension, or osteoarthritis) and mental illness (affective disorders, personality disorders and schizophrenia) were more likely to use emergency services and have higher healthcare costs (\$9,897 vs. \$6,584) than individuals with obesity and physical illness without mental illness (Shen, Sambamoorthi, & Rust, 2008). Depression has been linked to the incidence of coronary heart disease. In a four year prospective study of 1,302 individuals drawn from the 1995 Nova Scotia Health Survey, a one standard deviation in the Center for Epidemiological Studies-Depression scale was associated with 1.32 times the risk of coronary heart disease, after controlling for other coronary heart disease risk factors such as age, gender, body mass index, physical activity level, family history of premature coronary heart disease, diastolic blood pressure, lipids, smoking, alcohol use, diabetes, and education level (Rowan, Haas, Campbell, Maclean & Davidson, 2005). A one year prospective study of over 10,000 health maintenance organization enrollees found an association between depression and anxiety and increased general medical care utilization and cost, after controlling for age, gender, race, medical conditions and smoking (Hunkeler, Spector, Fireman, Rice & Weisner, 2003). Individuals who were not depressed or anxious had mean costs for general medical care of \$1,948, compared to

\$3,006 for individuals who were depressed and anxious. Anxiety and depression were also associated with functional impairment and individuals who were depressed, anxious and functionally impaired were more likely to be admitted to hospital and utilize emergency room services. Kreyenbuhl, Medoff, Seliger and Dixon (2008) used 2001-2003 Medicaid data to study the cardiovascular disease medication management provided to a sample of individuals who had both psychotic disorders and Type 2 diabetes. More frequent contact with the mental health system and having a substance abuse disorder were both associated with reduced use of cardiovascular disease medication. More frequent outpatient visits for diabetes and being female were both associated with increased use of cardiovascular disease medication. A study using National Comorbidity Survey-Replication data found that individuals with depression used more mental health services and antidepressants and that both mental health costs and general medical costs were higher for depressed individuals than individuals who were not depressed. Healthcare utilization and costs increased with increasing clinical severity of depression from mild to moderate and severe (Birnbaum, et al. 2009). The findings of a study of almost 1,000 veterans indicated that veterans who had post traumatic stress disorder were found to utilize more mental *and* physical health care services compared to veterans without post traumatic stress disorder (Calhoun, Bosworth, Grambow, Dudley & Beckham, 2002). A study by Wagner, et al., found that individuals with psychiatric disorders had statistically significantly more emergency room treatment and overnight hospital stays than individuals without psychiatric disorders, after controlling for various demographic and health status variables (Wagner, Pietrzak & Petry, 2008).

Substance abuse: Although it would seem that individuals with a diagnosis of substance abuse would utilize more healthcare services, there is some evidence that this is not the case (Nietert, French, Kirchner & Booth, 2007; Leukefeld, et al., 2006; Narevic, et al., 2006). The studies by Leukefeld et al. and Narevic et al. are discussed in Chapter 4. Nietert, French, Kirchner and Booth (2007) examined non mental health and substance abuse healthcare utilization of a sample of 443 at-risk drinkers from the South-east. Contrary to expectation the multivariate analysis they conducted revealed that users of mental health or substance abuse services did not incur greater overall costs for non mental health or substance abuse services than individuals who do not use mental health or substance abuse services. In fact, the authors found emergency department costs were significantly lower among mental health and substance abuse service users

(Nietert, French, Kirchner and Booth, 2007). In another study, the medical care for a group of 29,122 individuals receiving treatment for alcoholism was categorized as alcohol specific, alcohol acute, alcohol chronic and non alcohol related (Kane, Wall, Potthoff & McAlpine, 2004). The effect of alcohol treatment on medical healthcare utilization differed by category. Non alcohol related and alcohol acute medical use declined in the year post treatment. Alcohol specific medical utilization was high during alcoholism treatment. All three categories declined in the period beyond the first year post treatment (peri-treatment). Alcohol chronic medical utilization increased in the year post alcoholism treatment and did not decrease in the following period. “The largest effect of alcoholism treatment is seen for medical encounters associated with diagnoses that reflect the acute effects of intoxication. Such a pattern suggests that treatment may reduce the frequency of intoxicated episodes and therefore related medical care utilization. Encounters related to conditions associated with chronic alcohol misuse were the only type that did not significantly decline 1 year past treatment” (p764).

Health Risk Factors

Evidence from published research that healthy lifestyles are associated with improved health outcomes and reduced healthcare utilization and costs will be presented in the next section. Linear regression analyses of the healthcare costs of a group 1,323 individuals aged between 68 and 95 found that healthy lifestyle behaviors were associated with reduced healthcare costs, after controlling for various socio-demographic factors (Leigh, Hubert & Romano, 2005). Smoking fewer cigarettes over a lifetime and having a lower body mass index were the strongest predictors of decreased healthcare costs with daily walking also a factor associated with lower healthcare costs.

Body Mass Index: Increasing body mass index (BMI) is a risk factor for diabetes, heart disease and certain cancers and is associated with increasing healthcare utilization and costs. The United States component of a multinational prospective cohort control study that examined characteristics, health status and healthcare utilization and cost for overweight individuals found that, on average, as BMI increased, so too did comorbidities (hypertension, diabetes and sleep apnea) and metabolic risk factors (Wolf et al., 2008). Compared to the control group who had average healthcare costs of \$456, individuals who were overweight had average healthcare costs of \$1084 and individuals who were obese had average healthcare costs of \$1,186.

Physical Activity: Physical activity has been associated with reduced healthcare cost and utilization. A study of 1,114 individuals aged 65 and older found that compared to individuals who did not participate in a community exercise program, those who did participate incurred almost 6 percent less annual total healthcare costs (Ackermann, Cheadle, Sandhu, Madsen, Wagner & LoGerfo, 2003). For those participants who exercised more than once a week, healthcare costs decreased by over 20 percent.

Smoking: Smoking is a risk factor for cancer and heart disease and has been associated with increased healthcare utilization and cost. Contrary to what one might expect, a study of over 1,200 Veterans found that current smokers and current alcohol users utilized medical health services less frequently than individuals who reported never smoking or drinking (Borzecki, Lee, Kalman & Kazis, 2005). The authors cite various articles that present mixed findings regarding the association between tobacco, alcohol use and healthcare utilization and suggest that further research be conducted into moderating factors such as age, gender and overall health status. No association was detected between health behaviors and mental healthcare utilization or hospital stays. The authors conclude that their study supports an association between poor health behaviors and reduced health-related quality of life, but not with higher healthcare utilization.

Non-adherence to medication: Non-adherence to prescribed medication has been associated with increased healthcare utilization and costs. A retrospective analysis of pharmacy and medical claims for patients with either diabetes or diabetes and cardiovascular disease who were enrolled in a managed care program for the period April 1998 to March 2000 found that patients with higher adherence to oral anti-hyperglycemic medication had statistically significantly fewer hospitalizations or emergency room visits and incurred statistically significantly less healthcare expenditures (White, Vanderplas, Chang, Dezii & Abrams, 2004). Specifically, compared to diabetic patients with greater than 95 percent adherence to their anti-hyperglycemic medications, diabetic patients with less than 75 percent adherence had a 31 percent greater chance of hospitalization or emergency room visit, and patients with between 75 percent and 95 percent adherence had a 19 percent greater chance of being hospitalized or having an emergency room visit. The increased healthcare utilization associated with non-adherence was even greater for comorbid individuals with diabetes and cardiovascular disease. For these patients, less than 75 percent

adherence was associated with a 51 percent greater chance of hospitalization or emergency room admission, and adherence of between 75 and 95 percent adherence was associated with a 44 percent greater chance of healthcare utilization, compared with those with greater than 95 percent medication adherence. Adjusted mean total costs for diabetic patients in the 95 percent adherence group were \$4,835, rising to \$5,314 for patients in the 75 to 95 percent adherent group and \$5,706 for patients with less than 75 percent adherence. For the comorbid patients, healthcare costs were considerably higher. Adjusted mean total costs for the comorbid patients in the 95 percent adherence group were \$25,354, rising to \$31,547 for patients in the 75 to 95 percent adherent group and \$37,648 for patients with less than 75 percent adherence. A longitudinal cohort study of 775 Type 2 diabetics aged over 65 who were enrolled in a health maintenance organization also found that increased medication adherence, measured using medication possession ratios, was statistically significantly associated with decreased healthcare cost (Balkrishnan, Rajagopalan, Camacho, Huston, Murray & Anderson, 2003). Specifically, a ten percent increase in the medication possession ratio was associated with lower annual healthcare costs of between 8.6 and 28.9 percent. All articles in a review of academic publications that measured healthcare costs or inpatient days attributable to non-adherence to antipsychotic medications by individuals with a diagnosis of schizophrenia found that non-adherence was associated with an increase in hospitalization rates, length of hospital stays and hospital costs (Sun, Liu, Christensen & Fu, 2007). Data from the articles and from the National Inpatient Sample of Healthcare Cost and Utilization Project were extrapolated to provide national estimates of the increased costs associated with non-adherence to antipsychotic medications for individuals with a diagnosis of schizophrenia. For 2005, it is estimated that this was in the range of \$1,392 million and \$1,826 million.

Since this study sample includes only incarcerated individuals with diabetes, hypertension and/or hyperlipidemia, the following section will briefly highlight the morbidity and mortality burden of these conditions.

The Morbidity and Mortality Burden of Cardiovascular Disease and Diabetes

The financial cost and the high rates of utilization of physician office visits, ambulatory care services and in-patient hospital stays that are associated with diabetes and hypertension have previously been detailed. These diseases also result in

considerable morbidity and mortality, and can result in great burden to both patients and care givers.

Cardiovascular disease

All three of the conditions that are the focus of attention for this research (diabetes, high blood pressure and high blood cholesterol and other lipids) are risk factors for cardiovascular disease. Other risk factors include tobacco use, physical inactivity and being either overweight or obese. According to the American Heart Association (AHA), over one third (36.3%) of the United States population had a cardiovascular disease in 2006. Cardiovascular diseases include coronary heart disease (heart attack and angina pectoris), stroke, high blood pressure, heart failure, peripheral arterial disease and congenital cardiovascular defects. On average, one person dies every 37 seconds in the United States from cardiovascular disease, which accounts for one of every 2.8 deaths in the United States (AHA Heart Disease and Stroke Statistics – 2009 update, AHA). The prevalence of cardiovascular disease is highest among black people (45.9% for both males and females) and is lowest for Mexican-Americans (26.1% for males and 32.5% for females). White males have a higher prevalence of cardiovascular disease (37.7%) than white women (33.3%). Almost half of the 80 million individuals with cardiovascular disease are estimated to be over 60 years of age. Kentucky ranks 46th in the nation for age-adjusted death rate from cardiovascular disease.

Diabetes Mellitus

According to the American Diabetes Association, 23.6 million people or 8 percent of the United States population have diabetes. (ADA, 2009). Type 1 diabetes occurs because the body does not produce insulin and is usually diagnosed in children and young adults. Type 2 diabetes is the more common condition and results from either the body's inability to produce enough insulin or cells non-response to the insulin that is produced. Individuals with a diagnosis of diabetes are at increased risk for complications such as heart disease and stroke, high blood pressure, blindness, kidney disease, nervous system disease, amputations, dental disease, complications of pregnancy and biochemical imbalances. Risk factors for Type 2 diabetes include individuals aged over 45 who have a family history of diabetes, individuals who are overweight and do not exercise regularly, and individuals with low HDL cholesterol or high triglycerides and high blood pressure. Type 1 diabetics require regular medication

with insulin. Type 2 diabetics may also require oral medication, but can also control their condition by means of healthy diet and exercise.

Diabetes mellitus co-morbidities and complications result in much higher death rates among diabetics than the rest of the population (Palumbo, Elveback, Chu, Connolly & Kurland, 1976). Complications resulting from diabetes have serious health implications for individuals, which, in the case of offenders results in serious financial implications for taxpayers. Complications include heart disease and stroke, high blood pressure, blindness, kidney disease, nervous system disease, dental disease, amputations and complications during pregnancy. Tighter control of known insulin-dependent diabetics may prevent complications (Diabetes Control and Complications Trial Research Group, 1993.) A study by Pladevall, Williams, Potts, Divine, Xi and Lafata (2004) found that poor medication adherence resulted in non-adherent patients having both statistically and clinically worse outcomes than adherent patients, even after adjusting for demographic and clinical characteristics.

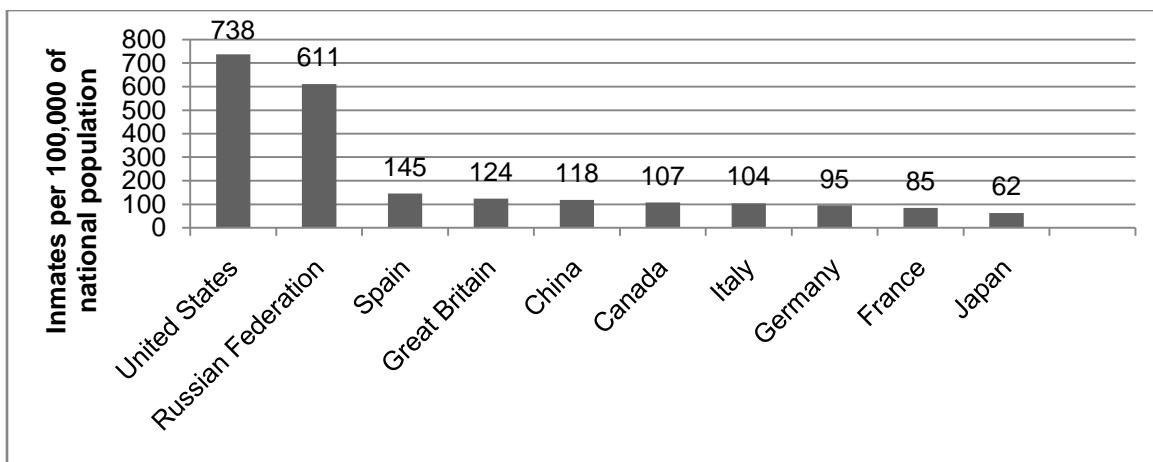
The following chapter will describe the characteristics of prison inmates in the United States, their health status and discuss the few studies that have been conducted to date regarding the healthcare utilization patterns of inmates.

Chapter 4 – Prison Inmates in the United States

Incarceration Rates in the United States

The United States has the highest incarceration rate in the world. The latest available rate of 738 per 100,000 of the national population for the US is almost five and a half times as high as the median rate for Europe, which is 137.5 per 100,000 of the national population (Walmsley, 2007). National incarceration rates in 2006 are illustrated in Figure 3 below.

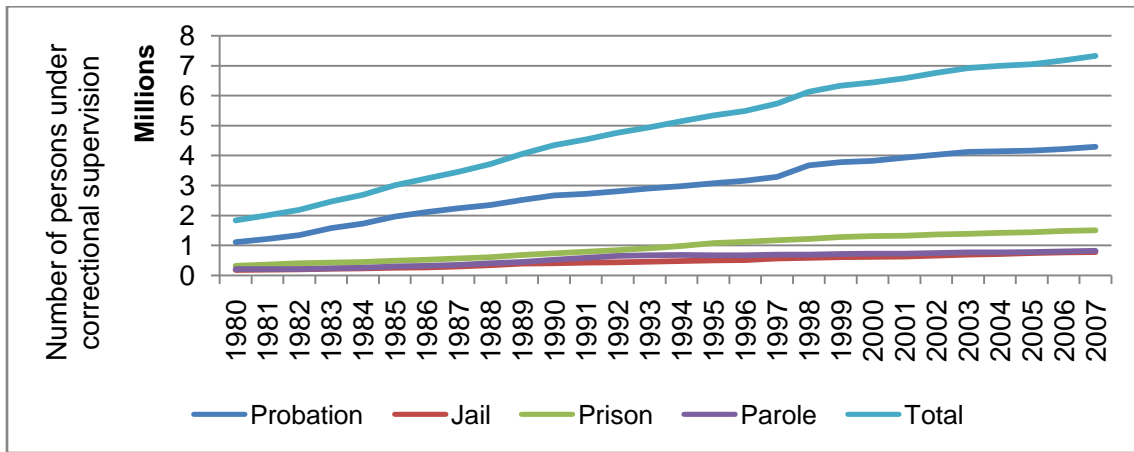
Figure 4-1: Number of Inmates per 100,000 of National Population (2006)



Source: Walmsley, 2007

The adult correctional population (those in jail and prison and those on probation and parole) has increased from 1,842,100 in 1980 to 7,328,200 in 2007 (Bureau of Justice Statistics, 2008). The number of people under correctional supervision in the United States over the period 1980 to 2007 is illustrated in Figure 4 below.

Figure 4-2: Number of persons under correctional supervision in the United States (1980 - 2007)



Source: Bureau of Justice Statistics Correctional Surveys (The National Prisoner Statistics Program, Annual Survey of Jails, Annual Probation Survey, and Annual Parole Survey)

In 2000, 357 of all state and federal prisons were operating under a consent decree or court order, primarily due to overcrowding. In 75 of these cases, the cause was inadequate medical treatment and in 91 cases the cause was to inadequate mental health treatment (Stephan & Karberg, 2003). In 2000, the number of privately operated prisons operating under a consent decree or court was 33, nine of which was due to inadequate medical facilities and five due to inadequate mental health treatment. The Human Rights World Report for 2006 highlights a number of areas of concern regarding the treatment of incarcerated individuals in the United States, which include the inadequate provision of programs and services necessitated by insufficient government funding. The report states, “Across the country, medical and mental health care in prisons ranges from mediocre to terrible” (p 508). Perhaps the most extreme example of the dysfunction of the corrections system can be found in the California Department of Corrections and Rehabilitation which was placed in receivership in 2005 after investigations revealed that each week, one inmate died due to neglect or medical incompetence (California Prison Health Care Services website accessed at <http://www.cprinc.org/about.aspx> on July 2, 2009). One possible explanation for this could be the social construction of inmates in the United States.

The Social Construction of Offenders

The theory of social construction may help explain why conditions in many prisons and jails are poor, and why the situation requires judicial intervention to obtain improvements. Social construction refers to the normative evaluations that society makes in characterizing various segments of the population. These characterizations can affect the policy environment of various groups. Schneider and Ingram suggest that “social constructions influence the policy agenda and the selection of policy tools, as well as the rationales that legitimate policy choices” (Schneider & Ingram, 1993, p334). They categorize target populations using two dimensions – social construction and power. Groups they suggest are positively constructed and powerful (the advantaged) include the elderly, business, veterans and scientists. Groups they suggest are negatively constructed and powerful (the contenders) are big unions, minorities, the rich and cultural elites. Groups they suggest are positively constructed but have weak power (the dependents) includes children, mothers and the disabled. The group they call deviants has a negative social construction and weak power and includes criminals, drug addicts, communists and gangs. Schneider and Ingram suggest that deviants have no control over the political agenda, and have undersubscribed benefits and oversubscribed burdens and policy tools are likely to be punitive rather than rehabilitative in nature. (Schneider & Ingram, 1995). As noted above, this appears to be the case for prison inmates.

A Profile of Prison and Jail Inmates in the United States

The following statistics are presented in the Bureau of Justice Statistics (BJS) 2006 and 2007 mid-year reports on prison inmates (Sabol & Couture, 2008; Sabol, Minton & Harrison, 2007). Prison and jail inmates are predominantly male (92.8%), although the rate of incarceration of females has been increasing in recent years. In 2007 the female inmate population increased by 2.5 percent, as compared to the male inmate population which increased by 1.5 percent. Inmates are also disproportionately from minority racial groups. Black males comprise 35.4 percent of all incarcerated males, followed by white males (32.9%) and Hispanic males (17.9%). Compared to the estimated number of black, white and Hispanic males resident in the United States, black males are six times more likely to be incarcerated than white males, and Hispanic males are just over twice as likely to be incarcerated as white males. Black females are

incarcerated at a rate four times as high as white females and twice the rate of Hispanic women.

The Financial Costs of Incarcerating Prison and Jail Inmates in the United States

The latest national figures available from the Bureau of Justice Statistics are now somewhat dated and can be found in a special report entitled “State Prison Expenditure, 2001” (Stephan, 2004). These figures indicate that from 1986 to 2001 state prison expenditures increased 150 percent from \$11.7 billion to \$29.5 billion. According to this report “At an average annual increase of 6.2 percent for total State correctional spending and 6.4 percent specifically for prisons, increases in the cost of adult incarceration outpaced those of health care (5.8%), education (4.2%), and natural resources (3.3%).” (Stephan, 2004, p 2). The 2001 BJS special report on State Prison Expenditures indicates that spending on medical care for state prisoners totaled \$3.3 billion, or 12 percent of operating expenditures (Stephan, 2004). The report contrasts the average annual inmate medical expenditure of \$2,625 per inmate with the average annual health care expenditure of U.S. residents, including all sources in FY 2001, which was \$4,370, or \$11.97 per day. (U.S. Department of Health and Human Services, National Center for Health Statistics, citing Centers for Medicare and Medicaid Services in Health, United States, 2003, table 116).

Health Status of Prison and Jail Inmates in the United States

It is noteworthy that the only population group that has a constitutional right to health care in the United States is prison and jail inmates. This is due to the Supreme Court ruling in the case of *Estelle vs. Gamble* (1976), which finds that inadequate medical treatment constitutes cruel and unusual punishment, a violation of the Eighth Amendment. In general, inmates are sicker than the non-incarcerated population, as will be outlined below. A number of factors may contribute to this, including high-risk health behaviors, lack of access to continuous medical care, and low socioeconomic status prior to incarceration. The following section provides more details regarding the health status of jail and prison inmates in the United States.

Physical Health

In a year-long study of the disease profile of over 170,000 inmates incarcerated in the Texas Department of Criminal Justice system, Baillargeon, Black, Pulvino & Dunn (2000) found infectious diseases were the most prevalent condition, affecting 30 percent of the population. Other prevalent conditions included diseases of the musculoskeletal

system and connective tissue (15.3%), diseases of the circulatory system (14%), mental disorders (11%) and diseases of the respiratory system (6%). Two thirds of the 15 most prevalent conditions were chronic diseases, with two mental disorders and three infectious diseases making up the remaining one third. Prevalence of conditions varied by age, race and gender. For example, more females than males had more than one medical condition; Hispanics had lower overall disease rates than blacks or whites; whites had the fewest positive tuberculin skin tests but were much more likely to have affective disorders than blacks or Hispanics; and older inmates had higher disease prevalence rates than younger inmates. An analysis of the cause of death of inmates who died while incarcerated at a large jail in Chicago over a ten year period (1995 to 2004) found that heart disease was the most common cause of death, followed by cerebro-vascular disease and suicide (Kim, 2007). Compared to the non-incarcerated population, mortality rates for jail inmates were higher for heart diseases, infectious conditions and suicide. Whites were more likely to commit suicide than either blacks or Hispanics and females were more likely to die of drug overdose or withdrawal than males. A study by Fickenscher, Lapidus, Silk-Walker and Becker (2001) found high prevalence of self-reported health risk factors in a sample of incarcerated women including a history of intravenous drug use, a history of sexual and drug abuse, and of trading sex for money. A 2002 report to Congress on the health status of soon-to-be-released inmates compiled by the National Commission on Correctional Health Care (NCCHC, 2002) found that inmates have a higher prevalence of communicable disease than the non-incarcerated population. These diseases include sexually transmitted diseases (STDs), human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), hepatitis B and C, and tuberculosis (TB) (NCCHC, 2002). Inmates also have higher rates of chronic diseases, mental health and substance abuse problems than the non-incarcerated population (NCCHC, 2002). According to the most recent information available from the Bureau of Justice Statistics, an estimated 44 percent of state inmates and 39 percent of federal inmates reported a current medical problem other than a cold or virus (Maruschak, 2008). Arthritis and hypertension were the two most commonly reported medical problems. The percentages of state and federal inmates who reported a medical problem, a dental problem, or having had surgery since admission increased with age. Female inmates in both state and federal prisons were more likely to report having a current medical problem than male inmates (Maruschak, 2008). Based on an analysis of the 2004 Survey of Inmates in State and Federal

Correctional Facilities, Wilper and colleagues (2009) found that after age standardization to the 2000 US census, the prevalence of selected chronic conditions was higher for state prison inmates than for the non-incarcerated population. A comparison of the prevalence of selected chronic conditions between state prison inmates and the US population adapted from this analysis is presented in Table 1.

Table 4-1: A Comparison of the Prevalence of Selected Medical Conditions in the United States Population and the State Prison Population

Condition	State Inmates % (S.E)	US Population % (S.E)
Diabetes Mellitus	10.1 (2.0)	6.5 (0.5)
Hypertension	30.8 (1.5)	25.6 (1.0)
Prior myocardial infarction	5.7 (2.8)	3.0 (0.3)
Persistent asthma	9.8 (1.4)	7.5 (0.6)
HIV	1.7 (1.8)	0.5 (0.1)

(Adapted from Wilper et al, American Journal of Public Health, 2009, Table 2)

Regarding dental health, a sample of 174 inmates from the Iowa Medical Classification Centre had 8.4 times the amount of tooth decay, but similar numbers of missing teeth compared to the non-incarcerated population (Boyer, Nielsen-Thompson & Hill, 2002). A study of 191 inmates incarcerated at Leavenworth Penitentiary in Kansas showed that the prevalence of decayed, missing or filled teeth increased as inmates aged and that there was variation by racial group (Mixson, Eplee, Feil, Jones & Rico, 1990).

Mental Health

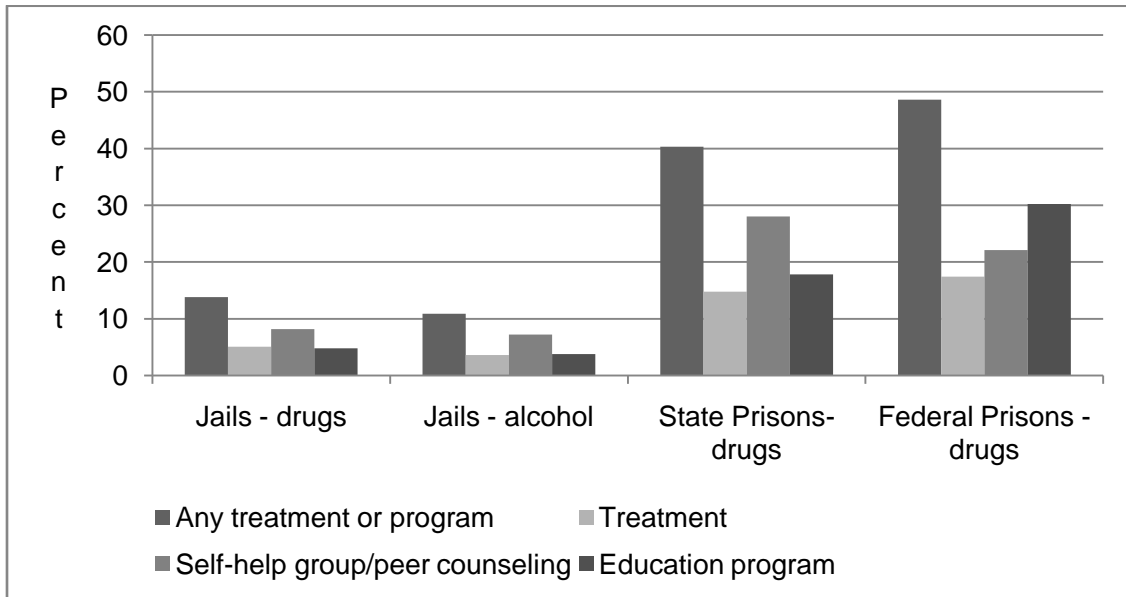
The following information comes from a Bureau of Justice Statistics Special Report “Mental Health Problems of Prison and Jail Inmates” prepared in 2008 by BJS statisticians James & Glaze. In 2002, local jail inmates and in 2004, state and federal prisoners were interviewed about their mental health in the preceding year. Over half reported a history of mental illness (either a clinical diagnosis or treatment by a mental health professional) or symptoms of a mental illness (based on criteria specified in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition). Female prison inmates reported higher rates of mental health problems (73%) than male prison inmates (55%). Three quarters of the state prison and local jail inmates who reported mental health problems also had co-occurring substance dependence or abuse. When compared to inmates without mental health problems, inmates with mental health problems were more likely to have been homeless in the year prior to their arrest, were

more likely to have been either physically or sexually abused in the past and were more likely to have lived in foster care when growing up. State prisoners with a history of mental health problems were more likely to have a violent criminal record and longer sentences than those without a history of mental health problems. They were also more likely to be injured in a fight while incarcerated and be charged with rule violations. About one third of state prisoners and about one sixth of jail inmates reported receiving treatment for mental health problems since admission (James & Glaze, 2008).

Substance Abuse

Statistics regarding drug use and dependence among state and federal prisoners are available from the Bureau of Justice Statistics for 2004 (Mumola & Karberg, 2006). In 2004, 83.2 percent of state prisoners report ever having used any type of drug, with almost 70 percent reporting regular use and almost one third reporting use at the time of committing the offense. The figures for Federal prisoners are similar with 78.7 percent reporting ever having used any type of drug, over two thirds reporting regular use of drugs and over one quarter reporting the use of drugs at the time the offense was committed. In 2004, inmates held for drug law violations comprised 21 percent of state inmates and 55 percent of federal inmates. Although it is the youngest inmates who report the highest drug use in the month before the offense, the largest increase in prior drug use was among middle-aged inmates. There was also a sharp increase in reported prior drug use among female federal inmates. “Drug dependent or abusing inmates were more likely than other inmates to report troubled personal backgrounds, including experiences of physical or sexual abuse, homelessness, unemployment, parental substance abuse and parental incarceration” (Mumola & Karberg, 2006, p. 8). For jail inmates, the Bureau of Justice Statistics prepared a special report on substance dependence, abuse and treatment using data from 2002 (Karberg & James, 2005). Over two thirds of jail inmates (68%) reported symptoms of substance dependence or abuse in the year prior to incarceration, and over half of jail inmates committed their offense while under the influence of drugs or alcohol (Karberg & James, 2005). Considering the extent of the problem of substance dependence and abuse in US jails and prisons, the percentage of inmates receiving treatment or access to other programs appears inadequate. Figure 5 illustrates the percentage of inmates meeting substance abuse dependence or abuse criteria who participated in treatment or other programs since being incarcerated.

Figure 4-3: Percentage of Inmates Meeting Substance Dependence or Abuse Criteria who Participated in Treatment or Other Programs since Admission



Source: Jail data: Karberg & James, 2005; prison data: Mumola & Karberg, 2006

Aging Prison Inmates

“Prisoners are defined as “geriatric” at age 55, because they develop disability and comorbid conditions earlier than persons in the general U.S. population” (Williams, Lindquist, Sudore, Strupp, Willmott & Walter, 2006). The prison population is aging - prisoners aged 50 years and older increased to 7.9 percent of the overall prison population in 2001 compared to 5.7 percent in 1992 (Shimkus, 2004). Between 1992 and 2001, the number of federal and state prison inmates aged 50 years and older increased 172.6 percent, from 41,586 to 113,358 (Anno, Graham, Lawrence & Shansky, 2004). Aging prison inmates are associated with increasing medical expenditure as they, like the non-incarcerated population, have greater medical needs, including more chronic and terminal conditions. Institutional challenges noted in a report prepared by the National Institute of Corrections on the needs of elderly, chronically ill, and terminally ill inmates include providing (in a cost contained manner) special housing, services and management for elderly inmates. Additional challenges include ensuring the health and safety of elderly inmates and providing appropriate training to correctional staff. The report notes that challenges facing elderly inmates include vulnerability to abuse and predation, difficulty in establishing social relationships with younger inmates and the

need for special physical accommodations and programs (Anno, Graham, Lawrence & Shansky, 2004).

Causes of Death

A comparison of the top ten leading causes of death among the incarcerated and non-incarcerated population reveals that for both population groups, the top two leading causes of death are heart disease and cancer, as illustrated in Table 2. Other leading causes of death shared by both population groups but ranked differently include stroke, chronic lower respiratory diseases, influenza/pneumonia, septicemia, suicide and liver disease. Liver disease is associated with alcohol abuse, which may explain the considerably higher ranking of this cause of death in the inmate population, compared to the non-incarcerated population. Accidents, diabetes and Alzheimer's and kidney disease are leading causes of death in the non-incarcerated population, but not in the incarcerated population, probably attributable to a younger incarcerated population that leads a relatively more sheltered life in terms of accident related injuries. AIDS and digestive diseases are leading causes of death in the incarcerated population, but not in the non-incarcerated population. The high number of deaths from AIDS among the inmate population is likely due to intravenous drug use and other high risk behaviors.

Table 4-2: A Comparison of Causes of Death in the Non-Incarcerated and Incarcerated Population

Condition	Rank for Non-incarcerated Population	Attributable deaths (%)	Rank for Incarcerated Population	Attributable deaths (%)
Heart Disease	1	26.6%	1	27%
Cancer	2	22.8%	2	23%
Stroke	3	5.9%	7	3%
Respiratory diseases	4	5.3%	6	4%
Accidents	5	4.8%	-	-
Diabetes	6	3.1%	-	-
Alzheimer's	7	2.9%	-	-
Influenza/pneumonia	8	2.6%	9	2%
Nephritis	9	1.8%	-	-
Septicemia	10	1.4%	8	2%
Suicide	11	1.3%	5	6%
Liver disease	12	1.1%	3	10%
AIDS	-	-	4	7%
Digestive diseases	-	-	10	2%

Source: For the non-incarcerated: <http://www.cdc.gov/nchs/FASTATS/lcod.htm> accessed on April 26 2009, for the incarcerated: Mumola, 2007.

Studies of Healthcare Utilization in the Incarcerated Population

In general, state Departments of Corrections provide a level of care commensurate with that provided to the community (Kinsella, 2004). Although there may be some variation in the type of healthcare services provided by different states the following services are usually provided: chronic care clinics, preventive screenings, annual physicals, hospice services, special units for the elderly and the disabled and early release for elderly or terminally ill inmates who are not viewed as a threat to the community. (Reviere & Young, 2004). Efforts to contain rising inmate healthcare expenditure have included the use of telemedicine, privatization of health care services and disease prevention programs (Kinsella, 2004).

There are limited published studies of utilization of healthcare services by prison inmates in the United States. A few studies examine utilization once an inmate has returned to the community or prior to incarceration (Baillargeon et al., 2009; Leukefeld et al., 2006; Harzke, Ross & Scott, 2006; Staton, Leukefeld & Logan, 2001). Baillargeon et al. (2009) found that less than one third of 2,115 inmates who were receiving antiretroviral therapy (ART) for Acquired Immune Deficiency Syndrome while incarcerated had filled a prescription for ART within 60 days of release which poses a public health threat. Leukefeld et al. (2006) found that health status was the strongest predictor of high cost health services in the year following release and that older inmates had more health problems at baseline, which resulted in greater healthcare utilization. This study did not find any association between race and healthcare utilization. An unexpected finding was that substance abuse was not statistically significantly associated with the utilization of high cost health services in the year following release. Possible reasons for this anomaly provided by the authors include increasing age, parole supervision and a short follow-up period. Harzke, Ross and Scott (2006) interviewed 60 inmates one month after release to determine factors associated with use of primary care services in the month following release. Variables associated with primary care utilization included having adequate and consistent housing, taking ART at the time of release and the avoidance of alcohol use. The finding of interest in a small focus group qualitative study of 34 female inmates by Staton, Leukefeld and Logan (2001) was that, when not incarcerated, women often chose not to use available community based medical or mental health services if they were actively abusing drugs or alcohol.

A few studies have focused particularly on the healthcare utilization of inmates with mental illness and substance abuse (Staton-Tindall, Duvall, Leukefeld & Oser, 2007; Narevic et al., 2006; Hiller, Webster, Garrity, Leukefeld, Narevic & Staton 2005; Leukefeld et al., 2002; Walker, Staton & Leukefeld, 2001; Warner & Leukefeld, 2001). In the study by Hiller, Webster, Garrity, Leukefeld, Narevic and Staton (2005), inmates with a diagnosis of either substance abuse or mental illness, or both were compared to inmates with no such diagnosis. Over the course of their lifetimes, inmates with a diagnosis of substance abuse were found to have had more emergency room visits and hospitalizations compared to inmates with no substance abuse problems. Inmates with mental illness were found to have had greater emergency room visits and hospitalizations compared to inmates with no mental illness problems and inmates with substance abuse, and inmates with co-occurring mental illness and substance abuse had the highest rate of utilization. Narevic et al. (2006) studied 661 inmates with a diagnosis of chronic substance abuse in 1998 and 1999 and found that drug use, being white, better educated and having poorer mental and physical health status, were all associated with greater unmet health service needs. Leukefeld et al. (2002) described the health status and healthcare utilization of a sample of male inmates with a diagnosis of substance abuse, some of whom were also HIV positive. The study found that, compared to inmates who were HIV negative, inmates who were HIV positive received more mental health treatment. HIV status was not associated with the use of medical services, psychiatric and medical hospitalizations, emergency room visits, outpatient visits or substance abuse treatment. In the study of 591 substance abusing inmates by Walker, Staton and Leukefeld (2001), having multiple head injuries was associated with more emergency room visits and hospitalizations compared to inmates with no head injuries. In the study by Warner and Leukefeld (2001), prior to incarceration, chronic drug abusing inmates from rural areas were less likely to have sought substance abuse treatment than substance abusing inmates from urban areas. A study of the utilization of healthcare services of 100 women from rural and urban locations found that more urban than rural women report utilizing community based health services, particularly behavioral health services such as mental health and substance abuse services, prior to incarceration. This study suggests that, "rural women who reported using needed community services before prison also reported fewer health problems in prison." (Staton-Tindall, Duvall, Leukefeld & Oser, 2007, p. 183).

The earliest empirical study of the utilization of health services by an inmate population seems to be that of Twaddle in 1976. Twaddle (1976) describes the characteristics of a sample of 300 inmates who made sick call visits to a prison hospital during the month of September 1972. Although these visits were to a hospital, they are comparable to physician office visits by the non-incarcerated population, and not inpatient stays. Twaddle used the one month utilization data from the sample to estimate annual utilization rates of healthcare services for the national incarcerated population, which he then compared to annual national healthcare utilization in the non incarcerated population. The estimates were adjusted for organizational features that might be expected to increase inmate utilization that would not be relevant in the non-incarcerated population. These features included utilization of medical services for the administration of prescribed psychotropic medications or daily injectable medications, malingering and administrative requirements such as the purchase of civilian shoes. After these adjustments, Twaddle estimated that inmate healthcare utilization is at least double that of the non incarcerated population. The only statistics presented in the paper were proportions of the variables of interest, specifically, demographic, sentence, security classification, work assignment, time served and health status characteristics. No statistical analysis was reported. Contrary to what might be expected given the review of studies in the non incarcerated presented above, Twaddle found that more prison sick call visits were associated with black race, younger age (although the sample contained few older inmates) and being married. Little association was found between prison hospital sick call visits and type of crime and length of sentence. Inmates sentenced for sexual assault and those with longer sentences had slightly higher utilization, while inmates sentenced for forgery or drug related crimes had less utilization. Increasing security level was associated with increased sick call visits. Twaddle found that in the first year of incarceration, inmates had more frequent sick call visits. Poorer health status was associated with more sick call visits. Suggested explanations for higher utilization patterns include inadequate utilization of needed health care services prior to incarceration, high rates of infectious diseases, within prison violence, stress and “social” reasons such as the need to feel cared for, the desire to meet other inmates, attempts to obtain medications and work excuse release. Inadequate prison health records seriously hampered this study. A later study by Paris (1994) supports the finding of over utilization of healthcare services by inmates. In this small study, sick call utilization patterns were examined at one correctional institution in Florida in the early

1990s. Results indicate that of the 122 physician clinic visits that occurred, only about one third were judged medically necessary by the physicians, with the remainder being due to malingering on the part of the inmates, or in order to comply with institutional systems requirements

In 1987, Sheps, Schechter and Prefontaine published a study of 7,449 healthcare encounters made by inmates at six regional Canadian correctional facilities during the month of June 1984. As in the study by Twaddle, only frequencies and descriptive statistics of institutions and encounters are provided with no statistical analysis. The paper by Sheps, Schechter and Prefontaine does not describe any demographic characteristics of the inmate population. The average number of physician visits per inmate was 6.7, which was 2.4 times higher than for non-incarcerated Canadian males. Over half of these visits were for new illnesses and just less than a third were for chronic conditions, the remainder being for injury, psychosocial and administrative reasons. The three most common complaints were headache (41%), sore throat (11%) and stomach complaint (9%). About one quarter of all encounters were made by only 3.5 percent of inmates.

A more comprehensive study by Lindquist and Lindquist (1999) used data gathered from interviews of a sample of 198 male and female jail inmates between the winters of 1995 and 1996. The data were analyzed using stepwise multiple regression techniques to examine the association between gender, race, age, marital status, employment status, educational attainment, prior incarcerations and duration of incarceration on three outcome variables: 1) physical health status measured as self reported health status (excellent, good, fair, poor) and self-reported physical health problems (the sum of 20 common physical complaints) 2) a count of the use of health care services 3) evaluation of perceived accessibility of medical care (very difficult, acceptable, very easy) and perceived quality of care (poor, acceptable, excellent). Regarding healthcare utilization, the authors calculate the average rate of healthcare utilization to be 0.6 visits per week and found that a few inmates account for a disproportionately large amount of utilization. Being female and older and having more self reported physical health complaints were statistically significantly associated with greater healthcare utilization.

In a study by Clark, Grossman, White, Goldenson and Tulsy (2006) of the chronic care provided to 424 diabetic inmates incarcerated at the San Francisco County

Jail in 2003, compliance with immediate-term care guidelines such as finger-stick glucose and blood pressure checks at intake were high (95 and 97 percent respectively), but longer term process measures such as HbA1c and lipid panel measurements were less frequently performed (40 and 36 percent respectively). Compliance with care guidelines was not found to vary with an inmate's age, race or gender.

A recent article published in the American Journal of Public Health uses data from the 2002 Survey of Inmates in Local Jails and the 2004 Survey of Inmates in State and Federal Prisons to assess the health status of inmates and their access to healthcare in jails and state and federal prisons nationwide (Wilper et al, 2009). This study used self reported data provided by 14,499 inmates selected from 287 state prisons and 39 federal prisons. The study found that access to healthcare for jail inmates is generally not good. Sixty-eight percent of jail inmates with persistent medical problems, defined as pregnancy, diabetes, asthma, hypertension, problems with the heart or kidneys, stroke or brain injury, paralysis, cancer, cirrhosis, arthritis, hepatitis or a sexually transmitted disease had received no medical care since incarceration. Over one third (36.5%) of jail inmates who had an active medical problem, defined as hypertension, stroke, diabetes, heart problem, kidney disease, arthritis, asthma, hepatitis, cirrhosis and HIV/AIDS who were on prescribed medication at the time of their incarceration were not continued on the same medication during their incarceration. Forty-one percent of jail inmates on any prescription medication at the time of their incarceration were not continued on medication during their incarceration. Sixty percent of jail inmates who had an active medical problem that usually involves having a blood test, had no blood test performed since incarceration. One quarter of inmates who had a serious injury, defined as knife or gun shoot wounds, broken bones, sexual assault, internal injuries and being knocked unconscious were not examined after the serious injury. Although not suggested by the authors, it is possible that the high turnover of jail inmates who generally serve much shorter sentences than prison inmates could be a contributing factor to the lack of access to healthcare by this particular group of incarcerated individuals. The statistics for state prisons are better than for jails, and federal prisons are better than state prisons. The percentage of inmates with a persistent medical problem who were not examined by medical personnel during their incarceration was 20 percent in state prisons and 14 percent in federal prisons. The percentage of inmates with active medical problems who were not continued on the same medication they were taking at the time of incarceration was 24 percent for state prisoners and 21

percent for federal prisoners. The percentage of inmates who were not continued on any prescription drugs they were taking at the time of incarceration was 29 percent for state prisoners and 26 percent for federal prisoners. The percentage of inmates with a problem that usually requires blood testing who did not receive a blood test was 6 percent for state prisoners and 4 percent for federal inmates. The percentage of inmates who were not examined after a serious injury was 12 percent in state prisons and eight percent in federal prisons. The picture regarding medication for the treatment of mental illness is the reverse of that painted above. The analysis suggests that many more inmates were taking prescribed medication for mental illness during incarceration than were on medication at the time of their arrest (jail inmates: at time of arrest 39% vs 46% after arrest; state prison inmates 30% at time of arrest vs. 69% after arrest; federal prison inmates 26% at time of arrest vs. 69% after arrest).

Potential Organizational Reasons for Differences in Healthcare Utilization Between the Non-Incarcerated and the Incarcerated Population

In addition to the differences in demand for healthcare services between inmates and non-inmates that may exist and are noted in Chapter Two, it is likely that institutional differences that are a direct consequence of incarceration will affect healthcare utilization patterns. For example, when an inmate is first incarcerated, a thorough mental and physical health assessment is conducted. Inmates require medical authorization for special diets and work and bed assignments. Visits to providers are scheduled through sick call notes, following which the inmates are seen first by a non-provider who triages the inmate as deemed appropriate. Medication administration is documented in the inmates' charts, as are instances of refusal of treatment or non-compliance with treatment. The health status of inmates in segregation is regularly monitored and documented. Considerable medical administrative documentation is required when inmates are transferred between facilities and when they are released to the community. Much of this additional utilization might be expected to be reflected in more frequent encounters with non-providers.

Challenges Faced by Correctional Healthcare Providers

Correctional healthcare providers face many obstacles. Inmates often enter the system with high rates of substance abuse, mental illness, reproductive problems and chronic illness. Many inmates have high risk health behaviors and are non-compliant with medication and treatment. In addition, some inmates may manipulate the system

and so are not honest about their symptoms and degree of pain or discomfort. Finding a balance between the custody mentality and the care mentality may be especially difficult for healthcare providers. Institutional barriers include tight budget constraints which may result in inadequate provision of healthcare and other programs and services, shortages of appropriately trained and credentialed staff, and limited access to modern healthcare equipment and health information technology. Continuity of care may be disrupted when inmates are seen by outside providers, or are transferred to other facilities, particularly in the absence of an electronic health record system. Institutional rules and bureaucracy may also hamper the provision of quality care, and in particular may make organizational change for improvement difficult to implement and sustain.

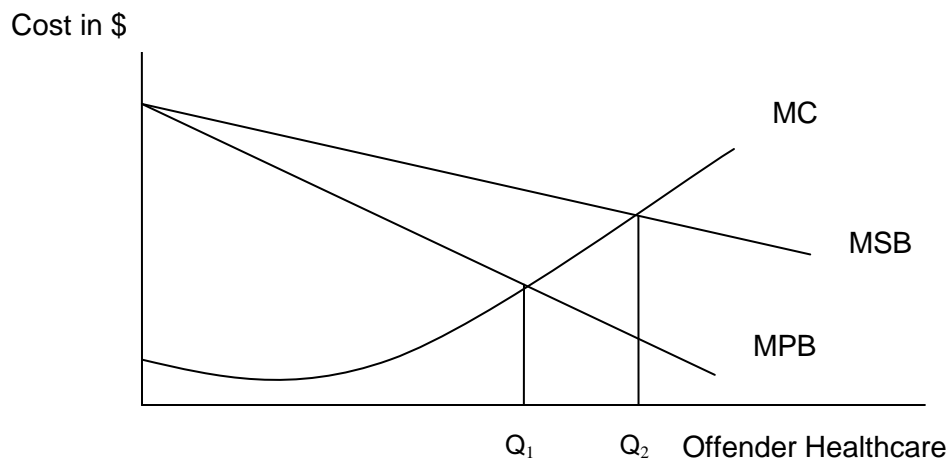
Externalities and Marginal Benefits of Providing Healthcare to Inmates

Having established the many potential reasons why demand for and utilization of healthcare services is likely to be different for the inmate population when compared to the non-incarcerated population, it is appropriate to recall why this issue is important. In the United States, the growing and aging inmate population is going to increasingly require additional healthcare services, which in turn, will further burden state budgets. Apart from the constitutionally mandated requirement to provide an appropriate quality and quantity of healthcare to inmates, the provision of healthcare may make more than altruistic sense as will be explained below.

Although health is a private good in that the benefit of good health accrues to the individual, there are two aspects which can be considered “public goods” in the economic sense: 1) the prevention of the spread of infectious diseases and 2) the improvement of the economic productivity of communities and nations (Smith, Beaglehole, Woodward and Drager, 2003) and these aspects will be discussed further after a very brief explanation of the theory of public goods. A public good is one that is non-rival and non-excludable. Paul Samuelson (1954) defined a non-rival good as one “which all enjoy in common in the sense that each individual’s consumption of such a good leads to no subtractions from any other individual’s consumption of that good”. He further suggests that in the case of a public good it is impossible to exclude any individuals from its consumption, which is the concept of non-excludability. The provision of public goods can give rise to externalities. An externality is a cost or benefit that parties external to the transaction incur or receive. Goods that have a positive externality are often underprovided because only private benefits and not social benefits

are taken into consideration. The classic healthcare example is that of vaccinations. When individuals consider only the benefit to themselves of being vaccinated against infectious diseases, they may choose not to receive the vaccination, because they do not take into account the additional benefit that would accrue to the community by preventing the spread of infectious disease. The social benefit of infectious disease control is greater than the private benefit individuals receive. Providing offenders with healthcare could result in substantial benefits, not only to the individuals, but also to society. The fact that these positive externalities are not considered when allocating state budgetary resources may lead to an under provision of healthcare to offenders. There is thus a non-Pareto-optimal allocation of resources. This is illustrated in Figure 6.

Figure 4-4: The Undersupply of Inmate Healthcare



MPB = marginal private benefit, MSB = marginal social benefit, MC = marginal cost

Q1 = amount of healthcare provided if only the benefits to the offender are considered

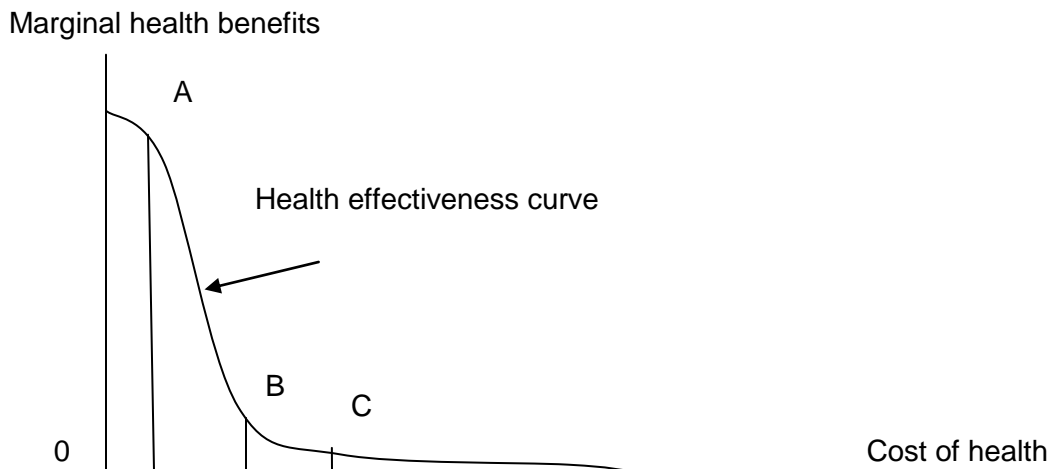
Q2 = amount of healthcare provided if the benefits to both the offender and society are considered

There are two positive benefits of providing appropriate treatment to inmates while incarcerated which may be overlooked – resulting in the under-provision of inmate healthcare services. Firstly, large numbers of closely confined inmates with mental illness and communicable diseases may pose a public health risk for the 2.2 million incarcerated inmates and the approximately 750,000 staff who work in the corrections environment (Gibbons & Katzenbach, 2006). Secondly, almost 95 percent of inmates will be released to their communities, many of which are under-resourced in terms of healthcare service capacity. Releasing inmates with mental illness and high rates of

communicable diseases can potentially pose a health and safety risk for the general population, as well as increase the financial burden to state and local governments. Healthier inmates may be more likely to gain and retain meaningful employment.

Because inmates are, on average, less healthy than the non-incarcerated population, it is possible that the marginal benefit of providing healthcare to inmates will outweigh the costs. An earlier section of this paper noted the problem of moral hazard that induces over-utilization of healthcare services. This overutilization of healthcare has led to what has been called “flat of the curve” medicine. This is illustrated in Figure 7.

Figure 4-5: "Flat of the Curve" Medicine



Source: Gruber J, 2004

The health care provided at point A yields considerable marginal benefit relative to the cost of that care. At point C, however, the cost of healthcare outweighs the marginal health benefits. For inmates it is possible that appropriate healthcare provided while incarcerated will fall somewhere between point A and B – in which case the marginal benefit, both to the individual inmates and to society will outweigh the costs.

In order for correctional healthcare administrators and policy makers to fulfill their mandates of providing appropriate cost-effective care it is necessary to have a thorough understanding of the utilization patterns of the incarcerated, and of the factors that are associated with both within facility and secondary care healthcare utilization. The empirical research conducted for this dissertation will shed light on this important topic.

The data to be analyzed in this research is gathered from 12 state-operated prisons located across the Commonwealth of Kentucky. Observable differences across these facilities include physical size and layout, number of inmates, security classification, medical staffing patterns and inmate to total staff and medical staff ratios, all of which may result in variations of care provided. There may be other less obvious inter-facility differences that affect inmate utilization of within facility and secondary care. There are, however, two features of the Kentucky corrections environment that may limit variation in the provision of healthcare. Firstly, the organizational structure of prisons in general is mechanistic - rule based with standard operating procedures and a requirement for extensive record keeping; as well as hierarchical, with an authoritarian-based chain of command, defined spheres of competence and the requirement for specialized training for employees (Burns & Stalker, 1961). Healthcare providers within the KyDOC have standardized institutional guidelines which govern inmate healthcare. Secondly, implementation of an electronic health record in June 2005 to July 2006 may help in standardizing healthcare procedures. The electronic health record provides clinical decision-making support at the point of care through the use of embedded evidence-based medical diagnostic and treatment guidelines. Prior to implementing the electronic health record system, the nurse service administrators from all the facilities participated in multiple workshops to revise work processes, agreeing on a best practice approach which was then used in the electronic health record templates and forms. Benefits of an electronic health record system which may facilitate standardization of processes at all facilities across the state include improved chart availability, better organization of medical records, increased legibility, improved timeliness and accuracy of messages among system-wide providers and with outside providers and patients. Problem specific templates with embedded prompts can be used to remind clinicians to ask about particular symptoms, order particular test and prescriptions, perform preventive or disease management activities and flag abnormal test results. It is anticipated that differences between facility will be observable in the within facility utilization by inmates. It is anticipated, however, that there will be less observable variation in secondary care utilization, on the premise that only truly sick inmates will get sent outside for care, and that this will override any between facility differences.

The few studies that have been published to date regarding inmate healthcare utilization do not provide much information on which to base hypotheses regarding the effect of sentencing variables on within facility and secondary healthcare utilization. It is

possible that inmates who have committed crimes of a violent or a sexual nature may require greater utilization of mental healthcare services if such crimes were committed during periods of mental instability, or because of chronic mental disorders. Length of sentence is correlated with degree of severity of crime, and it is possible that individuals sentenced for longer periods may have a higher prevalence of mental illness, and thus have more mental healthcare utilization. In the longer term, longer time incarcerated will result in cumulatively greater healthcare costs and utilization as inmates age. A longer time consistently incarcerated prior to the study start date (January 1 2007) may be associated with less medical healthcare utilization due to the more controlled living environment which limits unhealthy behaviors, facilitates access to preventive healthcare and provides opportunities for healthy nutritional choices and regular exercise. Repeat offenders who have previously had access to prison based healthcare could be healthier and therefore have less healthcare utilization. On the other hand periods of non-incarceration may result in less access to care and high risk health behaviors, in which case the inmates may have greater healthcare needs.

It is anticipated that this study will shed light on the important, but previously under-researched area of healthcare utilization of prison inmates. The next chapter will introduce the Kentucky setting that will be the focus of the research in this dissertation.

Chapter 5 – The Kentucky Setting

MISSION of the Kentucky Department of Corrections

To protect the citizens of the Commonwealth and to provide a safe, secure and humane environment for staff and offenders in carrying out the mandates of the legislative and judicial processes; and, to provide opportunities for offenders to acquire skills which facilitate non-criminal behavior^a.

Overview of Prisons Operated by the Kentucky Department of Corrections

In Kentucky 13 state-operated prisons house approximately 12,000 inmates. There is one state-operated prison for women – the Kentucky Correctional Institution for Women – and one maximum security state-operated prison – the Kentucky State Penitentiary. Table 3 lists the Kentucky state-operated prisons and shows the number of inmates, the gender of inmates housed at each facility and the security level.

Table 5-1: State Prisons operated by the Kentucky Department of Corrections (2007)

Facility	Number of Inmates	Gender	Security Level
Bell County Forestry Camp	274	Male	Minimum
Blackburn Correctional Complex	588	Male	Minimum
Eastern Kentucky Correctional Complex	1703	Male	Medium
Frankfort Career Development Center	201	Male	Minimum
Green River Correctional Complex	965	Male	Medium/minimum
Kentucky Correctional Institution for Women	709	Female	Medium
Kentucky State Penitentiary	853	Male	*Maximum/Death Row
Kentucky State Reformatory	1953	Male	Medium
#Little Sandy Correctional Complex	979	Male	Medium/minimum
Luther Lockett Correctional Complex	1032	Male	Medium/minimum
North Point Training Centre	1233	Male	Medium
Roederer Correctional Complex	1016	Male	Medium/minimum
Western Kentucky Correctional Complex	668	Male	Medium/minimum

Little Sandy Correctional Complex was added to the state prisons operated by the KyDOC on July 1, 2007

Source: Jessa & Winter, 2007.

^a Accessed at <http://www.corrections.ky.gov/> on July 11, 2009.

In addition to the state-operated prisons there are three privately operated prisons managed by Corrections Corporation of America which are listed in Table 4.

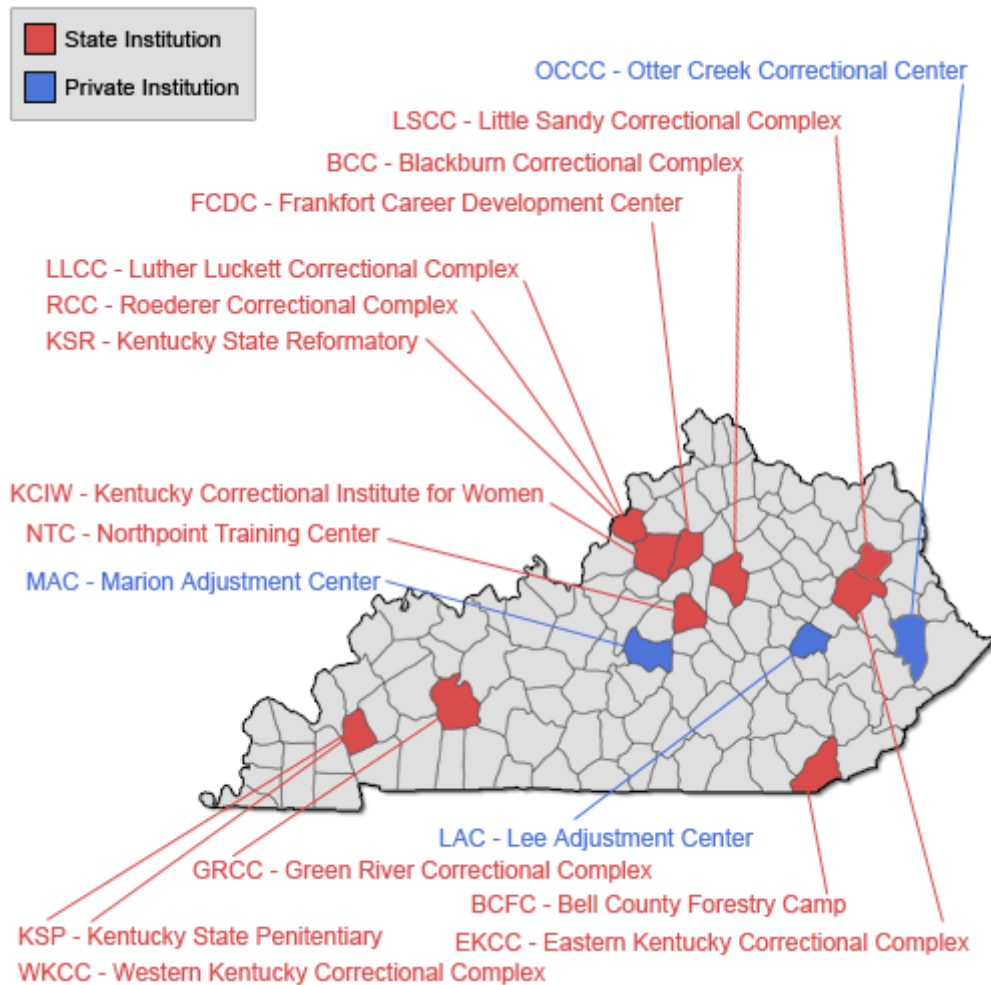
Table 5-2: Privately operated state prisons in Kentucky (2007)

Facility	Number of Inmates	Gender	Security Level
Lee Adjustment Centre	390	Male	Medium
Marion Adjustment Centre	826	Male	Minimum
Otter Creek Correctional Center	656	Female	Medium

Source: Jessa & Winter, 2007.

Figure 8 illustrates the location of the corrections facilities within the state.

Figure 5-1: Map Showing Kentucky State Prison Facilities



Source: Kentucky Department of Corrections Institutions and Facilities accessed at <http://www.corrections.ky.gov/instfac/> on July 4, 2009

Abbreviations of Facility Names

For much of the rest of this dissertation, the facility names will be abbreviated to their initial letters as shown in Table 5:

Table 5-3: Abbreviations of Kentucky State-operated Prison Names

Facility	Abbreviation
Bell County Forestry Camp	BCFC
Blackburn Correctional Complex	BCC
Eastern Kentucky Correctional Complex	EKCC
Frankfort Career Development Center	FCDC
Green River Correctional Complex	GRCC
Kentucky Correctional Institution for Women	KCIW
Kentucky State Penitentiary	KSP
Kentucky State Reformatory	KSR
Little Sandy Correctional Complex	LSCC
Luther Lockett Correctional Complex	LLCC
North Point Training Centre	NTC
Roederer Correctional Complex	RCC
Western Kentucky Correctional Complex	WKCC

Inmate Classification and Assignment Process

The Assessment and Classification Center, located at Roederer Correctional Complex processes all incoming male inmates with the exception of those sentenced to death row. The death row inmates go directly to the Kentucky State Penitentiary, which is the only maximum security prison in Kentucky. All female inmates are processed at the Kentucky Correctional Institution for Women. Each inmate receives extensive physical, dental and mental health screenings which “are intended to identify security, medical, mental health, substance abuse, educational, and cognitive risks” (Jessa & Winter, 2007, p. 8, unpublished report). This process usually takes a number of weeks. Data gathered during the assessment are used to populate an inmate’s electronic health record, ensure continuity of medications and identify inmates with communicable diseases.

The most important consideration in assigning inmates to a particular facility is to match the inmate custody level with the facility security classification. Additional factors that are considered include the available bed space, inmate program needs, inmate work assignments, inmate medical and mental health needs and conflicts between inmates.

Male inmates who require greater medical or mental health treatment are assigned to the Kentucky State Reformatory which is the main prison medical facility in Kentucky. In addition to the 12 dormitories that house just fewer than 2,000 inmates, the Kentucky State Reformatory has a 58-bed nursing care unit and medical service building. It also has a Special Management Unit that can house 130 inmates requiring higher security supervision and a Psychiatric Unit that can house 150 inmates requiring specialized mental health management and treatment.

Kentucky Inmate Characteristics

The latest statistics produced by the Kentucky Department of Corrections are for 2005 indicate that the inmate population is 68 percent white, 31 percent black and 1 percent other (which includes Native Americans, Asians, and Hispanics). By comparison, the Kentucky population is 90 percent white, 7.7 percent black and 2.3 percent other. The population is overwhelmingly male (91 percent). The median age of offenders is 34 and 8 percent of the population are aged 50 years or older.

The types of offenses for which inmates are sentenced include violent (36 percent), drug (25 percent), property (21 percent), sex (11 percent), other (3 percent), weapon (2 percent), and undetermined (2 percent). The median prison sentence is 8 years. The proportion of new commitments was 74 percent, with the remaining 26 percent being return offenders.

Data gathered from electronic health records in August 2006 by KCHSN staff revealed over 3,000 active medical problems listed for 16,756 inmates (Connell & Curd, 2006, unpublished report). Cardiovascular system disorders, including hypertension, vascular/cardiac conditions and stroke, and mental illness topped the list of most frequent disorders.

The Provision of Healthcare to Kentucky State Prison Inmates

A unique public/private partnership, the Kentucky Corrections Health Services Network (KCHSN) was formed in October 2003 for the purposes of achieving greater long-term value in the Kentucky Department of Corrections (KyDOC) medical services. This partnership comprises the University of Kentucky, the Kentucky Department of Corrections and a private healthcare management company, CorrectCare Integrated Health, LLC and performs a function similar to a traditional Health Maintenance Organization. Cost containment and quality improvement have been achieved through

the establishment of a health services network, utilization review and pre-authorization processes and the negotiation of contractual relationships with a variety of health care providers. One of the earliest achievements of the KCHSN was the implementation of a state-wide electronic health record (EHR), DocSynergy by MedUnison, which were fully implemented at all state-operated prisons by June 2006. The rich data that encompasses medical encounters of inmates within the state-operated prisons, as well as details of secondary care will be utilized in this dissertation research.

Kentucky Inmate Incarceration Costs

The figures produced by the Kentucky Department of Corrections for the financial year ending on June 30, 2007, indicate that the average cost of incarceration at the thirteen state operated prisons was \$50.60 per day per inmate, or \$18,470.67 per year per inmate. The maximum cost was incurred at the Kentucky State Reformatory (which houses many of the state's sicker inmates) which, for the financial year ending on June 30, 2007, had a daily inmate cost of \$72.82 and an average annual cost of \$26,578.59. The minimum cost was incurred at Bell County Forestry Camp, which had a daily inmate cost to incarcerate of \$37.56 and an annual cost of \$13,710.94 per inmate.

The total cost of inmate healthcare can be disaggregated into primary care, which is administered within the prisons, and secondary care, which is administered at facilities located outside the prisons. It should be noted that these costs do not include the additional costs of corrections officers escorting inmates on secondary care visits. In FY 2006, the average total medical costs per state inmate were \$3,503, as illustrated in Table 6.

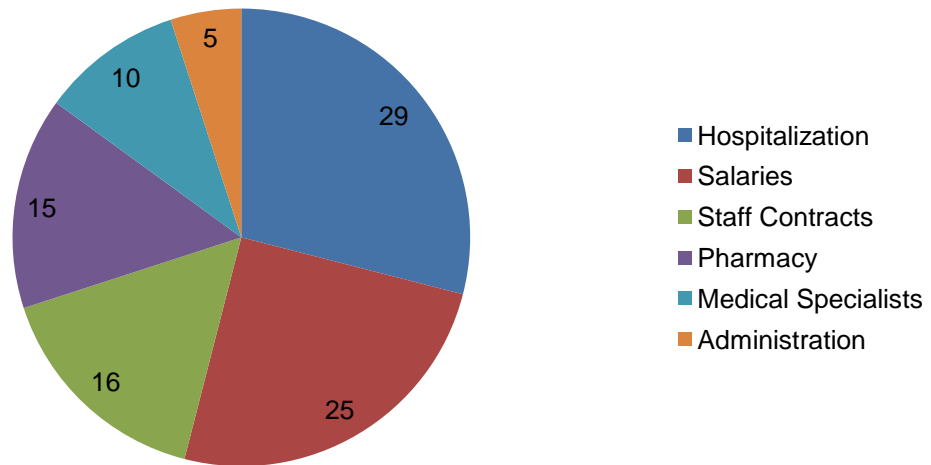
Table 5-4: Primary and Secondary Costs of Medical Care per Inmate (excludes mental health)

Year	Primary Care Costs	Secondary Care Costs	Total Costs	Number of State Inmates	Total Medical Costs per Inmate
2006	\$26,975,908	\$14,508,592	\$41,484,500	11,841	\$3,503.46

Source: Jessa & Winter, 2007.

The allocation of the medical care costs for the fiscal year ending June 30, 2006, is illustrated in Figure 9. Hospitalizations accounted for almost 30 percent of the total adult institutional healthcare budget for this year.

Figure 5-2: Proportion of KyDOC Healthcare Expenditures for the fiscal year ending June 30 2006



Source: Jessa & Winter, 2007.

Kentucky Department of Corrections Medical Staffing

“Health care services to inmates are provided in a clinically appropriate manner by properly credentialed professionals in settings equipped and designed for the delivery of health care ... The range of health care services that are provided to the state inmate population include primary care services, psychiatric, specialist services, dental, pharmacy, laboratory, radiographic, diagnostic tests, dialysis, and rehabilitation ... Monitoring and treatment of communicable diseases, chronic disease management, and continuity of care following hospitalizations are key components of the health care services”. (Jessa & Winter, unpublished report prepared for the KyDOC, 2007, pp. 5 & 6). The medical staffing for each facility is presented in Table 7 below.

Table 5-5: Kentucky Department of Corrections Adult Prison Medical Staffing (2007)

Facility	Number of Inmates	Total Medical Staff	MDs and ARNP ^b	Dentists	Total Nursing Staff	LPNs ^c	RNs ^d
BCFC	274	3.3	0.2	0.1	3	1	2
BCC	588	10.25	0.45	0.8	8	3	5
EKCC	1703	17.2	0.8	1.0	11	5	6
FCDC	201	2.2	0.1	0.1	2	0	2
GRCC	965	13.2	0.4	0.8	11	2	9
KCIW	709	18.0	2.0	1.0	11	9	2
KSP	853	17.2	1.2	0.8	13	6	7
KSR	1953	84.0	6.0	1.0	51	34	17
LLCC	1032	18.0	1.0	1.0	13	6	7
LSCC	979	14.9	0.1	0.8	11	5	6
NTC	1233	16.3	1.2	1.0	12	6	6
RCC	1016	15.5	2.5	1.0	11	8	3
WKCC	668	8.5	1.0	0.5	7	0	7
Total	12173	238.6	17.0	9.9	164	85	79

* These staff data are Full Time Equivalents. Offender population data for 2007 are from June and staffing data are from August. The mean offender population is 936 for 13 facilities in 2007.

Source: Roeder, 2008.

The following chapter will detail the statistical methodology that will be used in this research.

Copyright © Sandra Jane Winter 2009

^b Medical Doctors and Advanced Registered Nurse Practitioners

^c Licensed Practical Nurses

^d Registered Nurses

Chapter 6 – Statistical Methodology

Previous Research by the Kentucky Corrections Health Services Network

This dissertation is an extension of a disease management study commissioned by the Medical Director of the Kentucky Department of Corrections and carried out by researchers at the Kentucky Corrections Health Services Network (Connell & Winter, 2008, unpublished report). Data was extracted from the electronic health record of approximately 700 inmates in order to examine the disease management processes for diabetes, hypertension and hyperlipidemia within the Kentucky Department of Corrections and to determine how the electronic health record contributes to the documentation of Kentucky Department of Corrections disease management. In later research, data from the initial study was used to calculate the Framingham Risk Index, which is included as one of the explanatory variables in this dissertation. The Framingham Risk Index indicates the 10-year risk of a particular individual developing cardiovascular disease and is calculated using data on age (applicable to individuals aged between 30 and 74), gender, blood pressure (systolic and diastolic), total cholesterol, HDL values, smoking status and whether or not the individual has diabetes.

The sample of inmates selected for this research all had one or more chronic conditions – diabetes mellitus, essential hypertension, or disorders of lipid metabolism (hereinafter referred to as hyperlipidemia). The International Classification of Diseases 9th Revision (ICD-9) coding used for diabetes was 250, for hypertension was 401 and for hyperlipidemia was 272. These disease states were chosen not only because they are often co-occurring and share a similar patho-physiology, but also because they impose a considerable burden of disease in terms of both quality of life and economic cost for both inmates and the non-incarcerated. These disease states are also responsible for increased utilization of healthcare services.

The prevalence of chronic conditions increases with age. The inmate population is, on average, younger than the non-incarcerated adult population, and consequently, the prevalence of chronic conditions among inmates is lower than that of the non-incarcerated population. On June 1, 2007 at the KyDOC, the prevalence of Diabetes Mellitus was 5.0 percent, for hyperlipidemia was 10.1 percent and for hypertension was 15.6 percent. Comparative national and state figures for 2007 are provided in Table 8 below:

Table 6-1: Comparison of the Prevalence Rates of High Blood Pressure, Hyperlipidemia and Diabetes in the United States, in Kentucky and in the Kentucky Inmate Population

Condition	United States*	Kentucky [†]	Inmates [‡]
High Blood Pressure	33.3%	24.4%	15.6%
Hyperlipidemia	45%	Not available	10.1%
Diabetes	8.1%	9.9%	5.0%

*Source: Kaiser state health facts accessed on May 3 2009 at <http://statehealthfacts.kff.org/profileind.jsp?rgn=19&cat=2&ind=70>.

[†] Source: Kentucky Cabinet for Health and Family Services accessed at <http://chfs.ky.gov/dph/diseases/cardio2010objectives.htm> on May 3, 2009

[‡]Source: Kentucky Department of Corrections Administrative and Medical Data

The results of the research mentioned above indicate that with regards to specific comprehensive chronic care measures, the care provided to inmates by the Kentucky Department of Corrections is as good as, and often better than that provided to individuals with commercial insurance, Medicaid and Medicare. This comparison was made using the 2007 Healthcare and Effectiveness Data Information Set and is illustrated in Table 9 below.

Table 6-2: Comparison of Selected HEDIS Quality of Care Indicators Measured in the Kentucky Department of Corrections, Commercial Insurers, Medicaid and Medicare Populations

Comprehensive Diabetes Care Quality Measurements	KyDOC	Commercial Insurers	Medicare	Medicaid
Percent of diabetic patients who had at least one HbA1c in the measurement year	92	88	87	78
Percent of diabetic patients who had at least one dilated or retinal eye exam in the measurement year	59	55	62	51
Percent of diabetic patients who had at least one lipid profile during the measurement year	85	83	85	71
Percent of diabetic patients who had HbA1c greater than 9.0% at the last reading (poor control)	19	30	27	49
Percent of diabetic patients with LDL-C levels less than 100 mg/dL at the last reading (good lipid management)	65	43	47	31
Percent of diabetic patients with blood pressure below 140/90 at last reading	78	61	58	57

Source: Modified from The State Of Health Care Quality 2007. National Committee for Quality Assurance, Washington, D.C., and Kentucky Department of Corrections Health Records.

An unpublished study by the Director of the Kentucky Corrections Health Services Network examined the question “Does increasing access to primary care decrease costs of secondary care?” (Roeder, 2008, unpublished report). The number of primary care staff working at Kentucky state operated prisons increased over the period 2004 to 2007 and a strong correlation was observed ($r = -.82$) between increased primary care staff and reduced secondary care costs. Over this period, the health status of the inmate population appears to have been stable, as evidenced by the percent of inmates on five or more prescribed medications, and the proportion of inmates on non-formulary medications which was constant over time. Although the management practices of the Kentucky Corrections Health Services Network over this time resulted in substantial system-wide reductions in inmate healthcare costs, there was a differential effect observed by facility, specifically “institutions with the largest increases in staffing had the largest decreases in average paid claims per offender” (p. 1).

Anecdotal information gathered in discussions with KyDOC providers suggests that some inmates from medium and maximum security facilities, particularly the elderly, may be disinclined to receive secondary care for non-emergency needs because of the requirement that these inmates wear full restraints while outside the perimeter of the facility, in other words, orange jump suit and wrist and ankle shackles. In addition, inmates transported outside the facilities often have to leave early in the morning, may consequently miss meals, and may have to wait until all the inmates requiring care have been seen before being transported back to prison, which could be all day.

Research Purpose

The purpose of this study is to

- 1) describe the sample inmate population in terms of
 - a. individual inmate characteristics (demographic factors, health status variables, health risk factors and criminal offense related characteristics) and
 - b. facility level characteristics (inmate to staff ratios and quality of care features)
- 2) analyze the healthcare utilization for this sample of inmates that takes place for the period January 1, 2007 to December 31, 2007
 - a. within the prison facilities according to the type of medical professional and support staff and
 - b. outside the prison facilities, and includes inpatient and ambulatory care, and costs of this outside care

- 3) compare healthcare utilization by various sub-groups of the sample inmate population, looking specifically at within facility documented encounters with medical and mental health providers, and at the receipt of secondary care and
- 4) identify factors associated with variations in within facility and secondary care utilization by this sample of inmates using appropriate regression analysis techniques.

Institutional Review Board Approval

Approval to conduct this research on a vulnerable population group was obtained from the University of Kentucky Institutional Review Board.

Study Design

This study was a cross-sectional, retrospective examination of healthcare data of a group of Kentucky Department of Corrections inmates who were incarcerated during the period January 1, 2007 to December 31, 2007 and had one or more of the chronic conditions diabetes mellitus, hypertension, and hyperlipidemia.

Sample Selection

The first step in selecting the study sample was to extract from the electronic health record a list of all inmates with the chronic conditions diabetes, hypertension or hyperlipidemia. This yielded 1217 inmates with diabetes, 3983 inmates with hypertension and 2237 inmates with hyperlipidemia. From this list, the study sample was drawn using a random number generator. Study participants were included if they were 18 years of age or older and incarcerated from January 1, 2007, through December 31, 2007, regardless of gender. Inmates were excluded if they 1) entered the prison after January 1, 2007, 2) were incarcerated at one of the private facilities managed by the Correctional Corporation of America or 3) if they had episodic, short term or self-limiting conditions. Episodic, short term or self-limiting conditions included drug-induced hyperglycemia, paroxysmal hypertension, gestational or puerperal related hypertension or diabetes and conditions that are organ specific such as ocular, portal, venous, or pulmonary artery hypertension. Secondary care utilization and cost data are not readily available for inmates incarcerated at the privately operated prisons. One of the thirteen state- operated prisons was privately operated until July 1 2007, so inmates at this facility were not included in the sample. The final sample of inmates consisted of 577 inmates in total, of whom 254 had a diagnosis of diabetes, 429 had a diagnosis of

hypertension and 345 had a diagnosis of hyperlipidemia. These do not sum to 577 because of the presence of considerable co-morbidity.

Source of Data

The data that was used in this research came from three primary sources:

1. The inmates' electronic health record
2. Data from CorrectCare Integrated Health, LLC, the healthcare management company that is contracted by the Kentucky Department of Corrections to manage many aspects of the provision of healthcare to inmates
3. The Kentucky Department of Corrections administrative records and publically available information found on the Kentucky Department of Corrections website.

Data from the inmates' electronic health record were collected by opening and reviewing the electronic health record of each inmate and extracting relevant data to either an Excel spreadsheet or a custom-designed Access database.

Variables

Primary Outcome Variables

There were two primary outcome measures for this research:

1. Within facility healthcare utilization will be measured using a count of the number of provider transactions recorded in an inmate's electronic health record. Being incarcerated may have a differential effect on physical and mental health, so the analysis will be conducted using a count of the documented encounters with medical providers defined as medical doctors and advanced registered nurse practitioners and mental health providers, defined as psychiatrists and psychologists
2. Outside facility utilization will be categorized using a dichotomous variable indicating whether or not an inmate has received secondary care, defined as care provided outside the prison setting

Explanatory Variables

At the individual level, the explanatory variables include demographic variables, health status variables, modifiable health risk factor variables and sentencing variables. At the facility level, the explanatory variables include individual facility identification, inmate to staff provider ratios and quality of care variables.

Individual Level Variables

Demographic variables

- Age: a continuous variable measured in years. Source: electronic health records.
- Gender: a dichotomous variable 1 = male, 0 = female. Source: electronic health records.
- Race: a dichotomous variable for three racial groups – white, black and other : Source: electronic health records.
- Educational level: a dichotomous variable 1 = graduated high school, 0 = did not graduate high school. Source: KyDOC administrative records.
- Marital status: a dichotomous variable 1 = currently married, 0 = not currently married. Source: KyDOC administrative records.

Health status variables

- Diagnosis of the chronic conditions of interest: dichotomous variables for five different categories – diabetes only, hypertension only, hyperlipidemia only, any two conditions, all three conditions. Source: electronic health records.
- Framingham risk index score: A continuous variable, the Framingham Risk Index indicates the 10 year risk of a particular individual developing cardiovascular disease and is calculated using data on age (applicable to individuals aged between 30 and 74), gender, blood pressure (systolic and diastolic), total cholesterol, HDL values, smoking status and whether or not the individual has diabetes. Each of these predictors generates a point value, which are summed and then used to estimate the percentage risk of developing cardiovascular disease in the next ten years (Source: The Framingham Heart Study, accessed on April 16, 2009, at <http://www.framinghamheartstudy.org/about/index.html>). Source: compiled by Nicholas Gould, UK, from data extracted from the inmates electronic health record.
- Total number of problems listed in the inmate's electronic health record: a count. Source: electronic health records.
- Diagnosis of substance abuse: a dichotomous variable indicating whether or not substance abuse was listed on the inmate's problem list in the electronic health record: 1 = has a diagnosis of substance abuse on the problem list, 0 = no such diagnosis. Source: electronic health record.

- Diagnosis of mental illness: a dichotomous variable indicating whether or not the inmate had a diagnosis of mental illness listed on the inmate's problem list in the electronic health record. ICD 9 codes of 290 to 319 which signify mental disorders were used in this classification: 1 = has a diagnosis of mental illness on the problem list, 0 = no such diagnosis. Source: electronic health record.

Health risk factor variables

- Body Mass Index (BMI): a continuous variable of the body mass index calculated using data extracted from the electronic health record on the height and average weight of each inmate. BMI categories are as follows:
 - o less than 18.5 indicates an individual is underweight
 - o between 18.5 and 24.9 indicates normal weight
 - o between 25 and 29.9 indicates overweight
 - o greater than 30 indicates obesity

Source: electronic health record.

- Smoking status: a dichotomous variable, 1 = has a note stating inmate has ever been a smoker on the problem list, 0 = no such note. Source: electronic health record.
- Adherence: for physical activity, diet and medication adherence a dichotomous variable was created where 1 = the majority of chronic care notes in the EHR where adherence was reported indicate that the inmate did adhere, 0 = the majority of chronic care notes where adherence was reported indicate that the inmate did not adhere. Source: electronic health records
 - o physical activity: a dichotomous variable, 1 = adhered to physical activity, 0 = did not adhere to physical activity
 - o diet: a dichotomous variable, 1 = adhered to diet, 0 = did not adhere to diet
 - o medications: a dichotomous variable, 1 = adhered to prescribed medications, 0 = did not adhere to prescribed medications
- Refusal of treatment: a dichotomous variable, 1 = inmate either missed appointments or refused medical treatment, 0 = inmate did not miss appointments and accepted treatment. This variable was generated by the researchers who were doing the initial data extraction and is based on provider

notes in the EHR. Missed appointments included no shows for laboratory work and provider visits. Source: electronic health records.

Sentence variables

- Type of crime: dichotomous variable indicating all types of crimes recorded for each inmate on the Kentucky Offender Online Lookup system categorized as violent crimes^e, sex crimes^f, drug crimes^g, weapons crimes^h, property crimesⁱ and other crimes^j. Inmates may have more than one of these crimes included in this variable. Source: Kentucky Offender Online Lookup system.
- Length of Sentence: a continuous variable measured in the years of sentence assigned to inmates when they were convicted of their crimes. The years of sentence for inmates with a sentence of greater than 100 years, or death or life were all converted to 100 years. Source: KyDOC administrative data.
- Time Served Since Date of Last Incarceration: a continuous variable measured in years from the date of last incarceration to January 1, 2007. Inmates tend to cycle in and out of prison. This variable could reflect that an inmate has been incarcerated since the original conviction, or have been released on parole then rearrested for parole violation or a new crime. Source: KyDOC administrative data.
- Repeat offender: a dichotomous variable indicating whether or not the inmate has been incarcerated previously. 1 = repeat offender, 0 = first offense. Source: KyDOC administrative data. Source: KyDOC administrative data.

Institutional Level Variables

Facility Identification

- A dichotomous variable for each of the 12 state operated prisons at which an inmate was housed during the year. An additional category was generated for

^e Violent crimes: murder, manslaughter, assault, endangerment, kidnapping, robbery.

^f Sex crimes: rape, sodomy, sexual abuse and incest

^g Drug crimes: trafficking in or possession of controlled substances.

^h Weapon crimes: possession of a firearm by a convicted felon and unlawfully possessing a weapon on school property

ⁱ Property crimes: theft, burglary, receiving stolen property and forgery

^j Other crimes: escape, promoting prostitution and driving under the influence.

inmates who were at more than one facility during the year. Source: electronic health record.

Inmate to Staff Ratio

Using inmate to staff ratios controls for the number of inmates per facility.

- Inmate to total corrections staff ratio: Ratio of the number of inmates per facility divided by the total number of staff at that facility. Source: KyDOC website for individual adult institutions.
- Inmate to total medical staff ratio: Ratio of the number of inmates per facility divided by the total number of full time equivalent medical staff at that facility. Source: KyDOC website for individual adult institutions and KyDOC administrative data.

Quality of Care Variables

It is assumed that the quality of care received by the sample of inmates is similar to that received by the general inmate population, and further that there is a relationship between the quality of care and both the utilization of healthcare and the receipt of secondary care. Accordingly, sample data has been used to create variables reflecting the quality of care.

- Minimum chronic care visits: Percentage of inmates from each facility who had the recommended minimum number of chronic care visits (for diabetes this is 3 and for hypertension and hyperlipidemia this is 2 per year)
- HEDIS quality of care score: The Healthcare and Effectiveness Data Information Set (HEDIS) lists eight quality measures for the care of adults with diabetes. Of these, five can be considered process measures as they refer to the percentage of patients who received a particular test or medical examination during the preceding year. The remaining three measures can be considered outcome measures as they refer to physiologic measures of patients – HbA1c levels, blood pressure readings, and lipid profiles. The quality of care to be considered in this research relates to actions on the part of the providers (whether or not the tests/examinations were carried out), as opposed to physiologic measures of the inmates so a derived score based on four quality of care process measures is used. An additional quality of care measure (the percentage of inmates who had a foot examination during the preceding year) was not used as data on foot

examinations recorded in the electronic health record were not detailed enough to determine if the exam had been carried out correctly. The HEDIS quality score was therefore calculated using:

- Dummy variable indicating whether or not a diabetic inmate had at least one HbA1c test done during the year (1 = yes, 0 = no)
- Dummy variable indicating whether or not a diabetic inmate had a dilated or retinal eye exam during the year (1 = yes, 0 = no)
- Dummy variable indicating whether or not a diabetic inmate had at least one test for microalbumin during the year (1 = yes, 0 = no)
- Dummy variable indicating whether or not a diabetic inmate had at least one test for lipid profile during the year (1 = yes, 0 = no)

A score was calculated for each inmate ranging from 0 to 4, depending on how many of the above tests had been done during the year. These scores were averaged by facility to give each facility a HEDIS quality score.

- Volume of care indicator: For each facility the mean number of all provider notes per inmate was calculated (for the sample, the number of all provider notes documented at that facility divided by the number of inmates at that facility). This number was divided by the total number of providers at that facility to derive a volume of care indicator.

Missing Data

For some of the variables of interest, data were not available for all inmates, specifically, years of education, marital status, the Framingham Risk Index, adherence to physical activity, diet and medication, and type of crime. A new dichotomous variable was generated for each of these variables to indicate inmates with missing data = 1, versus inmates with data = 0. Data on inmate educational level and marital status were missing because this information was not on record with the Kentucky Department of Corrections. Information was missing on the Framingham Risk Index, either because one of the composite pieces of data (gender, blood pressure (systolic and diastolic), total cholesterol, HDL values, smoking status and whether or not the individual has diabetes) was not available in the medical record, or because the inmate was aged younger than 30 or older than 74. The Framingham Risk Index is only appropriate for individuals aged 30 to 74 years old. Data regarding self-reported adherence to physical activity, diet and medications could have been missing from inmate's medical records for a variety of

reasons, such as inmates were either not receiving the recommended number of chronic care visits at which these questions should routinely be asked, providers were not asking these questions, or are not documenting the responses or inmates were declining to answer. Data on type of crime were extracted from the Kentucky Offender Online Lookup and was missing for some of the inmates.

The variables for missing data were:

- Missing educational data = 1, 0 otherwise
- Missing marital status data = 1, 0 otherwise
- Missing Framingham Risk Index score = 1, 0 otherwise
- Missing adherence data for physical activity, diet, medications = 1, 0 otherwise
- Missing type of crime data = 1, 0 otherwise

Secondary Outcome Variables

Additional secondary data analysis was conducted on the number of inpatient stays, the number of ambulance trips, the number of emergency department visits and the total cost of secondary healthcare utilization.

Generation of Hypotheses

After consideration of the material presented so far in this dissertation, the following hypotheses regarding the overall utilization of within facility and secondary healthcare services were postulated:

Individual Level Hypotheses

Hypothesis 1: Demographic factors that would be associated with increased utilization of within facility and secondary healthcare services would be increasing age, female gender, white race, more education and not being married.

Hypothesis 2: Health status factors that would be associated with increased utilization of within facility and secondary healthcare services would be having more than one chronic condition, having diabetes, having a higher Framingham risk index, having more problems on the problem list and having a diagnosis of mental illness.

Hypothesis 3: Modifiable behavioral risk factors that would be associated with increased within facility and secondary healthcare utilization would be having a higher body mass index, ever having been a smoker, not adhering to physical activity, diet and medication and refusing or missing treatment.

Hypothesis 4: Being incarcerated for a violent crime as opposed to a non-violent crime and being sentenced to a longer period in custody would be associated with greater within facility mental healthcare utilization. Being incarcerated for a drug related crime would be associated with greater within facility medical care utilization and the receipt of more secondary care. A shorter time continuously incarcerated prior to the study start date (January 1, 2007) would be associated with more within facility medical care utilization. Being a repeat offender would be associated with less within facility health care utilization.

Facility Level Hypotheses

As previously mentioned, there are a number of facility level factors that may result in variations to both within facility and secondary care healthcare utilization by inmates.

Hypothesis 5: Inmates from the medical facility and from the women's facility would incur more within facility healthcare utilization and secondary care. Inmates from the maximum security prison would incur increased within facility utilization and decreased secondary care utilization on the assumption that higher security classification (more dangerous) inmates would be sent out for treatment only as a last resort and would be treated within the facility whenever possible.

Hypothesis 6: Lower inmate to total corrections staff ratios (indicating more secure prisons with more corrections staff per inmate) would be associated with greater within facility healthcare utilization and less secondary care utilization. Higher inmate to medical staff ratio (indicating more inmates per medical provider which may have the effect of reducing access to care leading to poorer health status) would be associated with reduced within facility care and increased secondary care.

Hypothesis 7: A lower proportion of inmates receiving the minimum number of chronic care visits would be associated with reduced within facility care but higher secondary care utilization if poorer quality chronic care results in worsening health status. Similarly, a lower HEDIS quality of care composite score would be associated with lower within facility utilization (inmates are not receiving the recommended comprehensive care tests) but higher secondary care utilization due to poorer health status. A higher volume of care score would be expected to result in reduced within facility utilization if a high volume of care indicates providers are too busy to see inmates whose access to

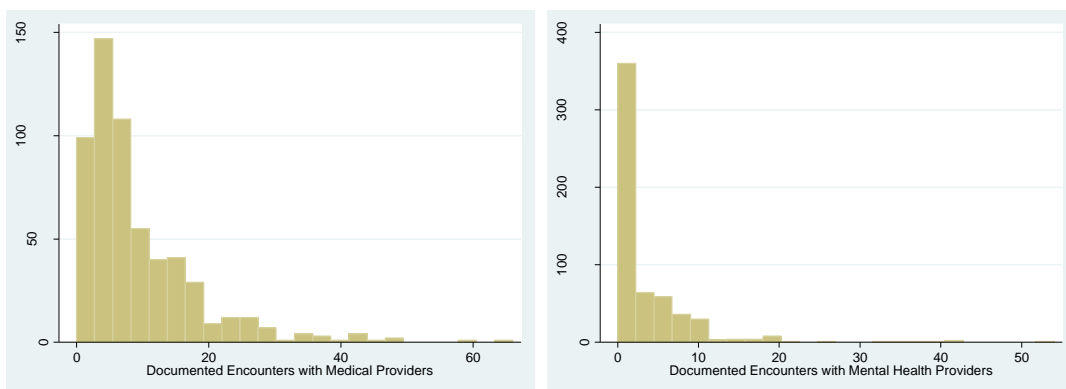
healthcare would therefore be reduced. This was expected to result in increased secondary care if health status worsens.

Statistical Analysis

All statistical analysis was done with Intercooled STATA 9. Continuous outcomes were summarized with descriptive statistics (frequency, mean, standard deviation, median, first and third quartiles, and minimum and maximum). Categorical outcomes were described with counts and percentages. In bivariate analysis the significance of differences between various groups of inmates was tested using the χ^2 test for percentages and t-tests for analysis of variances for means. Regression analysis was used to examine the effects of a number of explanatory variables on the primary outcomes. The explanatory variables included individual level characteristics, facility level characteristics and fixed effects for the medical facility, the women's facility and the maximum security facility which were entered directly as dummy variables for each facility.

The outcome variable of within facility encounters with providers that were documented in the electronic health records is a count. Ordinary least squares regression is not optimal for analyzing count data because the underlying distribution is closer to Poisson or negative binomial, as is clearly evident from the histograms of the two outcome variables shown in Figure 10.

Figure 6-1: Distribution of Within Facility Encounters with Healthcare providers



One option for analyzing count data is to use Poisson regression analysis. Poisson regression assumes, however, that the mean and the variance are the same. Further analysis of the count of the within facility healthcare utilization reveals

that this is not the case for the data to be used in this study, as can be seen from the data presented in Table 10.

Table 6-3: Variance and Mean of Documented Within Facility Encounters

Measure	N	Documented Encounters with Medical Providers	Documented Encounters with Mental Health Providers
Mean	577	9.1	3.2
Variance	577	78.8	34.2

The above table indicates that the data are subject to over-dispersion. A negative binomial distribution is more appropriate to use in cases of over-dispersion because it allows the variance to be greater than the mean. Negative binomial regression analysis will therefore be used to examine associations between the count outcome variables and the explanatory variables. As in Poisson regression, because the exposure time is the same for all subjects in the study (January 1, 2007, to December 31, 2007), the exponentiated coefficients can be interpreted as the incidence rate ratio for a unit increase in the covariates. The coefficients can be interpreted as the percentage change in the expected value of y given a one-unit increase in x if the coefficient is small.

If the data to be used violates the assumptions underlying regression analysis, the estimates of the coefficients and the standard errors may be biased. Using robust regression methods can account for minor flaws in the data. This analysis will use the Huber-White sandwich estimator which adjusts for heterogeneity in the model.

The dichotomous outcome variable of the probability of receiving secondary care during the study period (January 1, 2007, to December 31, 2007) has a Bernoulli distribution so the data will be analyzed using logistic regression. The exponentiated coefficients can be interpreted as the odds ratio for a unit increase in the covariates.

The model for the primary outcome variables is:

$$Y_{\text{outcome}} = \beta_0 + \beta_1 \text{demographic variables} + \beta_2 \text{health status variables} + \beta_3 \text{health risk factors} + \beta_4 \text{ sentence related factors} + \beta_5 \text{facility variables} + \beta_6 \text{inmate to staff ratios} + \beta_7 \text{quality of care variables} + \beta_8 \text{missing data variables}.$$

Demographic variables include: age, white race, years of education, and whether or not an inmate has ever been married.

Health status variables include: having all three chronic conditions, having diabetes only, the Framingham risk index score, the number of problems documented in the EHR, whether or not the inmate has a diagnosis of substance abuse and whether or not the inmate has a diagnosis of mental illness.

Health risk factors include: Body Mass Index, smoking status, adherence to physical activity, adherence to diet, adherence to medications and refusing/missing treatment.

Sentence related factors include: whether or not the crime was categorized as violent, length of sentence, length of time continuously incarcerated prior to January 1 2007, whether or not the inmate was a repeat offender.

Facility variables include: being incarcerated at the medical facility, being incarcerated at the maximum security facility, being incarcerated at the women's facility.

Inmate to staff ratios include: inmate to total corrections staff ratio and inmate to total medical staff ratio.

Quality of care variables include: the percentage of inmates who had the minimum number of chronic care visits, HEDIS quality score and the volume of care indicator.

Missing data variables include: adherence to physical activity, diet and medication not reported, educational level not reported, marital status not reported, Framingham Risk Index not reported, type of crime not reported.

The following chapter will provide descriptive statistics of the individual and facility level characteristics of the data used in this research.

Chapter 7 - Descriptive Statistics

One of the primary purposes of this dissertation is to provide a detailed description of various individual level and institutional level characteristics affecting the within facility and secondary healthcare utilization of this sample of inmates, all of whom suffer from at least one chronic condition. The descriptive statistics section of the results will therefore be appropriately detailed. In the following chapter, the results of statistical tests to examine what factors are associated with differences in within facility and secondary care utilization will be presented.

Description of Sample Inmate Population

The sample population comprised 577 inmates located at 12 state operated facilities in Kentucky who had a diagnosis of diabetes mellitus, hypertension or hyperlipidemia, or a combination of two or all of these conditions. The descriptive statistics for the sample are shown in Tables 9 to 24, and illustrated in Figures 11 and 12. Demographically, on average, the sample inmate population was older than the Kentucky inmate population (48 vs. 34 years old). There were fewer females (5% vs. 9%), more whites (72% vs. 68%) and fewer blacks (27% vs. 31%). The breakdown of age, race and gender for the sample are shown in Table 11. There were no females in the “Other” race group.

Table 7-1: Age, Race and Gender Distribution of Sample Population

Age, Race and Gender Distribution of Sample Population										
	Males						Females			
	Whites		Blacks		Other		Whites		Blacks	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
20–30	25	4	15	2	0	0	2	0	1	0
31–40	80	14	19	4	0	0	3	1	0	0
41–50	123	21	63	11	2	1	9	1	3	1
51–60	106	18	31	6	0	0	7	2	1	0
61–70	48	8	18	3	0	0	2	0	1	0
70+	13	2	5	1	0	0	0	0	0	0
Totals	395	68	151	26	2	1	23	4	6	1

The vast majority of the sample was male, reflecting the demographic of the incarcerated population. Of the 261 inmates for whom data were available regarding highest educational level attained, just over one third (n = 92, 35%) completed high

school and another 49 (20%) attended college. Four percent of inmates had only some elementary school education (n=11), and 16 percent had only some middle school education (n=41). Of the 178 inmates for whom data were available on marital status, just over a third (n = 67, 37%) were single. The majority of inmates were single with just under one fifth married (n = 32, 18%), and 43 percent (n = 79) divorced, separated or widowed. Demographic information of the sample inmate population is presented in Table 12.

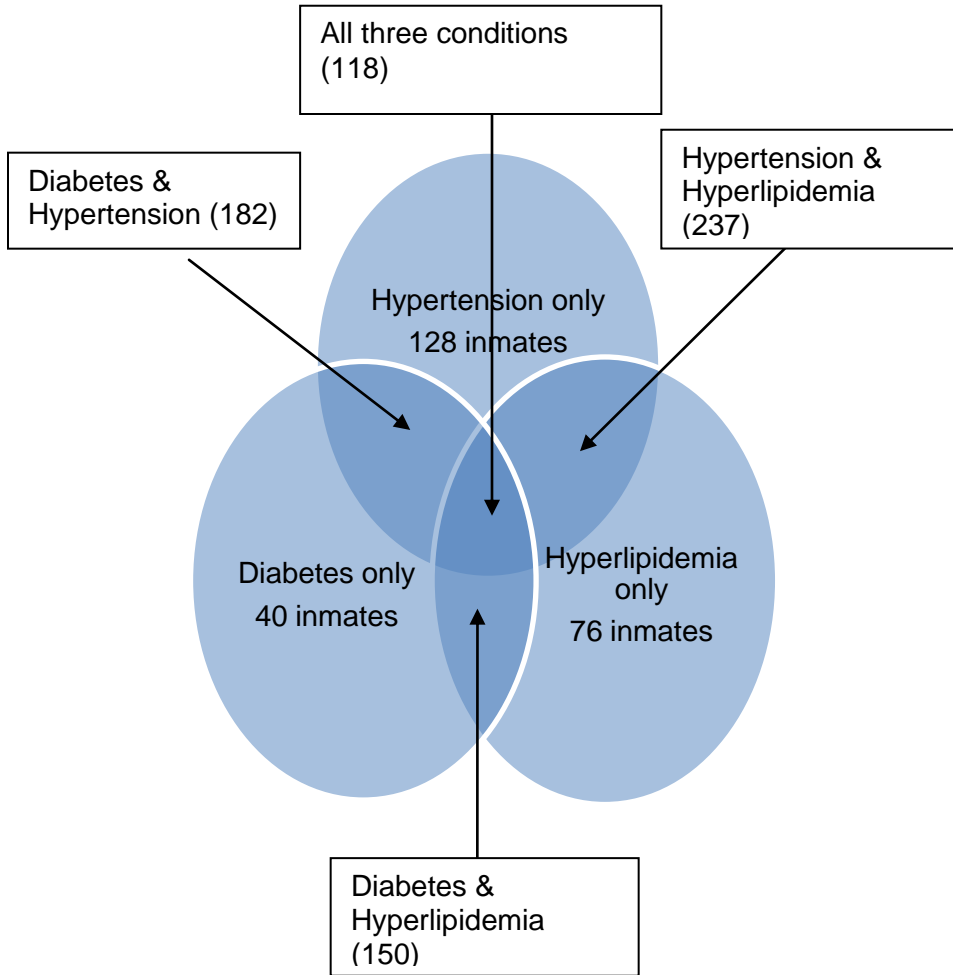
Table 7-2: Demographic Information of Sample Inmate Population

Demographic Information of Sample Inmate Population	
<u>Age</u>	n=577
Mean (Std. Dev)	48.2 (11.5)
Median (Q1, Q3)	48 (40,56)
Min, Max	20,81
<u>Gender</u>	n= 577
Male	548 (95%)
Female	29 (5%)
<u>Race</u>	n = 577
White	418 (72%)
Black	157 (27%)
Other	2 (1%)
<u>Educational Status</u>	n = 261
Grades 1 - 5	11 (4%)
Grades 6 - 8	41 (16%)
Grades 9 - 12	160 (61%)
More than high school	49(19%)
<u>Life Partner</u>	n=180
Single	67 (37%)
Married	33 (18%)
Separated	10 (6%)
Divorced	66 (37%)
Widowed	4 (2%)

Of the sample of 577 inmates, 429 inmates had a diagnosis of hypertension, 345 inmates had a diagnosis of hyperlipidemia and 254 inmates had a diagnosis of diabetes, indicating the presence of considerable co-morbidities. One fifth (n= 118, 20%) of the sample had all three conditions and 215 (37%) had any two conditions. One quarter of the inmates (150) had diabetes and hyperlipidemia, 182 (31%) had diabetes and hypertension and 237 (40%) had hypertension and hyperlipidemia. The sub-sample analysis by condition revealed that inmates with all three chronic conditions were more

likely than the total sample to be older (53.4), white (75%) and male (99%). The above information is detailed in Figure 11.

Figure 7-1: Venn Diagram Indicating the Presence of Co-Morbidities in the Sample Inmate Population



** Not drawn to scale **

For the total sample, the mean Framingham Risk Index score (which indicates the percent risk of developing cardiovascular disease within the next ten years) was 12% (std. dev. 8.6), with a minimum risk score of 2 percent and a maximum of 53 percent. Sample inmates with all three conditions had the highest Framingham Risk Index (15%), while inmates with hypertension only had the lowest (9%). The mean number of problems listed on the problem list was 7.8 (std. dev. 3.5) with a range of 1 to 24. The sample inmates with more than one chronic condition had more than the average

number of problems listed on the problem list, while the sample inmates with only one of the chronic conditions of interest had less than the average. Almost half of all the sample inmates (48.6%) had a diagnosis of substance abuse in their medical record. Almost one third of the sample inmates with hypertension only (66.4%) and over half (55.8%) of the sample inmates with hyperlipidemia only had a diagnosis of substance abuse. Almost 46 percent of the total sample inmates had a diagnosis of mental illness. Mental illness was least prevalent in the sample inmates with all three conditions (38.1%) and most prevalent in the group of inmates who had a diagnosis of diabetes only (52.5%). One quarter of the sample inmates had co-occurring mental health and substance abuse issues. Descriptive statistics of the health status of the sample inmate population are provided in Table 13.

Table 7-3: Health Status Information of Sample Inmate Population

Health Status Information of Sample Inmate Population	
<u>Chronic Conditions</u>	n = 577
All three conditions	118 (20%)
Any two conditions	215 (37%)
Diabetes only	40 (7%)
Hypertension only	128 (22%)
Hyperlipidemia only	76 (13%)
<u>Framingham Risk Index</u>	n = 322
Mean (Std.Dev.)	11.6 (8.6)
Median (Q1, Q3)	8 (7,16)
Min, Max	2, 53
<u>Number of Problems</u>	n = 577
Mean (Std. Dev)	7.8 (3.5)
Median (Q1, Q3)	8 (5, 10)
Min, Max	1, 24
<u>Diagnosis of Substance Abuse</u>	n = 577
Yes	280 (48.5%)
No	297 (51.5%)
<u>Diagnosis of Mental Illness</u>	n = 577
Yes	263 (45.6%)
No	314 (54.4%)

Information on the risk factors that can be classified as modifiable, in other words, within the power of the inmate to change, were only available on a smaller set of inmates than the total sample. These inmates, on average, had a body mass index (BMI) of 30.5 (std. dev. 6.4) which is the lower bound in the obese category for the body mass index. Over half (n = 301, 52.2%) of the inmates in the sample were smokers. Self reported adherence to a physical activity regimen and compliance with taking

prescribed medications were high (n = 161, 81% and n= 205, 89%, respectively). Adherence to diet was, however, somewhat lower (n = 132, 61%). Almost 30 percent of the inmates (n = 169) were reported to have refused treatment, or missed provider appointments.

Table 14 provides descriptive statistics regarding the modifiable risk factors of the sample inmate population.

Table 7-4: Modifiable Risk Factor Information of Sample Inmate Population

Modifiable Risk Factor Information of Sample Inmate Population	
<u>BMI</u>	n=509
Mean (Std.Dev.)	30.5 (6)
Median (Q1, Q3)	30 (26, 34)
Min, Max	16, 74
<u>Smoker</u>	n= 577
Yes	301 (52.2%)
No	276 (47.8%)
<u>Engages in Physical Activity</u>	n=200
Yes	161 (81%)
No	39 (19%)
<u>Adheres to Diet</u>	n=215
Yes	132 (61%)
No	83 (39%)
<u>Adheres to Medications</u>	n= 231
Yes	205 (89%)
No	26 (11%)
<u>Misses/refuses treatment</u>	n=575
Yes ^k	169 (29%)
No	406 (71%)

Most of the inmates were incarcerated for committing more than one type of crime. Violent crimes were the most common, and weapons crimes the least common. One quarter of the inmates had a sentence of longer than 40 years. The mean length of sentence assigned at time of conviction was 35.8 years (Std.Dev. 33.9). On average, the inmates had been incarcerated for a period of 6.6 years (std. dev 7.0) from the date of last incarceration to the start date of the study, with a range of 0.01 to 33.44 years. Twenty nine percent of the sample inmates (n = 165) were repeat offenders who had been previously incarcerated. Table 15 presents data regarding the type of crime, length of sentence, time served and recidivism status of the sample inmate population.

^k No show for laboratory work n = 33, refused treatment n = 54, no show for provider visits n = 60, no show for multiple encounters n = 22.

Table 7-5: Sentence Characteristics Information of Sample Inmate Population

Sentence Characteristics Information of Sample Inmate Population	
<u>Type of Crime¹</u>	
Violent	224 (57%)
Sex	136 (35%)
Drug	47 (12%)
Weapons	28 (7%)
Property	86 (22%)
Other	122 (31%)
<u>Length of sentence (years)</u>	n = 577
Death	11 (2%)
Life	83 (14%)
>100 years	12 (2%)
51 – 100 years	25 (4%)
41 – 50 years	24 (4%)
31 – 40 years	41 (7%)
21 – 30 years	71 (12%)
11 – 20 years	166 (29%)
1 – 10 years	147 (25%)
<u>Time served to Jan 1, 2007</u>	n = 577
Mean (Std.Dev.)	6.6 (7.0)
Median (Q1, Q3)	4.0 (1.3, 9.6)
Min, Max	.01, 33.44
<u>Repeat Offender</u>	n = 577
Yes	165 (29%)
No	412 (71%)

In summary, the sample inmate population was predominantly white males who were unmarried. Most of the inmates had been incarcerated for violent crimes and were serving long prison sentences. This population had high rates of comorbidities of chronic conditions, mental illness and substance abuse. Although many reported adhering to exercise, fewer reported adhering to diet and the average BMI was in the obese category. More than half the sample population reported tobacco use. Approximately one third had refused treatment or missed appointments, although the compliance rate for taking prescribed medications was high.

The following section will describe the facilities in more detail.

Description of Facilities

Of the 577 sample inmates, about three quarters were incarcerated at one facility for the entire year of the study period. The remaining 25 percent of inmates were

transferred to one or more facilities during 2007. The location of inmates for the duration of the study period is shown in Table 16.

Table 7-6: Location of Inmates for Duration of Study Period by Facility

Location of inmates for duration of study period by facility		
Facility	Frequency	Percent
More than one facility	145	25
Bell County Forestry Camp	4	1
Blackburn Correctional Complex	17	3
Eastern Kentucky Correctional Complex	25	4
Frankfort Career Development Centre	3	1
Green River Correctional Complex	20	3
Kentucky State Penitentiary	63	11
Kentucky State Reformatory	175	30
Kentucky Correctional Institute for Women	30	5
Luther Luckett Correctional Complex	44	8
Northpoint Training Centre	20	3
Roederer Correctional Complex	6	1
Western Kentucky Correctional Complex	28	5
Total	577	100.00

The following section describes the 12 Kentucky state operated prisons at which the sample inmates were incarcerated.

Of the 12 Kentucky state operated prisons, only one houses women (KCIW) and only one facility is maximum security (KSP). One of the facilities serves as the main medical facility (KSR). There are three minimum security prisons and eight medium security prisons. For the study period, the average daily count of inmates per facility ranged from 201 to 1,953. The smallest prison (FCDC) had the least number of total corrections staff (42) and the least number of medical staff (2.2) while the largest prison (KSR) had the most total corrections staff (624) and the most medical staff (84). The total number of full time equivalent medical providers operating at each facility ranged from 2.2 at one of the minimum security prisons to 84 at the medical facility. Descriptive statistics of the gender of the facilities, the security classification and the number of inmates and staff at each facility are provided in Table 17.

¹ Many inmates have been incarcerated for committing more than one crime, so this variable does not sum to 577.

Table 7-7: Facilities Described by Gender, Security Classification, Inmate Size and Total Staff

Facilities Described by Gender, Security Classification, Inmate Size and Total Staff				
Facility	Gender	Security Level	Total Inmates	Total Staff
BCFC	Male	Minimum	274	49
BCC	Male	Minimum	588	128
EKCC	Male	Medium	1703	377
FCDC	Male	Minimum	201	42
GRCC	Male	Medium	965	254
KSP	Male	Maximum	853	348
KSR	Male	Medium	1953	624
KCIW	Female	Medium	709	220
LLCC	Male	Medium	1032	256
NTC	Male	Medium	1233	285
RCC	Male	Medium	1016	254
WKCC	Male	Medium	668	211

For each category of staff, a ratio of the number of inmates per staff member was calculated, with a smaller result indicating more staff per inmate. One would expect that facilities with a higher security classification would have more corrections staff per inmate, and vice versa. For purposes of analysis, the mean for each category was calculated and then for each facility a dichotomous variable indicating whether that facility was above or below the average was generated. The mean inmate to total corrections staff ratio was 3.4 (range = 2.4 at the maximum security prison to 5.6 at the minimum security forestry camp). The mean inmate to total medical provider ratio was 47 (range = 23 at the medical facility to 99 at Eastern Kentucky Correctional complex). The mean inmate to MD/ARNP ratio was 769 (range = 326 at the medical facility to 2413 at Green River Correctional Complex). The mean inmate to dentist ratio was 1471 (range = 709 at the women's' facility to 2740 at the minimum security forestry camp). The mean inmate to total nurse ratio was 67 (range = 38 at the medical facility to 155 at Eastern Kentucky Correctional Complex). Inmate to staff ratios per facility are provided in Table 18.

Table 7-8: Inmate to Staff Ratios by Facility

Inmate to Staff Ratios by Facility					
Facility	Inmate to Total Corrections Staff Ratio	Inmate to Total Medical Provider Ratio	Inmate to MD/ARNP Ratio	Inmate to DMD Ratio	Inmate to Total Nurse Ratio
Mean Ratios (Std. Dev.)	3.4 (0.67)	47.2 (23.82)	769.4 (600.45)	1471.2 (477.84)	66.9 (30.78)
BCFC	5.6	83	1370	2740	91
BCC	4.6	57	1307	735	73.5
EKCC	4.5	99	2129	1703	155
FCDC	4.8	91	2010	2010	101
GRCC	3.8	73	2413	1206	88
KCIW	3.2	39	354	709	64
KSP	2.4	50	710	1066	66
KSR	3.1	23	326	1953	38
LLCC	4.0	57	1032	1032	79
NTC	4.3	76	1028	1233	103
RCC	4.0	66	406.4	1016	92
WKCC	3.2	79	668	1336	95

(Adapted from Roeder, 2008)

Variables were calculated for quality of care provided at each facility using data from the sample. The number of chronic care visits received by the sample population of 577 inmates in 2007 is shown in Table 19.

Table 7-9: Number of Chronic Care Visits Received by the Sample Population

Number of visits					
Zero	One	Two	Three	Four	Five or more
271 (47%)	140 (24%)	91 (16%)	40 (7%)	27 (5%)	8 (1%)

As previously mentioned, the American Corrections Association guidelines, which have been adopted by the KyDOC, recommend that inmates with a diagnosis of diabetes have three chronic care visits per year, and inmates with a diagnosis of hypertension and hyperlipidemia have a minimum of two chronic care visits per year, with more as needed. Clearly, the 411 (71%) inmates who did not have a chronic care visit or who had only one visit during 2007 did not have the minimum recommended number of chronic care visits. The 75 (13%) inmates who had more than three chronic

care visits (the minimum for diabetes) can be considered to have had the recommended minimum level of care. Of the remaining 91 inmates who received two visits, 61 (11%) had diabetes, and therefore did not have the minimum number of recommended visits. The remaining 30 inmates (5%) had either hypertension or hyperlipidemia. It should be noted that these calculations assume that none of the inmates had additional risk factors which would warrant more than the minimum recommended number of chronic visits and that inmates with co-occurring chronic conditions received care for all conditions at each chronic care visit, assumptions which may not always hold true. In summary, only 18 percent of inmates received the recommended minimum number of chronic care visits. Table 20 indicates the percentage of inmates who received the minimum number of recommended chronic care visits by facility for all three conditions.

Table 7-10: Percentage of Inmates who Received the Minimum Number of Recommended Chronic Care Visits by Facility for All Three Conditions

Percentage of Inmates who Received the Minimum Number Of Recommended Chronic Care Visits by Facility for all Three Conditions			
	Number of inmates who did not receive minimum number of chronic care visits	Number of Inmates who did receive minimum number of chronic care visits	Percent receiving minimum care
Multiple Facilities	118	26	18%
BCC	16	1	6%
BCFC	1	3	75%
EKCC	18	7	28%
FCDC	1	2	67%
GRCC	16	4	20%
KCIW	19	9	32%
KSP	45	18	29%
KSR	150	25	14%
LLCC	41	2	5%
NTC	15	5	25%
RCC	6	0	0%
WKCC	26	2	7%

Of the four HEDIS comprehensive diabetes care tests variable used in this study, (HbA1c test, eye examination, lipid profile, urine protein screening), on average, sample inmates with a diagnosis of diabetes received 2.5 of the tests with some receiving none of the tests, and some receiving all four. At five of ten facilities, 19 of the

197 inmates (10%) did not receive any of the recommended comprehensive diabetes care tests. These five facilities were Eastern Kentucky Correctional Complex, Green River Correctional Complex, Kentucky State Penitentiary and the Kentucky State Reformatory. Only at Kentucky Corrections Insititue for Women, Kentucky State Reformatory and Luther Luckett Correctional Complex did some inmates (n = 31, 16%) receive all four of the tests. The average number of comprehensive diabetes care tests per facility was calculated to yield a HEDIS quality of care score. Table 21 indicates the four HEDIS process outcome measures that were used to derive the HEDIS quality score, and the percentage of inmates from each facility who received each measure. Also indicated in Table 21 are the number of inmates who did not receive any of the HEDIS process measures and the facilities in which they were incarcerated.

Table 7-11: HEDIS Process Measures Received by Inmates by Facility

Number of HEDIS Process Measures Received Per Inmate by Facility					
	None	Eye Exam	Urine Protein Screening	Lipid profile	HbA1c
> 1 Facility (n=50)	1 (2%)	10 (20%)	35 (70%)	41 (82%)	48 (96%)
BCC (n=6)	0 (0%)	0 (0%)	1(16%)	6 (100%)	5 (83%)
EKCC (n=11)	3 (27%)	2 (18%)	4 (36%)	5 (45%)	8 (73%)
GRCC (n=7)	1 (14%)	0 (0%)	0 (0%)	4 (57%)	6 (86%)
KSP (n=19)	8 (42%)	0 (0%)	3 (16%)	4 (21%)	11 (58%)
KSR (n=74)	4 (5%)	18 (24%)	63 (85%)	67 (92%)	70 (95%)
KCIW (n=7)	0 (0%)	4 (57%)	4 (57%)	6 (86%)	7 (100%)
LLCC (n=7)	0 (0%)	6 (86%)	7 (100%)	7 (100%)	7 (100%)
NTC (n=6)	0 (0%)	0 (0%)	4 (67%)	6 (100%)	5 (83%)
RCC (n=1)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	1 (100%)
WKCC (n=9)	2(22%)	0 (0%)	3 (33%)	7 (78%)	5 (56%)
Total (n= 197)	19 (10%)	41 (21%)	124 63%)	154 (78%)	173 (88%)

The average number of provider entered records in the EHR per inmate at FCDC was 5.3 for the study period. The number of providers at FCDC was 2.2. The FCDC providers, therefore, each entered on average 2.41 EHR notes for this sample of inmates (5.3/2.2). By contrast, although inmates at KSR had a higher average number of provider entered records in the EHR (20.5), there are more providers at KSR (84), therefore, these providers each entered on average only 0.24 EHR notes for this sample of inmates for the study period (20.5/84). This indicates a higher per provider volume of

care at FCDC than at KSR. A summary of all the quality of care indicators by facility is provided in Table 22.

Table 7-12: Descriptive Statistics of Quality of Care Indicators by Facility

Descriptive Statistics of Quality of Care Indicators			
	% of inmates who received minimum number of chronic care visits	HEDIS quality of care score	Volume of care indicator
Mean Facility Score (std.dev)		2.5 (0.89)	0.53 (0.38)
BCFC	75	2.5	1.36
BCC	6	2.00	0.69
EKCC	28	1.73	0.52
FCDC	67	-	2.41
GRCC	20	1.43	0.70
KCIW	32	3.00	1.58
KSP	29	0.95	0.59
KSR	14	2.95	0.24
LLCC	5	3.86	0.53
NTC	25	2.50	0.63
RCC	0	3.00	0.30
WKCC	7	1.67	0.62

Within Facility Healthcare Utilization

The within facility healthcare utilization was measured using the number of entries in each inmate's electronic health record. These entries could have been made by providers, or non-providers. The providers were categorized as medical doctors, mental health providers (psychiatrists and psychologists), advanced registered nurse practitioners (ARNPs), dentists, physiotherapists and optometrists. The non providers were categorized as registered nurses, certified nurse assistants, licensed practical nurses and medical record/administrative staff. All of the inmates had entries recorded in their electronic health record (EHR) during the study period (January 1, 2007, to December 31, 2007). The minimum number of total EHR entries for an inmate was 3 and the maximum number was 293. The average of the total number of EHR entries was 56.55 (Std Dev. 41.33). On average, only a quarter (26.8%) of the total number of EHR entries was made by providers.

Only three inmates had no provider notes in their electronic health records. For the remaining inmates, the mean number of provider-entered EHR records was 15.17 for all providers, with a minimum of 1 and a maximum of 95. Inmates with diabetes or all

three conditions had more records (18.5 and 18.9 respectively) and inmates with hyperlipidemia only and hypertension only had a mean number of records of 12.5 and 12.9. Due to the different staffing patterns at the various institutions, not all inmates saw each type of provider. Just over 70 percent of inmates had entries made by medical doctors and three quarters of the inmates had electronic health records entered by ARNPs. Only 79 inmates (13%) had encounters documented by physical therapists. Just fewer than 50 percent of inmate had encounters documented by mental health providers, dentists and optometrists. For medical doctors, ARNPs and mental health providers, the average number of electronic health records entered per inmate was around 6. For dentists, the average number of electronic records was 3, for physiotherapists was 4 and for optometrists the average number of electronic records was only 1.66. Details of provider encounters are provided in Table 23.

Table 7-13: Analysis of Number of Provider Visits by Type of Provider

Analysis of Number of Provider Visits by Type of Provider	
<u>All Providers</u>	n= 577
Mean (Std.Dev.)	15.19 (13.61)
Median (Q1, Q3)	11 (6, 19)
Min, Max	1, 95
<u>Medical Doctors</u>	n= 414
Mean (Std.Dev.)	6.00 (5.93)
Median (Q1, Q3)	4 (2,9)
Min, Max	1, 56
<u>Nurse Practitioners</u>	n= 430
Mean (Std.Dev.)	6.47 (6.20)
Median (Q1, Q3)	5 (2, 8)
Min, Max	1, 49
<u>Mental Health Providers</u>	n= 278
Mean (Std.Dev.)	6.61 (6.96)
Median (Q1, Q3)	5 (3, 8)
Min, Max	1, 54
<u>Dentists</u>	n= 269
Mean (Std.Dev.)	3.26 (3.62)
Median (Q1, Q3)	2 (1, 4)
Min, Max	1, 43
<u>Optometrists</u>	n= 258
Mean (Std.Dev.)	1.66 (1.83)
Median (Q1, Q3)	1 (1, 2)
Min, Max	1, 23
<u>Physiotherapists</u>	n = 79
Mean (Std.Dev.)	4.00 (5.98)
Median (Q1, Q3)	2 (1, 3)
Min, Max	1, 32

All of the sample inmates had some type of non provider documentation in their electronic health record. The average number of all non-provider entries in the EHR was 41.44 (Std.Dev. 30.8), with a minimum of 3 and a maximum of 250. Apart from a very small subset of inmates who were seen more frequently by social service clinicians, the highest mean number of entries was recorded by medical record or administrative staff (19.82, std. dev. 13.2). The visits to non-providers are summarized in Table 24.

Table 7-14: Analysis of Number of Non-Provider Visits by Type of Provider

Analysis of Number of Non-Provider Visits by Type of Non-Provider	
<u>Total Non Providers</u>	n= 577
Mean (Std.Dev.)	41.52 (30.8)
Median (Q1, Q3)	32 (22, 51)
Min, Max	3, 250
<u>Medical Record/Administrative Staff</u>	n=574
Mean (Std.Dev.)	19.82 (13.2)
Median (Q1, Q3)	17 (12,24)
Min, Max	1, 109
<u>Registered Nurses</u>	n=502
Mean (Std.Dev.)	11.85 (12.84)
Median (Q1, Q3)	8 (3, 15)
Min, Max	1, 84
<u>Certified Nurse Assistants</u>	n = 244
Mean (Std.Dev.)	3.27 (2.3)
Median (Q1, Q3)	3 (2, 4)
Min, Max	1, 14
<u>Licensed Practical Nurses</u>	n= 504
Mean (Std.Dev.)	10.78 (12.12)
Median (Q1, Q3)	7 (3, 13)
Min, Max	1, 96
<u>Social Services Clinicians</u>	n= 17
Mean (Std.Dev.)	23.59 (19.52)
Median (Q1, Q3)	15 (8, 43)
Min, Max	1, 56

Secondary Care Utilization

Of the 577 inmates in the sample, 185 (32%) received healthcare by providers located outside the prison facilities. For those inmates receiving secondary care, the average number of visits outside was 3.0 (std. dev. 4.5) and ranged between 1 and 51 (for an inmate requiring radiation therapy). In keeping with the demographic of the sample, 177 (95%) inmates requiring secondary care were males, and approximately three quarters were white and one quarter black.

Inpatient and Observation Care

Inpatient care was provided to 26 patients with a mean length of inpatient stay of 6.1 days (std.dev. 5.7) and a range of between one and 24 days in total. In addition to inpatient stays, there were 14 observation stays which ranged in duration from 1 to 3 days with a mean of 1.8 (std. dev. 0.058). Table 25 indicates the frequency of inpatient and outpatient stays.

Table 7-15: Number of Inmates with Inpatient and Observation Stays

Frequency of Inpatient and Observation Stays	One stay	Two stays	Three stays	Four stays
Number of Inmates with inpatient stays	20	1	4	1
Number of Inmates with observation stays	4	9	1	-

Ambulatory Care, Ambulance Transportation and Emergency Department Visits

One hundred and fifty six patients received ambulatory care. For 17 of the inmates receiving either inpatient or ambulatory secondary care, an ambulance was required to transport them to the hospital, and for 40 of these inmates, the trip to the hospital involved an emergency department visit. Seventy one (50%) of the inmates with all three chronic conditions required some type of secondary care compared to 51 (43%) of inmates with any two conditions, 13 (33%) of inmates with diabetes only, 33 (26%) of inmates with only hypertension

Disease Classifications of Secondary Care

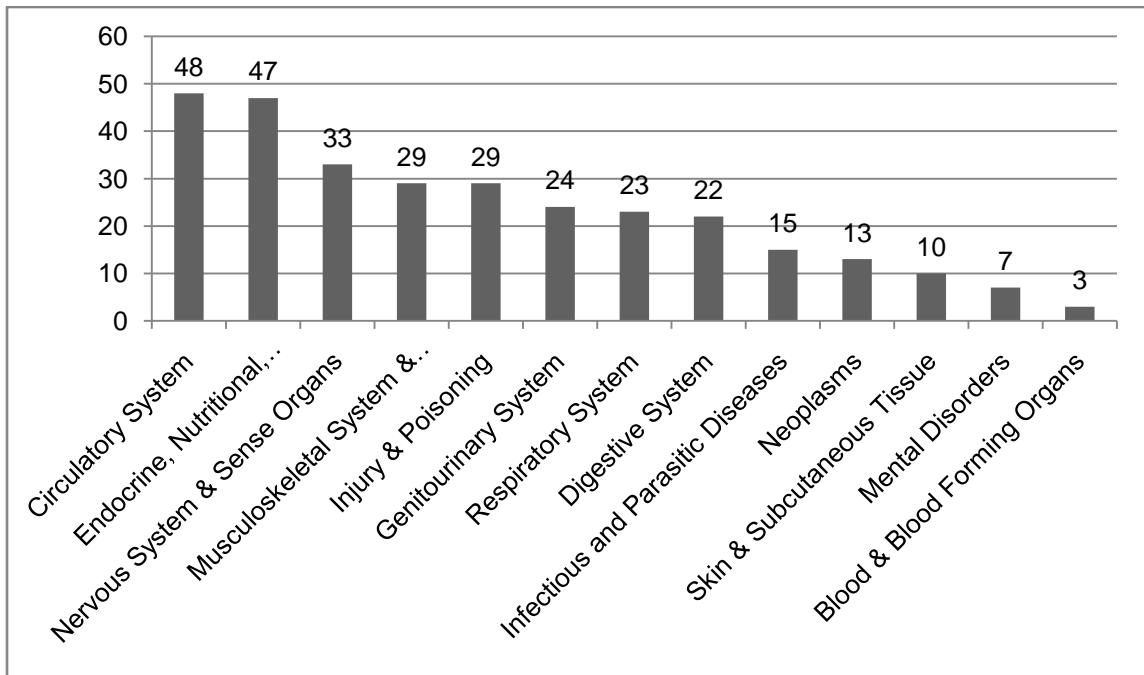
The International Disease Classification (ICD) system is a method of classifying morbidity and mortality information for statistical purposes. The major classifications which were recorded for inmates in the sample were:

- Infectious and parasitic diseases
- Neoplasms
- Endocrine, nutritional, metabolic, immunity
- Blood and blood-forming organs
- Mental Disorders
- Nervous System and sense organs
- Circulatory system
- Respiratory system
- Digestive system
- Genitourinary system
- Skin and subcutaneous tissue
- Musculoskeletal system & connective tissue

There were no inmates with records in three additional categories, namely, complications of pregnancy, congenital abnormalities and conditions in the peri-natal period. For each inmate who required secondary care, the number of different ICD codes in the administrative record was tabulated indicating a mean number of ICD codes per inmate of 2.2 with a range of 1 to 10. For the most part inmates had only one (45%) or two ICD codes (24%).

Not surprisingly, given the underlying disease state of this sample of inmates, one quarter (48) were recorded as having problems with their circulatory system and another quarter (47) were recorded as having problems involving their endocrine, nutritional, metabolic or immune systems. There were no inmates with records in three categories, namely, complications of pregnancy, congenital abnormalities and conditions in the peri-natal period. The frequency of ICD9 codes documented for inmates who received secondary care is illustrated in Figure 12.

Figure 7-2: Frequency of ICD9 Codes Documented for Inmates who Received Secondary Care



Cost of Secondary Care

The total cost of secondary healthcare for the 185 inmates who received care at a healthcare facility located outside the prison for the period January 1, 2007, to December 31, 2007, was \$1,149,688.74. The average per inmate patient cost was

\$6,214.53 (std. dev. \$13,289.73), the minimum was \$11.19 and the maximum was \$102,831.20. Inmates with any two conditions had the highest mean cost of secondary care (\$6,961) and inmates with hypertension only had the lowest mean cost of secondary care (\$5,643). Half of the secondary care costs were less than \$1,000.00 per inmate. Care costing less than \$5,000 was provided to one quarter of the inmates. One inmate contributed substantially to the total cost with care that cost over \$100,000. Not surprisingly, mean cost for inpatient care was higher than that for ambulatory care (\$24,057 vs. \$3,296.82). A summary of the cost of secondary care for the sample inmate population is provided in Table 26.

Table 7-16: Cost of Secondary Care per Inmate

Cost of Secondary Care Per Inmate	Inmates	Percent
< \$1,000	90	49%
\$1001 - \$5,000	45	23.5%
\$5,001 - \$10,000	23	12%
\$10,001 - \$20,000	11	6%
\$20,001 - \$30,000	6	3%
\$30,001 - \$40,000	5	3%
\$50,001 - \$80,000	4	3%
\$100,000	1	.5%
Total	185	100%

Having provided a detailed description of individual and facility level characteristics of the inmate population, chapter eight will provide the results of the statistical analysis which will compare healthcare utilization by various sub-groups of the sample inmate population, looking specifically at within facility documented encounters with medical and mental health providers, and at the receipt of secondary care and identify factors associated with variations in within facility and secondary care utilization by this sample of inmates using negative binomial regression analysis.

Chapter 8 - Statistical Analysis

Primary Data Analysis

Tables 27 to 33 describe the results of the comparative analysis of the outcome variables of interest : documented encounters with medical providers, documented encounters with mental health providers and the receipt of secondary care by various sub-groups of the sample inmate population.

Testing for Differences in Within Facility and Secondary Care Health Service Utilization at the Individual Level

A Student t-test indicates if there is a difference in a continuous outcome variable between two different groups in the sample, in this case, the continuous outcome variable being the mean number of provider entries in an inmate's electronic health record hereinafter named "within facility utilization". To conduct this test, it was necessary to divide continuous explanatory variables into meaningful groups for exploratory data analysis. Age was arbitrarily divided into over 50 and 50 or under to capture differences that may be attributable to increasing age and BMI was divided into 30 and over and under 30 as 30 is the cut-off for obesity. For categorical explanatory variables one way analysis of Variance (ANOVA) was used to test for differences in means. For the dichotomous outcome variable indicating whether or not an inmate received secondary care, a Pearson's χ^2 – test was used. Not all inmates had documentation in their electronic health record of encounters with medical or mental health providers. The comparative analysis that follows is for the 550 inmates who had encounters documented in their electronic health record by medical doctors and advanced registered nurse practitioners and the 278 inmates who had documented encounters with psychiatrists or psychologists. In all cases, significance at $p < 0.001$ is denoted by ***, at $p < 0.01$ by ** and at $p < 0.05$ by *.

Demographic Variables

For this sample, being older, female and having ever been married were all found to be statistically significantly associated with more documented encounters with medical providers. Details of differences in healthcare utilization along demographic grounds are provided in Table 27. Inmates over the age of 50 had on average, 11 encounters with providers over the study period compared to 8.5 for inmates aged less than 50 ($p = 0.0005$), females had on average 14.3 encounters compared to 9.3 encounters for males

(p = 0.0017) and individuals who were ever married had on average 11.7 encounters compared to 7.5 for those individuals who had never been married (p = 0.0033). Regarding mental health encounters, females had double the number of visits to mental health providers than males (12.3 vs. 6.2, p = 0.0001). No other demographic variables were found to be statistically associated with mental health care utilization. Being older was statistically significantly associated with an inmate having received secondary care (p < 0.001). Only a quarter of the inmates who were aged 50 or younger received secondary care, whereas 41 percent of inmates over the age of 50 received secondary care. For this sample race and whether or not an inmate had graduated from high school were not statistically significantly associated with any of the outcome variables.

Table 8-1: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Demographic Variables

Demo-graphic Variables	Encounters with Medical Providers (Mean)	P values	Encounters with Mental Health Providers (Mean)	P values	Received Secondary Care Frequency (%)	P values
<u>Age</u>	(n=550)	0.0005	(n=278)	0.0835		
> 50	11.0	***	5.7	N.S.	97(41%)	<0.001
=<50	8.5		6.9		88(26%)	***
<u>Gender</u>	(n=550)	0.0017	(n=278)	0.0001		0.596
Females	14.3	**	12.3	***	8(28%)	N.S
Males	9.3		6.2		177(32%)	
<u>Race</u>	(n=550)	0.2777	(n=278)	0.2710		0.184
White	9.9	N.S.	7.0	N.S	125(30%)	N.S
Black	8.9		5.5		59(38%)	
Other	3.5		4.0		1(50%)	
<u>Education</u>	(n= 250)	0.5432	(n= 114)	0.2339		0.663
=> high school	9.6	N.S.	7.4	N.S.	40(28%)	N.S
< high school	9.5		6.4		37(31%)	
<u>Ever Married</u>	(n=168)	0.0033	(n=91)	0.0664		0.079
Yes	11.7	**	7.3	N.S.	46(41%)	N.S
No	7.5		4.9		19(28%)	

Health Status Variables

The results of analysis in healthcare utilization for inmates with varying health status characteristics are presented in Table 28. A one-way ANOVA revealed statistically significant differences in medical care utilization between the various

categories of chronic conditions. Further analysis, not included in this table, indicate that this difference was attributable to sample inmates with diabetes who had on average of 12.1 encounters with medical providers compared to 7.5 encounters for the rest of the sample population ($p < 0.001$), and inmates with all three of the chronic conditions who had on average 12.3 documented encounters with medical providers compared to 8.8 for the rest of the sample population ($p = 0.0001$). Having a chronic condition was not, however, statistically significantly associated with encounters with mental health providers. Inmates with a diagnosis of mental illness had statistically significantly more encounters with both medical providers and mental health providers. Specifically, inmates with a mental health diagnosis were seen by medical providers on average 11.3 times compared to 8.1 times for those inmates without a diagnosis of mental illness ($p < 0.001$). Inmates with a mental health diagnosis had more than twice the number of documented visits with mental health providers compared to those without a mental health diagnosis. (7.8 vs. 2.9, $p < 0.001$). Inmates with a diagnosis of substance abuse were less likely to have documented encounters with medical providers compared to inmates without a substance abuse diagnosis (8.2 vs. 10.8, $p = 0.0004$). Having a diagnosis of substance abuse was not statistically associated with encounters with mental health providers. Regarding secondary care, inmates with all three conditions and those with diabetes only received significantly more secondary care than the rest of the sample inmates. Forty three percent of inmates with all three conditions and 42 percent of inmates with diabetes only received secondary care, compared to 29 percent and 24 percent of the rest of the sample inmates (all three , $p=0.004$, diabetes only, $p < 0.001$).

Table 8-2: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Health Status

Health Status	Encounters with Medical Providers (Mean)	P values	Encounters with Mental Health Providers (Mean)	P values	Received Secondary Care Frequency (%)	P values
<u>Chronic Conditions</u>	(n=550)	0.0001 ***	(n=278)	0.6016 N.S		0.014 *
All three	9.5		5.8		71 (33%)	
Any two	12.3		6.7		51 (43%)	
Diabetes	11.2		7.7		13 (33%)	
*HTN	7.8		7.3		33 (26%)	
^HL	7.1		6.8		17 (22%)	
<u>Substance abuse</u>	(n= 550)	0.0004 ***	(n = 278)	0.0822 N.S		0.303 N.S
Yes	8.2		6.1		84 (30%)	
No	10.8		7.3		101 (34%)	
<u>Mental illness</u>	(n=550)	<0.001 ***	(n=278)	<0.001 ***		0.056 N.S
Yes	11.3		7.8		95 (36%)	
No	8.1		2.9		90 (29%)	

* HTN = Hypertension, ^HL= Hyperlipidemia

Health Risk Behavior Variables

Table 29 presents the results of the analysis of differences in healthcare utilization between various groups of inmates by health risk behaviors. Inmates with a Body Mass Index equal to or greater than 30 (in the obese category) and those who had refused treatment or missed appointments had statistically significantly more documented encounters with medical providers compared to inmates with a BMI of less than 30 and inmates who were not documented as having missed appointments or refused treatment. (BMI > 30 11.2 vs. 9.3, p = 0.0250; non-adherence to treatment 10.5 vs. 9.1, p = 0.0466). Inmates who adhered to a physical activity regimen had statistically significantly fewer encounters with medical providers and with mental health providers than those who reported not adhering to a physical activity regimen. (Medical healthcare utilization 9.7 vs. 14.3, p = 0.0004, mental healthcare utilization 6.2 vs. 9.9, p = 0.0297). Inmates who reported adhering to their medication had almost half the number of documented encounters with mental healthcare providers than inmates who reported not adhering, and this was statistically significant. (6.1 vs. 11.2, p=0.0116). Regarding receiving secondary care, 39 percent of the inmates who refused treatment or missed appointments received secondary care, compared with only 29 percent of the

inmates who did not refuse treatment or miss appointments ($p = 0.023$). Adhering to diet was statistically significantly associated with receiving less secondary care than not adhering to diet. Specifically, only 29 percent of inmates who adhered to their diet received secondary care, compared to 43 percent of inmates who did not adhere to their diet ($p = 0.028$). For this sample, being a smoker was not statistically significantly associated with increased medical or mental health care utilization or receipt of secondary care.

Table 8-3: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Health Risk Factors

Health Risk Factors	Encounters with medical providers (Mean)	P values	Encounters with mental health providers (Mean)	P values	Received Secondary Care Frequency (%)	P values
<u>BMI</u>	(n=362)	0.025	(n=179)	0.0982		0.438
>= 30	11.2	0	7.4	N.S	71 (37%)	N.S
< 30	9.3	*	6.0		59 (33%)	
<u>Smoker</u>	(n=550)	0.315	(n=278)	0.1520		0.061
Yes	9.4	6	6.3	N.S	86 (29%)	N.S
No	9.8	N.S	7.2		99 (36%)	
<u>Adheres to exercise</u>	(n=200)	0.000	(n=96)	0.0297		0.117
Yes	9.7	4	6.2	*	49 (30%)	N.S
No	14.3	***	9.9		17 (44%)	
<u>Adheres to diet</u>	(n=214)	0.108	(n=106)	0.3961		0.028
Yes	10.2	4	6.7	N.S	38 (29%)	*
No	11.7	N.S	7.2		36 (43%)	
<u>Adheres to medication</u>	(n=230)	0.058	(n=111)	0.0116		0.090
Yes	10.4	2	6.1	**	68 (33%)	N.S
No	13.1	N.S	11.2		13 (50%)	
<u>Missed/refused treatment</u>	(n=548)	0.046	(n=276)	0.4261		0.023
Yes	10.5	6	6.7	N.S	66 (39%)	*
No	9.1	*	6.5		119 (29%)	

Sentence Related Variables

Differences in the effect of sentence related variables on healthcare utilization are presented in Table 30. Neither the type of crime nor whether or not the inmate was a repeat offender was statistically significantly associated with within facility medical or

mental healthcare utilization. Both, however, were statistically significantly associated with receiving secondary care. On further analysis of the categories of most serious crime, it was found that 65 percent of inmates whose most serious crime was drug related received secondary care, compared to only 28 percent of inmates with other categorizations of most serious crime (p=0.003). Care should be taken not to generalize this result, however, as only 14 inmates had a drug crime as their most serious crime. Only one quarter (25%) of the sample inmates who were repeat offenders received secondary care, compared to over one third (35%) of inmates who were not repeat offenders (p=0.031).

Table 8-4: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Sentence Related Variables

Sentence Related Variables	Encounters with medical providers (Mean)	P values	Encounters with mental health providers (Mean)	P values	Received Secondary Care Frequency (%)	P values
<u>Most serious crime committed</u>	(n=373)	0.3528 N.S	(n=194)	0.2073 N.S		0.041 *
Violent	8.5		6.5		61(26%)	
Sex	9.3		5.9		32(29%)	
Property	7.6		6.3		9(29%)	
Drug	12.1		14.3		9(64%)	
Other	6.6		5.0		3(43%)	
<u>Repeat Offender</u>	(n=550)	0.5384 N.S	(n=278)	0.3801 N.S		0.031 *
Yes	9.6		6.4		42(25%)	
No	9.5		6.7		143(35%)	

Testing for Differences in Within Facility and Secondary Care Health Service Utilization at the Facility Level

Statistically significant differences were found by facility for all the outcome variables which are reported in Table 31. In order to gain a greater understanding of these differences, the analysis was repeated by facility and the results are reported in the following section in narrative form.

Statistically significant differences in the mean number of encounters with medical providers documented in the EHR were detected by facility (p < 0.001) and are presented in Table 31. The analysis was repeated for each facility individually. The

following facilities had statistically significantly fewer documented encounters with medical providers compared to other facilities: Blackburn Correctional Complex (BCC 5.8 vs. other facilities 9.7, $p = 0.0427$); Eastern Kentucky Correctional Complex (EKCC 5.3 vs. other facilities 9.8, $p = 0.0427$); Green River Correctional Complex (GRCC 4.9 vs. other facilities 9.7, $p = 0.0096$); Kentucky State Penitentiary (KSP 5.7 vs. other facilities 10.0, $p = 0.0002$); Luther Luckett Correctional Complex (LLCC 5.9 vs. other facilities 9.9, $p = 0.0025$); Western Kentucky Correctional Complex (WKCC 4.4 vs. other facilities 9.9, $p = 0.0022$). The following facilities had statistically significantly more documented encounters with medical providers compared to other facilities: Kentucky Correctional Institution for Women (KCIW 14.8 vs. other facilities 9.3, $p = 0.0008$); Kentucky State Reformatory (KSR 13.6 vs. other facilities 7.7, $p < 0.001$). Statistically significant differences in documented encounters with medical care providers were not detected at Bell County Forestry Camp, Frankfort Career Development Centre, Northpoint Training Centre and Roederer Correctional Complex.

Kentucky Corrections Institution for Women, was the only facility that had statistically significantly more mean mental health provider encounters than other facilities (KCIW 12.3 vs. other facilities 6.2, $p = 0.0001$).

Statistically significant differences in the percentages of inmates receiving secondary care were detected between facilities ($p < 0.001$). When tested individually, the facilities that had fewer inmates receiving secondary care compared to other facilities were Eastern Kentucky Corrections Complex (EKCC 12% vs. other facilities 33%, $p = 0.028$); Kentucky State Penitentiary (KSP 10% vs. other facilities 35%) and Luther Luckett Correctional Complex (LLCC 14% vs. 34%, $p = 0.006$). One facility, the Kentucky State Reformatory, had more inmates receiving secondary care than other facilities (KSR 42% vs. other facilities 28%, $p = 0.001$). Inmates from Bell County Forestry Camp, Blackburn Correctional Complex, Frankfort Career Development Centre, Green River Correctional Complex, Kentucky Correctional Institute for Women, Northpoint Training Centre, Roederer Correctional Complex and Western Kentucky Correctional Complex did not have statistically significant differences in the percentage of inmates receiving secondary care.

Table 8-5: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care by Facility

Facilities	Medical providers (Mean)	P values	Mental health provider (Mean)	P values	Received Secondary Care Frequency (%)		P values
BCFC	4.0	<0.001 ***	-	0.0136 *	2(50)	2 (50%)	<0.001 ***
BCC	5.8		1.5		9(53)	8(47%)	
EKCC	5.3		3.8		3(12)	22(88%)	
FCDC	3.3		-		0(00)	3(100%)	
GRCC	4.9		6.3		6(30)	14(70%)	
KCIW	14.8		12.3		8(29)	20(71%)	
KSP	5.7		4.9		6(10)	57(90%)	
KSR	13.6		7.4		73(42)	102(58%)	
LLCC	5.9		7.1		6(14)	38(86%)	
NTC	7.4		4.7		6(30)	14(70%)	
RCC	2.4		2.0		0(00)	6(100%)	
WKCC	4.4		2.2		6(21)	22(79%)	

Inmate to staff ratios

Table 32 displays the results of the statistical analysis on the outcome variables of interest and the inmate to staff ratios.

Inmate to Total Corrections Staff Ratio

The mean inmate to total corrections staff ratio for all facilities was 3.4 (std.dev. 0.67). Facilities with below the mean inmate to total corrections staff ratio (in other words, more total corrections staff per inmate) were the women’s prison, the maximum security facility, the medical facility and Western Kentucky Correctional Complex. Inmates incarcerated at facilities with below the mean ratio of inmates to total corrections staff had on average twice the number of encounters with corrections providers documented in their electronic health record (11.3), compared to inmates incarcerated at facilities with above the mean ratio of inmates to total corrections staff (5.6), and this difference was statistically significant ($p < 0.001$). There was no statistically significant difference in documented encounters with mental health providers or receipt of secondary care by inmates at facilities with either above or below the average inmate to total corrections staff ratio.

Inmate to Total Medical Staff Ratio

The mean inmate to total medical staff ratio for all facilities was 47.2 (std.dev. 23.82). The facilities with below the mean inmate to total medical staff ratio (in other words, more total medical staff per inmate) were the women’s facility and the medical facility. Inmates incarcerated at these two facilities had on average twice the number of encounters with medical providers documented in their electronic health record (13.8), compared to inmates incarcerated at facilities with above the mean ratio of inmates to total medical staff (5.5), and this difference in utilization was statistically significant ($p < 0.001$). Inmates from the women’s facility and the medical facility also had more documented encounters with mental health providers in their electronic record (8.2) compared to inmates from facilities with above the mean ratio of inmates to total medical staff (5.0) ($p = 0.0011$). Regarding secondary care, 40 percent of inmates from the women’s facility and the medical facility received secondary care, compared to only 19 percent of inmates from facilities with above the mean inmate to total medical staff ratio and this difference was statistically significant ($p < 0.001$).

Table 8-6: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Inmate to Staff Ratios

Inmate to Staff Ratios	Encounters with medical providers (Mean)	P Values	Encounter with mental health providers (Mean)	P Values	Received Secondary Care Frequency (%)	P Values
<u>Inmate to Total Corrections Staff</u>	(n=409)	<0.001 ***	(n=186)	0.0747 N.S		0.065 N.S
Above ave.	5.6		5.4		32(23%)	
Below ave.	11.3		7.2		93(32%)	
<u>Inmate to Total Medical Staff</u>	(n=409)	<0.001 ***	(n=186)	0.0011 **		<0.001 ***
Above ave.	5.5		5.0		44(19%)	
Below ave	13.8		8.2		81(40%)	

Quality of Care Indicators

Table 33 displays the results of the statistical analysis on the outcome variables of interest and the quality of care variables.

Minimum Number of Chronic Care Visits

Inmates who received at least the minimum number of chronic care visits as suggested by the ACA guideline (four for diabetes and two for hypertension and hyperlipidemia) had statistically significantly more documented encounters with medical providers (12.7) than those who did not receive the minimum number of chronic care visits (8.8) ($p < 0.001$). Receiving the required number of chronic care visits did not appear to have been significantly associated with documented encounters with mental health providers or receiving secondary care.

Table 8-7: Comparison of Encounters with Medical Providers, Mental Health Providers and Receipt of Secondary Care: Quality of Care Indicators

Quality of Care Indicators	Encounter with medical providers (Mean)	P Values	Encounters with mental health providers (Mean)	P Values	Received Secondary Care Frequency (%)	P Values
<u>Minimum Number of Chronic Care Visits Provided</u>		<0.001 ***		0.3012 N.S		0.380 N.S
Yes	12.7		6.1		37 (36%)	
No	8.8		6.7		147 (31%)	
<u>HEDIS Quality Score</u>	(n= 409)	<0.001 ***	(n=186)	0.0021 **		<0.001 ***
Above ave.	11.6		7.8		155 (37%)	
Below ave	5.3		4.6		30 (20%)	
<u>Volume of Care Indicator</u>	(n = 409)	<0.001 ***	(n=186)	0.3584 N.S		0.035 **
Above ave.	7.0		6.6		43 (23%)	
Below ave	11.2		7.0		82 (33%)	

A HEDIS Quality of Care score and a Volume of Care Indicator were calculated for each of the 12 facilities in this study. A dummy variable was created indicating whether a particular facility had scored higher or lower than the average for each of these indicators. As these measures are specific to a particular facility, the sample size

for these two measures is the 433 inmates who were incarcerated at only one facility for the entire year of this study. Of these 433 inmates, only 409 had documented encounters with medical providers and only 186 had documented encounters with mental health providers.

HEDIS Quality Score

The mean HEDIS quality score for all facilities was 2.5 (std.dev. 0.89). Facilities with below the mean HEDIS quality score (indicating that, on average, inmates at these facilities provided fewer of the recommended tests deemed necessary to provide quality of comprehensive diabetic care) were Blackburn Correctional Complex, Eastern Kentucky Correctional Complex, Green River Correctional Complex, Kentucky State Penitentiary and Western Kentucky Correctional Complex. Inmates from facilities with below the mean HEDIS quality score had, on average, about half the number (5.3) of documented encounters with medical providers in their medical records compared to inmates from facilities with above the mean HEDIS quality score (11.6), and this difference was statistically significant ($p < 0.001$). Inmates from the facilities with below the mean HEDIS quality score also had, on average, statistically significantly fewer documented encounters with mental health providers (4.6) compared to inmates incarcerated at facilities with above the mean HEDIS quality score (7.8) ($p = 0.0021$). Inmates incarcerated at facilities with below average HEDIS quality of care scores had 20 percent of inmates receive secondary care, compared to 37 percent of inmates from facilities with above the mean HEDIS quality score, and this difference was statistically significant ($p < 0.001$).

Volume of Care Indicator

The mean volume of care indicator for all facilities was 0.53 (std. dev. 0.38). Facilities with below the mean volume of care indicator (in other words, the facilities at which providers saw, on average, fewer patients per provider) were Eastern Kentucky Correctional Complex, Kentucky State Reformatory, Luther Lockett Correctional Complex and Roederer Correctional Complex. Inmates at these facilities had, on average 11.2 documented encounters with medical providers compared to only 7.0 at other facilities, and this difference was statistically significant ($p < 0.001$). There was no statistically significant difference in documented encounters with mental health providers between facilities with a below average volume of care score and other facilities. About one third of the inmates from EKCC, KSR, LLCC and RCC received secondary care,

compared to only about one quarter of inmates from the other facilities and this difference was statistically significant ($p = 0.035$).

Summary

In summary, factors that were statistically significantly associated with more documented encounters with medical providers were being older than 50, being female, ever having been married, having all three chronic conditions, having a diagnosis of diabetes, *not* having a diagnosis of substance abuse, having a diagnosis of mental illness, having a BMI over 30, not exercising, refusing or missing treatment, being incarcerated at the women's facility or the medical facility, being incarcerated at a facility with below the average inmate to total corrections staff ratio or below the inmate to total medical staff ratio, receiving the minimum number of chronic care visits, and being at a facility with a higher than average HEDIS quality score and a below average volume of care indicator.

Factors statistically significantly associated with more documented encounters with mental health providers were being female, having a diagnosis of mental illness, not adhering to a physical exercise regimen and not adhering to medications, being incarcerated at the women's prison, or at a facility with below the mean inmate to medical staff ratio and being at a facility with an above average HEDIS quality score.

Factors statistically significantly associated with receiving more secondary care were being older than 50, having all three chronic conditions, having a diagnosis of diabetes, not adhering to diet, refusing or missing treatment, being incarcerated for a drug related crime, being a first time offender, being incarcerated at the medical facility, being incarcerated at a facility with below the mean inmate to medical staff ratio, being at a facility with a higher than average HEDIS quality score and lower than average volume of care indicator.

Factors that were not statistically significantly associated with any of the outcomes were race, education level and being a tobacco user.

The above analysis looks at the effect of each of the explanatory variables on the particular outcome variable in isolation, and does not take into account the combined effect that these variables may have on the outcomes of interest. In order to control for the various factors that are thought to have an effect, it is necessary to perform regression analysis.

Regression analysis

Regression analysis allows the interpretation of the association between the outcome variable and a particular explanatory variable, holding all the other variables in the model constant. Complete data was available for regression analysis on 374 of the sample inmates. Separate negative binomial regressions were conducted for documented encounters with medical providers and with mental health providers and logistic regression was conducted on receipt of secondary care. The results are displayed in Tables 34 to 36. IRR refers to the Incidence Rate Ratios and OR refers to the Odds Ratios. Each of the models were statistically significant ($p < 0.001$).

Documented Encounters with Medical Providers

The results of the negative binomial regression analysis on documented encounters with medical providers indicate that the more problems an inmate has listed in the electronic health record and having a diagnosis of diabetes both predict an increase in the rate of documented encounters with medical providers. Adhering to diet, not having adherence documented and not having a Framingham Risk Index score were all predictors of a decrease in the rate of documented encounters with medical providers. These results are displayed in Table 34.

Specifically, having a diagnosis of diabetes was associated with a 40 percent increase in the expected rate of documented encounters with medical providers ($p = 0.002$). Each additional problem an inmate had recorded in their electronic health record was associated with an 11 percent increase in the expected rate of documented encounters with medical providers ($p < 0.001$). Self-reported adherence to diet was associated with a 20 percent decrease in the expected rate of documented encounters with medical providers ($p = 0.046$). Not having adherence to physical activity, diet or medication noted in the electronic health record was associated with a 32 percent decrease in the expected rate of documented encounters with medical providers ($p = 0.004$). Inmates for whom no Framingham Risk Index score was calculated was associated with a 30 percent reduction in the expected rate of documented encounters with medical providers ($p = 0.001$).

Table 8-8: Negative Binomial Regression Results: Medical Care Utilization

	IRR	Std. Err.	z	P> z
Demographic Variables				
• Age	1.01	0.004	1.730	0.085
• White race	1.05	0.090	0.610	0.539
• Years of education	1.02	0.027	0.850	0.396
• Ever married	0.95	0.182	-0.290	0.773
Health Status Variables				
• All three conditions	0.88	0.115	-0.990	0.325
• Diabetes only	1.40	0.152	3.120	0.002
• Framingham Risk Index	1.00	0.006	-0.500	0.620
• Number of problems	1.11	0.017	6.430	<0.001
• Substance abuse	0.90	0.091	-1.030	0.301
• Mental illness	1.02	0.095	0.240	0.808
Health Risk Factor Variables				
• Body mass index	1.00	0.006	-0.620	0.534
• Smoking status	0.88	0.079	-1.470	0.142
• Adherence to physical activity	1.08	0.115	0.680	0.497
• Adherence to diet	0.80	0.089	-2.000	0.046
• Adherence to medications	1.03	0.132	0.260	0.795
• Adherence not reported	0.68	0.092	-2.880	0.004
• Refusing/missing treatment	0.94	0.086	-0.720	0.470
Sentence Characteristics				
• Violent crime	1.01	0.108	0.130	0.893
• Length of sentence	1.00	0.002	-1.720	0.085
• Time incarcerated	1.00	0.008	0.400	0.687
• Repeat offender	0.94	0.087	-0.650	0.518
Facility Variables				
• Maximum security facility	3.27	3.55	1.09	0.276
• Medical facility	5.01	7.36	1.1	0.273
• Women's facility	1.34	3.415	1.250	0.212
• Inmate to total staff ratio	1.44	0.333	1.580	0.114
• Inmate to medical staff ratio	1.01	0.019	0.340	0.737
Quality of Care Variables				
• Minimum chronic care visits (%)	1.00	0.022	-0.020	0.984
• HEDIS quality score	1.21	0.223	1.020	0.308
• Volume of care indicator	2.59	4.539	0.540	0.586
Missing Data Variables				
• Educational level not reported	1.44	0.394	1.340	0.182
• Marital status not reported	0.82	0.149	-1.110	0.265
• No Framingham Risk Index score	0.70	0.078	-3.190	0.001
• Type of crime not reported	1.08	0.124	0.660	0.508

Documented Encounters with Mental Health Providers

The results of the negative binomial regression analysis on documented encounters with mental health providers are displayed in Table 35 and indicate that factors that predict an increase in the expected rate of documentation of encounters with mental health providers include: having more problems listed in the electronic health record, having a diagnosis of mental illness, refusing or missing treatment, being convicted of a violent crime, receiving the minimum number of chronic care visits and not having the type of crime reported. Factors that predict a decrease in the expected rate of documentation of encounters with mental health provider include: increasing age, an increase in the Framingham Risk Index score, not having adherence documented, being a repeat offender, being incarcerated at the maximum security prison, being incarcerated at the medical facility, an Increasing inmate to total corrections staff ratio, an Increasing inmate to medical staff ratio and an Increasing volume of care indicator.

Specifically, each additional problem listed in the inmate's electronic health record was associated with a six percent increase in the expected rate of documented encounters with mental health providers ($p = 0.012$). Having a diagnosis of mental illness was associated with an expectation of over 16.5 times the rate of utilization of mental health services ($p < 0.001$). Refusing treatment or missing appointments was associated with a 50 percent increase in the expected rate of documented encounters with a mental health provider ($p = 0.033$). Having been convicted of a violent crime was associated with a 59 percent expected increase in the rate of documented encounters with a mental health provider ($p = 0.012$). Being at a facility that had a higher percentage of inmates who received the minimum number of chronic care visits was associated with a 21 percent increase in the expected rate of documented encounters with a mental health provider ($p = 0.001$). Not having the type of crime data available was associated with a 77 percent increase in the expected rate of documented encounters with a mental health provider ($p = 0.022$).

Each additional year of age was associated with a decrease of two percent in the expected rate of documented encounters with mental health providers ($p = 0.019$). Each additional point scored on the Framingham Risk Index was associated with a 3 percent decrease in the expected rate of documented encounters with mental health providers ($p = 0.022$). Not having self-reported adherence to physical activity, diet, or medications recorded by providers in the electronic health record was associated with a 48 percent

expected decrease in the rate of documented encounters with mental health providers ($p = 0.039$). Being a repeat offender was associated with a 48 percent decrease in the expected rate of documented encounters with mental health providers ($p < 0.001$). Being incarcerated at the maximum security prison or at the medical facility was associated with a decrease of almost 100 percent in the utilization of mental health services ($p = 0.009$ for maximum security inmates and $p = 0.006$ for the medical facility). A higher inmate to total staff ratio was associated with a reduction of 92 percent in the expected rate of documented encounters with mental health providers ($p = 0.002$). A higher inmate to medical staff ratio was associated with a 10 percent reduction in the expected rate of documented mental health provider encounters ($p = 0.018$). Each additional one unit increase in the volume of care indicator was associated with a decrease in the expected rate of mental health care utilization of almost 100 percent ($p = 0.012$).

Table 8-9: Negative Binomial Regression Results: Mental Healthcare Utilization

	IRR	Std. Err.	z	P> z
Demographic Variables				
• Age	0.98	0.009	-2.340	0.019
• White race	0.91	0.165	-0.550	0.586
• Years of education	1.04	0.050	0.840	0.399
• Ever married	0.93	0.330	-0.190	0.848
Health Status Variables				
• All three conditions	1.06	0.247	0.250	0.806
• Diabetes only	1.05	0.212	0.260	0.798
• Framingham Risk Index	0.97	0.013	-2.280	0.022
• Number of problems	1.06	0.026	2.510	0.012
• Substance abuse	0.89	0.163	-0.630	0.527
• Mental illness	16.68	3.499	13.410	<0.001
Health Risk Factor Variables				
• Body mass index	1.00	0.011	-0.190	0.846
• Smoking status	0.82	0.139	-1.180	0.238
• Adherence to physical activity	1.13	0.289	0.460	0.646
• Adherence to diet	0.88	0.261	-0.430	0.665
• Adherence to medications	0.59	0.188	-1.660	0.098
• Adherence not reported	0.52	0.165	-2.060	0.039
• Refusing/missing treatment	1.50	0.289	2.130	0.033
Sentence Characteristics				
• Violent crime	1.59	0.295	2.520	0.012
• Length of sentence	1.00	0.003	1.020	0.308
• Time incarcerated	0.98	0.014	-1.130	0.259
• Repeat offender	0.52	0.091	-3.720	<0.001
Facility Variables				
• Maximum security facility	0.004	0.0012	-2.600	0.009
• Medical facility	0.00002	0.00009	-2.75	0.006
• Women's facility	46.52	140.54	1.27	0.204
• Inmate to total staff ratio	0.08	0.064	-3.160	0.002
• Inmate to medical staff ratio	0.90	0.038	-2.380	0.018
Quality of Care Variables				
• Minimum chronic care visits (%)	1.21	0.071	3.220	0.001
• HEDIS quality score	0.95	0.464	-0.100	0.918
• Volume of care indicator	0.00005	0.000	-2.510	0.012
Missing Data Variables				
• Educational level not reported	1.86	1.014	1.150	0.252
• Marital status not reported	0.98	0.323	-0.070	0.944
• No Framingham Risk Index score	0.74	0.165	-1.370	0.171
• Type of crime not reported	1.77	0.438	2.290	0.022

Odds of Receiving Secondary Care

The results of the logistic regression on the odds of an inmate receiving secondary care are displayed in Table 36 and indicate that increasing age and having more problems listed in the electronic health record were associated with increased odds of receiving secondary care. Being a repeat offender was associated with decreased odds of receiving secondary care. Specifically, each additional year of age was associated with a 4 percent increased odds of an inmate receiving secondary care ($p = 0.011$). Each additional problem documented in the inmates' electronic health record was associated with a 27 percent increased odds of an inmate receiving secondary care ($p < 0.001$). An inmate being a repeat offender was associated with a 51 percent decreased odds of receiving secondary care ($p = 0.021$).

The following variables were not statistically significantly associated with any of the outcome variables: white race, years of education, ever having been married, having all three conditions, having a diagnosis of substance abuse, body mass index, smoking status, self-reported adherence to physical activity and medications, length of sentence when convicted, time spent continuously incarcerated prior to January 1 2007, being incarcerated at the medical facility, the HEDIS quality score and not having educational level achieved or marital status on record with the KyDOC.

Table 8-10: Logistic Regression Results: Odds of Receiving Secondary Care

	OR	Std. Err.	z	P> z
Demographic Variables				
• Age	1.04	0.016	2.540	0.011
• White race	1.02	0.358	0.040	0.964
• Years of education	0.99	0.087	-0.070	0.944
• Ever married	0.46	0.279	-1.280	0.201
Health Status Variables				
• All three conditions	0.69	0.287	-0.890	0.374
• Diabetes only	1.23	0.460	0.560	0.573
• Framingham Risk Index	0.99	0.022	-0.500	0.617
• Number of problems	1.27	0.064	4.710	<0.001
• Substance abuse	1.13	0.427	0.330	0.739
• Mental illness	1.00	0.341	0.010	0.993
Health Risk Factor Variables				
• Body mass index	0.98	0.021	-1.070	0.284
• Smoking status	0.55	0.184	-1.780	0.075
• Adherence to physical activity	0.90	0.447	-0.210	0.833
• Adherence to diet	0.41	0.209	-1.750	0.080
• Adherence to medications	1.48	0.681	0.850	0.398
• Adherence not reported	0.53	0.304	-1.110	0.266
• Refusing/missing treatment	1.46	0.481	1.140	0.254
Sentence Characteristics				
• Violent crime	1.39	0.525	0.880	0.378
• Length of sentence	1.00	0.007	-0.550	0.584
• Time incarcerated	0.93	0.034	-1.900	0.057
• Repeat offender	0.49	0.152	-2.300	0.021
Facility Variables				
• Maximum security facility	0.31	1.174	-0.31	0.757
• Medical facility	2.88	12.82	0.24	0.813
• Women's facility	.037	.078	-1.56	0.119
• Inmate to total staff ratio	1.01	0.814	0.020	0.987
• Inmate to medical staff ratio	0.98	0.055	-0.420	0.675
Quality of Care Variables				
• Minimum chronic care visits (%)	0.99	0.074	-0.120	0.906
• HEDIS quality score	0.73	0.390	-0.600	0.552
• Volume of care indicator	34.83	150.87	0.820	0.412
Missing Data Variables				
• Educational level not reported	1.61	1.575	0.490	0.624
• Marital status not reported	0.69	0.382	-0.670	0.500
• No Framingham Risk Index score	1.18	0.508	0.390	0.696
• Type of crime not reported	1.64	0.637	1.270	0.203

Secondary Analysis of Data

Analysis of Alternative Outcome Variables

The above analysis was repeated for the dichotomous outcome variables: inpatient, yes/no; emergency visit, yes/no and ambulance transportation yes/no. With regards to being an inpatient, the only explanatory variable that was significant was age with each one year increase in age resulting in a 4 percent increased odds ratio that an inmate would require inpatient care ($p = 0.018$). Every additional year of age was also associated with a 4 percent increased odds ratio that an inmate would have an emergency department visit ($p = 0.011$). Adhering to a physical activity regimen was associated with an 86 percent reduced odds ratio of having an emergency department visit ($p = 0.034$). There were no significant p values for any of the explanatory variables with regards to ambulance transportation.

Additional Facility Level Analysis

The inmate population of EKCC, KSP and LLCC (which were the three facilities that had statistically significantly lower secondary care odds ratios) were compared with the rest of the inmate sample to determine if there were observable differences between these two groups that might explain the lower odds of inmates at EKCC, KSP and LLCC receiving secondary care. A number of factors were found that could explain the difference – the inmate population at the three facilities was on average younger (46.7 vs. 48.6, $p = 0.0454$); had on average a lower Framingham Risk Index (5.3 vs. 6.7, $p = 0.0443$); had on average fewer problems listed in their electronic health record (6.5 vs. 8.2, $p < 0.001$); had fewer inmates with a diagnosis of mental illness (34% vs. 49%, $p = 0.003$); had on average a lower BMI (29.5 vs. 30.9, $p = 0.0158$) and had more inmates who reported adhering to physical activity (36% vs. 26%, $p = 0.025$). Based on the total sample results reported earlier in this research, all of these factors are associated with reduced odds of receiving secondary care, which may explain why inmates from these three facilities have statistically decreased odds of receiving secondary care.

Analysis of Inmates Who Incurred the Most Expensive Secondary Care

Compared to the 158 (84.5%) of inmates whose total secondary care costs were less than \$10,000 per inmate, the 27 (15.5%) of inmates who incurred the bulk of the total secondary care costs were older (55.7 vs. 51.2, $p = 0.0299$), more likely to be white than non-white (5.6% vs 1.84%, $p = 0.051$), had, on average, more problems listed in

their electronic health records (10.4 vs. 9.0, $p = 0.0217$) and were more likely to have come from the medical facility than other facilities (8.00% vs. 3.23%). The disease classification, range of procedures carried out, number of inmates and total cost are summarized in Table 37.

Table 8-11: Disease Classifications, Procedures, Number of Inmates and Cost of Secondary Care for Inmates with more than \$10,000 of Secondary Care Costs

Diseases	Procedures	Inmates	Cost
Circulatory system	Nuclear scan of heart, insert pacemaker, CAT scan, ECG, cardiac catheterization, insertion of emergency airway, Doppler exam, CABG, placement of intracoronary stent, chest x-rays	8	\$314,260.71
Neoplasms (lung, prostate, eyelid)	Chemotherapy and radiation therapy, MRIs, colonoscopies, CAT scans, bronchoscopy, removal of eyelid lining lesion	3	\$150,081.86
Digestive System (hernia repair, freeing intestinal adhesion, ulcer, acute cholecystitis)	Laparoscopy, freeing of bowel adhesion, repair of hernia, upper GI endoscopy with biopsy, extensive laboratory and pathology testing, CAT scans, cholecystectomy with cholangiography	6	\$120,597.79
Infectious and parasitic diseases (AIDS, septicemia)	Cardiac catheterization, bronchoscopy, bone marrow biopsy, hemodialysis, CAT scans, pathology tests, ECG, Doppler, MRI, x-rays, IV infusion for therapy	3	\$102,433.17
Skin and tissue (cellulitis, skin sensation disturbance)	Vein bypass graft, amputation of leg at thigh, nerve conduction tests	2	\$68,652.29
Injury & poisoning (repair of broken leg, complications of hip replacement)	Repair thigh fracture, hip replacement	2	\$36,222.33
Genitourinary system (fragment kidney stone, acute renal failure)	Fragment kidney stone by shock wave Cystoscopy/ureteral catheter, imaging, radiation treatment, CAT scan, tissue pathology, ultrasound	2	\$35,424.25
Musculoskeletal system & connective tissue (Tietzes disease)	Upper GI endoscopy with biopsy, extensive laboratory and pathology testing, CAT scans	1	\$13,926.51
Total cost		27	\$841,598.91

Twenty seven (15.5 percent) of the 185 inmates in this sample had care costing \$841,599 which represents 73 percent of the total secondary care costs (\$1,149,689). The classification of disease, the Diseases of the circulatory system were the most frequent and costly. Diseases of the digestive system were the second most frequently occurring diseases, while neoplasms were the second most costly diseases.

Bivariate Analysis of Variables by Disease State

Bivariate analyses were repeated for the various disease states to determine if there were statistically significant differences between inmates with different morbidities. Only the results that were statistically significant are reported.

Compared to inmates who did not have all three chronic conditions, the 118 inmates with all three conditions were older (53.4 years vs. 46.8 years, $p < 0.001$); had a higher proportion of males (99% vs. 94%, $p=0.020$); had a higher Framingham Risk Index score (10.1 vs. 5.5, $p < 0.001$); had more problems listed in their electronic records (9.4 vs. 7.4, $p < 0.001$); had a higher BMI (31.2 vs. 30.2, $p = 0.0051$), reported adhering to a physical activity regimen more (36% vs. 26%, $p = 0.020$), reported adhering to their medications more (52% vs. 31%, $p < 0.001$); had a higher proportion of inmates incarcerated for committing a sex crime (32% vs 21%, $p = 0.014$) and had been continuously incarcerated prior to January 1, 2007, for a longer period of time (8.2 years vs. 6.2 years, $p = 0.0021$).

Compared to the rest of the sample inmates, the 215 inmates with any two conditions were older (49.6 vs. 47.4, $p = 0.0109$); had a lower proportion of inmates with a diagnosis of substance abuse (40% vs. 53%, $p = 0.003$); reported adhering to diet more (27% vs. 20%, $p = 0.044$); had a longer average sentence (39.3 years vs. 33.7 years, $p = 0.0290$) and had a lower proportion of inmates incarcerated for committing a drug crime (5% vs 10%, $p = 0.040$).

The above analysis accounted for comorbidities in the sample population. The following analysis examines the various chronic condition categories individually and does not take comorbidities into account. Compared to the rest of the sample inmates, the 254 inmates who had a diagnosis of diabetes were older (50.5 years vs. 46.4 years, $p < 0.001$); had a higher proportion of males (97% vs. 93%, $p=0.027$); had a higher Framingham Risk Index score (7.7 vs. 5.4, $p = 0.0007$); had more problems listed in their electronic records (8.6 vs. 7.2, $p < 0.001$); had a lower proportion of inmates with a diagnosis of substance abuse (43% vs. 53%, $p = 0.010$); had a lower proportion of

inmates who were documented as being tobacco-users in their electronic health record (44% vs. 58%, $p = 0.001$); reported adhering to a physical activity regimen more (35% vs. 23%, $p = 0.001$); reported adhering to diet more (29% vs. 18%, $p = 0.002$); reported adhering to their medications more (46% vs. 27%, $p < 0.001$) and had more inmates refusing treatment or missing appointments (35% vs. 25%, $p = 0.008$).

Compared to the rest of the sample inmates, the 429 inmates with a diagnosis of hypertension were older (49.2 years vs 45.3 years, $p = 0.0001$); had a higher proportion of males (97% vs. 90%, $p = 0.001$); had a higher Framingham Risk Index score (6.8 vs. 5.4, $p = 0.0399$); had more problems listed in their electronic records (8.0 vs. 7.1, $p = 0.0032$); had a higher BMI (31.0 vs. 29.1, $p = 0.0016$) and reported adhering to a physical activity regimen more (31% vs. 20%, $p = 0.016$).

Compared to the rest of the sample inmates, the 345 inmates with a diagnosis of hyperlipidemia were older (49.7 years vs 46.0 years, $p = 0.0001$); had a higher proportion of inmates who graduated from high school (59% vs. 45%, $p = 0.031$); had a lower proportion of inmates who had reported ever having been married (16% vs. 24%, $p = 0.026$); had a higher Framingham Risk Index score (7.6 vs. 4.7, $p < 0.001$); had more problems listed in their electronic records (8.2 vs. 7.1, $p = 0.0001$); had a lower proportion of inmates with a diagnosis of substance abuse (44% vs. 55%, $p = 0.009$); had a lower BMI (30.1 vs. 31.3, $p = 0.0190$); had a higher proportion of inmates incarcerated for committing a sex crime (28% vs 18%, $p = 0.007$); had a lower proportion of inmates incarcerated for committing a drug crime (6% vs 12%, $p = 0.012$); had a lower proportion of inmates incarcerated for committing a crime categorized as other (27% vs 38%, $p = 0.018$); had a longer average sentence (41 years vs. 28 years, $p < 0.001$); had been continuously incarcerated prior to January 1, 2007, for a longer period of time (8.0 years vs. 4.5 years, $p < 0.001$).

Chapter nine will discuss the results of this analysis.

Chapter 9 – Interpretation of Results

The long term objective of this cross-sectional study was to provide information to Correctional healthcare policy makers and administrators that could be used to plan, implement and administer cost-effective inmate healthcare services of appropriate quality in an efficient manner. This study examined the healthcare utilization of 577 inmates who had diagnoses of diabetes, hypertension and/or hyperlipidemia in Kentucky state prisons during the 2007 calendar year. The goals of this study were to compare the healthcare utilization of medical and mental health services by various sub-groups of the sample inmate population and to identify factors predicting secondary care use.

This chapter will discuss in greater detail the results of the research presented in Chapter Eight. Firstly, the results of the bivariate analysis will be discussed, and this will be followed by the results of the regression analysis.

Interpretation of Bivariate Analysis

Documented Encounters with Medical Providers

Many of the hypotheses regarding factors that would be associated with increased within facility and secondary healthcare utilization were supported in the results of the bivariate analysis which examined the individual explanatory variables and each of the outcome variables. As expected, the following factors were all found to be associated with increased utilization of medical services: increasing age, being female, having chronic condition comorbidities, having a diagnosis of mental illness, having a high BMI, not exercising, refusing or missing treatment, being incarcerated at the women's facility or at the medical facility, being incarcerated at a facility with below the average inmate to total corrections staff ratio (higher security), being incarcerated at a facility with below the average inmate to total medical corrections staff ratio (more providers per inmate available to provide care), receiving the minimum number of chronic care visits, being at a facility with a higher than average HEDIS quality score and being at a facility with a below average volume of care indicator. As discussed in Chapters Two and Three, previous research has suggested that having a diagnosis of substance abuse may be associated with decreased medical care utilization, and this was the case in this analysis. There were some factors that had results other than that predicted. Currently being married was not statistically significantly associated with any of the outcome variables, but ever having been married was associated with increased

medical care utilization. As discussed in Chapter Three, the literature suggests that being married is associated with reduced morbidity and mortality, compared to being widowed, divorced or single.

Documented encounters with Mental Health Providers

As expected, being female, having a diagnosis of mental illness, not exercising, not adhering to medications, being incarcerated at the women's prison and being at a facility with a higher than average HEDIS quality score were all statistically significantly associated with higher within facility utilization of mental health services.

Secondary Care

The factors expected to be associated with increased secondary care were increasing age, having comorbidities, not adhering to diet, refusing or missing treatment, being incarcerated for a drug related crime and being incarcerated at the medical facility. Being incarcerated at a facility with below the mean inmate to medical staff ratio (more providers per inmate) was expected to be associated with reduced secondary care based on the previous unpublished research by Roeder (2008), but the results of this analysis indicate that inmates incarcerated at facilities with below the mean inmate to medical staff ratio actually had statistically significantly more secondary care utilization. Similarly, being incarcerated at a facility with below average volume of care (indicating that providers see fewer inmates and so therefore are able to provide a better quality of care) was expected to result in reduced odds of receiving secondary care. This was not the case. These results warrant further research. It was not clear *a priori* what effect recidivism would have on healthcare utilization. On the one hand, having previously been incarcerated may have provided opportunities for preventive and diagnostic healthcare which could have a positive health effect. On the other hand, being re-incarcerated indicates the continuation of previous lifestyle patterns, many of which are associated with high health risk. Being a first time offender was only found to be statistically significantly associated with increased secondary care utilization. Being incarcerated at a facility with a higher than average HEDIS quality score was expected to result in reduced secondary care utilization as these facilities may be considered to be providing better quality of care. A higher than average HEDIS quality score was, however, associated with increased secondary care utilization.

Interpretation of Regression Analysis

As mentioned in Chapter Two the demand for health and the resultant utilization of healthcare services is a complex multi-factorial matter. Bivariate analysis is a useful but insufficient tool as it does not take into account the simultaneous relationships that may exist between the variables in the model. The results of the regression analysis allow interpretation of the effect of a particular variable, holding all the other variables in the model constant, for example, the effect of age on healthcare utilization given that an inmate is male, has multiple comorbidities, is a smoker, and has been incarcerated for committing a violent crime.

Documented Encounters with Medical Providers

The results of the regression analysis reveal that having more problems listed in the inmate's electronic health record and having a diagnosis of diabetes were the only two factors that were statistically significantly associated with increased medical care utilization, after controlling for all other variables. Adhering to diet was statistically significantly associated with decreased medical care utilization, holding all other variables constant. Based on previous studies in the non-incarcerated population, these results were as expected. Two other variables were associated with reduced medical care utilization – having no provider documentation on adherence to diet, physical activity and medication and having no Framingham Risk Index score. Having no provider documentation of self-reported adherence to physical activity, diet and medication could be associated with less within facility medical care utilization because inmates are not receiving the recommended number of chronic care visits at which these questions should routinely be asked. The Framingham risk index is appropriate for use in individuals aged 30 to 74 and comprises a number of measures: gender, blood pressure (systolic and diastolic), total cholesterol, HDL values, smoking status and whether or not the individual has diabetes. Of the 577 inmates, 38 were not in the appropriate age range for the calculation of a Framingham Risk Index Score. Of the remaining 539 inmates, a Framingham Risk Index Score could only be calculated for 322 inmates because at least one of the measures necessary for calculating the score was missing. As with provider documentation of adherence, if inmates are not having regularly scheduled chronic care visits with providers, this could be associated with reduced within facility medical utilization. An alternative for both missing value variables, is that the inmates are receiving the recommended minimum number of visits but the

providers are not documenting adherence or the measures used in the Framingham Risk Index, or that the inmates are missing appointments, refusing treatment, or not providing the information when asked.

Documented Encounters with Mental Health Providers

There were many more significant variables in the regression results of mental health utilization than in the regression results for either medical care utilization or secondary care. The variables that predict increased mental health utilization and were expected include having a diagnosis of mental illness, having more problems listed in the EHR, refusing or missing treatment and being convicted of a violent crime. More encounters with medical providers could possibly result in more utilization of mental health services if medical providers refer patients they consider in need of mental health treatment. Support for this theory is that inmates who received the minimum number of chronic care visits also had more documented encounters with mental health providers, while those inmates who had no provider documentation of adherence (possibly due to not having regularly scheduled chronic care visits, as previously discussed) had statistically significantly fewer documented encounters with providers. In addition, two variables that may be associated with decreased access to care were also associated with fewer documented encounters with mental health providers, namely, a higher volume of care indicator and an increasing inmate to total medical staff ratio. The type of crime reported was extracted from the Kentucky Offender Online Lookup which is publicly available data. It is not clear if there is anything systematic about the inmates on whom data is missing that would explain why inmates whose type of crime was not reported had substantially and statistically significantly increased rates of mental health utilization. This is potentially an area for future research. The results that were unexpected and require further research were all associated with decreased utilization of mental healthcare services: greater age, a better Framingham Risk Index score, being a repeat offender, being at a maximum security prison or at the women's prison, and a higher inmate to total corrections staff ratio.

Odds of Receiving Secondary Care

The results of the regression analysis on receipt of secondary care reveal that, holding all other variables constant, only increasing age and having more problems documented in the electronic record were statistically significantly associated with increased odds of receiving secondary care. Repeat offenders had 50% less odds of

receiving secondary care. It is not clear, why this is the case, and this presents a possibility for future research.

Factors that were not statistically significantly associated with any of the outcomes in the bivariate analysis were being a tobacco user, education level and race. In fact, the results of this research indicate that having ever been a smoker was associated with lower medical and mental healthcare utilization and reduced odds of receiving secondary care, although this was not a statistically significant association. This result was unexpected and could be due to measurement error. The classification of smoker used for the purposes of this research was if the inmate had ever had a diagnosis of smoking or tobacco use documented in his/her electronic health record. It could be that some inmates who were smokers did not have this documented in their electronic record. In addition, individuals who were documented as being smokers in their electronic health record could subsequently have quit smoking. In addition, on May 1, 2006, the Kentucky Department of Corrections began implementing a ban on the use of all tobacco products by staff or inmates which has been phased in by facility. Kentucky State Reformatory was the first facility to institute this ban, so in theory, none of the 175 inmates in this sample had been smoking for at least six months prior to the start of January 1, 2007, the start date for this study.

Comparisons of Research Results with Relevant Data from the Non-Incarcerated Population

In order to put the results of this research in perspective, it is useful to compare the average charges for hospital stays between the incarcerated and the non-incarcerated. The mean charge per hospital stay for the Kentucky state prison inmates studied in this dissertation was \$24,057 with an average length of stay for both inpatient and observation stays of 3.95 days. A statistical brief prepared for the Agency for Healthcare Research and Quality by Merrill, Stocks and Stranges (2009) used data from the Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project and reports that in 2006 the average charge for a hospital stay for an uninsured individual was \$19,400 with an average length of stay of 4 days. Data from the Comprehensive Hospital Abstract Reporting System from the Washington State Department of Health reported by Burley (2009) compared the cost of hospitalizations of adults with and without a mental health diagnosis by various payer types: Medicare, Medicaid, Health Maintenance Organizations and commercial insurers. Adults with a diagnosis of mental

illness or substance abuse had, on average, higher charges for hospital stays than adults with no such diagnosis. For adults with no diagnosis of mental illness or substance abuse, the lowest average charge for a hospital stay was \$20,277 for patients on Medicaid, and the highest average charge for this group was \$31,459 for patients on Medicare. For adult patients with a diagnosis of mental illness or substance abuse, the lowest average charge for a hospital stay was \$20,663 for patients belonging to a Health Maintenance Organization and the highest average charge was \$23,377 for patients on Medicare. The average total secondary care costs for Kentucky State prison inmates who received secondary care (\$24,057) appears comparable with these results.

Comparing the rate of CABG procedures in this sample inmate population with rates in the US and Canadian Population, it would appear that the rate is lower in the inmate population than the non-incarcerated population. Only one of the 577 inmates in the sample received a Coronary Artery Bypass Graft (CABG). Extrapolating this one case to a rate per 100,000 inmates, the rate of CABG in the inmate population would be approximately 173/100,000. This is considerably lower than Agency for Healthcare Research and Quality data which indicate a rate in the United States of 241.41/100,000 of the population aged 40 years and over, and a rate of 251/100,000 of the population aged 20 years and over in Canada. (US data accessed at <http://chfs.ky.gov/NR/rdonlyres/83B5F306-6A8C-49D7-BB48-1D0C9758A88A/0/2006FebInpatientQualityIndicators.pdf> and Canadian data accessed at http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=12912 accessed on August 31, 2009.)

The Relationship Between Number of Staff, Quality of Care Variables and Secondary Care Costs

The data was examined to estimate if more medical staff results in better quality of care scores as follows: 1) a greater percentage of inmates receiving the minimum number of chronic care visits 2) a higher mean number of inmates receiving the HEDIS process measures during the previous year (tests for HbA1c and microalbumin, lipid profile, eye exam) and 3) a lower volume of care indicator. Better quality of care may in turn translate into fewer secondary care visits and/or costs. BCFC, FCDC and RCC were excluded from this analysis as in total they contributed only ten inmates to the sample. No clear relationships could be determined indicating more staff results in better quality of care which results in lower secondary care costs for this sample. The medical

facility, KSR, had the most staff per inmate (23 inmates for each member of the medical staff) which translated into the lowest volume of care indicator, but because KSR attends to many of the sicker inmates, KSR had the highest cost of secondary care. On the other hand, EKCC had the fewest staff per inmate (99 inmates for each member of the medical staff) but did not have the best quality of care scores or the lowest secondary care costs. BCC had the highest percentage of inmates receiving secondary care (53%). KCIW had the highest percentage of inmates who received the recommended minimum number of chronic care visits (32%), and KCIW also had the highest volume of care score (on average, each provider at KCIW documented 1.58 medical encounters, compared to only 0.24 by providers at the medical facility). KSP had the lowest percentage of inmates receiving secondary care and, on average, the inmates at KSP received only one of the four HEDIS process measures. On average, the inmates at LLCC received almost all the HEDIS process measures and LLCC also had the lowest percentage of inmates who received the minimum number of recommended chronic care visits. The inmates at LLCC incurred the least secondary care costs.

Table 9-1: Inmate to Medical Staff Ratio, Quality of Care Variables, Percentage and Cost of Inmates Receiving Secondary Care

Facility	Inmate To Total Medical Staff Ratio	Quality of Care Variables			Sample inmates receiving secondary care (%)	Cost of secondary care
		Minimum # cc visits	HEDIS score	Volume of care		
BCC	57	6	2	0.69	53% ⁺	\$35,551.57
EKCC	99 ⁺	28	1.73	0.52	12%	\$12,259.07
GRCC	73	20	1.43	0.7	30%	\$28,149.04
KCIW	39	32 ⁺	3	1.58 ⁺	29%	\$50,311.45
KSP	50	29	0.95 ⁻	0.59	10% ⁻	\$18,880.71
KSR	23 ⁻	14	2.95	0.24 ⁻	42%	\$580,589.80 ⁺
LLCC	57	5 ⁻	3.86 ⁺	0.53	14%	\$3,270.78 ⁻
NTC	76	25	2.5	0.63	30%	\$32,650.37
WKCC	79	7	1.67	0.62	21%	\$23,977.97

⁺ indicates maximum value in the column

⁻ indicates the minimum value in the column

The following chapter will present concluding thoughts, limitations of the study and opportunities for further research.

Copyright © Sandra Jane Winter 2009

Chapter 10 - Discussion, Policy Implications, Future Research Opportunities and Conclusions

Discussion

Data Collection, Analysis and Reporting

One of the goals of this dissertation was to quantify and describe the healthcare utilization patterns of Kentucky state prison inmates on the premise that

"Measurements are key. If you cannot measure it, you cannot control it. If you cannot control it, you cannot manage it. If you cannot manage it, you cannot improve it.

It is as simple as that."

(Harrington, 1991, p.82)

In considering the relevance of this research to other states it is perhaps useful to use the structure, process, outcomes quality framework developed in 1966 by Avedis Donabedian (Donabedian, 1980).

Structure, Process and Outcomes

Gathering structure, process and outcomes data can be used to facilitate decision making through measurement, understanding, control and improvement. The structure of the health care delivery system represents those features that either facilitate or inhibit access to, and provision of health care services. The structure of care examines how medical and other services are organized in a particular delivery system. As an example, the variables used in this research could be classified and analyzed as structural characteristics as follows:

- the community (facility identifiers and descriptive statistics of facilities)
- the health care organization (inmate to medical and mental staff ratios),
- the population (demographic variables such as age, gender, race, educational level and marital status and health risk variables such as BMI, smoking status and adherence to diet, physical activity and medications and treatment, and sentence variables such as length of sentence, type of crime, time continuously incarcerated, repeat offender)
- the need for health care (prevalence and incidence of disease, Framingham risk index score, diagnosis of substance abuse or mental illness, smoking status)

Additional structural characteristics include the providers (demographic, educational and experience variables) and the capacity of the community or health care delivery system to meet those needs.

The process dimension of the health care delivery system regards the interaction between a patient and a provider, for example: was the interaction medically appropriate and were practice guidelines and standards of care followed. As an example, the variables used in this research could be classified and analyzed as process characteristics as follows:

- did providers document adherence to diet, physical activity and medication
- did inmates receive the minimum number of chronic care visits
- what is the volume of care indicator
- how many of the HEDIS process measures do inmates receive annually

Outcomes are often thought of as the “bottom-line” measure of the effectiveness of the health care delivery system and encompass specific indicators of what happens to the patient once care has been delivered. Outcomes can be measured in terms of clinical and functional status and mortality rates. As an example, the variables used in this research could be classified and analyzed as outcome measures as follows:

- blood pressure and cholesterol readings that are part of the measures included in the Framingham risk index
- the number of outside trips and whether these required ambulance transportation, emergency department visits, or inpatient/observation admission

In order to gather accurate, timely data, on the structure, process and outcomes indicators as discussed above, it is recommended that all states implement a statewide Electronic Health Record system.

Electronic Health Record Systems

The potential advantages of an electronic health record system include 1) improved quality of care (through such things as reminders, and best practice templates) 2) improved continuity of care when inmates are transferred to other prisons in the system, 3) improved coordination of care by a team of healthcare providers who may be situated remotely (this is particularly important for patients with chronic conditions or co-morbidities who are likely to be under the care of a range of providers), 4) the provision of data which can be used to conduct epidemiological research and assist in resource

allocation decisions, and 5) decreased use of paper medical records is also good for the environment and can save storage space.

In order to be useful, data that has been gathered must be analyzed. A tool that has been adopted by healthcare providers in the for profit, not for profit and government sectors (including the Veterans Health Administration) is the use of a Balanced Score Card.

A Useful Data Collection and Analysis Tool: The Balanced Score Card

The concept of a Balanced Score Card was originated by Robert Kaplan and David Norton (1992) for the purposes of presenting a more balanced approach to organizational performance measurement than focusing primarily on financial metrics. A Balanced Score Card can be used to monitor important variables and trends for multiple organizational priorities and often measures achievement against an established benchmark. Typically, the data are categorized as financial, internal business processes, customer and organizational learning and growth, although these categorizations could be varied to suit the nature and goals of a particular organization. In a corrections setting, a modified Healthcare Balanced Score Card could 1) be produced quarterly, 2) include aggregate information as well as data on the top or bottom quintiles for each measure and 3) be categorized by facility for facility level comparisons. Examples of metrics that might be monitored include:

- financial data - metrics to monitor the cost of outside care provided to inmates and the cost of pharmaceuticals
- internal business processes data – volume of care indicators, quality of care indicators, provider practice patterns (are providers providing care congruent with clinical care guidelines embedded in the electronic health record, in terms of screening, disease management, providing health education?)
- inmate (customer) data - metrics to measure average daily count of inmates by major disease classification (including infectious and chronic diseases), number of inmates with a certain number, say five, current problems listed, health status of inmates using either the Framingham Risk Index or the Charlson Co-Morbidity Index, number of grievances filed
- staffing data - metrics to monitor number of inmates seen per provider, staffing patterns by institution, continuing medical education received by providers.

Collaboration Between Departments of Corrections and Academic Research Institutions

Closer affiliation between academic institutions and Departments of Corrections could present opportunities for training and skill development for a broad spectrum of individuals such as public health workers, nurses, medical and mental health providers, social workers and correctional staff. Such affiliations may facilitate the translation of research into practice, and reciprocally, ensure that researchers are better informed regarding the challenges facing those who work with the corrections population. Corrections workers who have training in how to deal with a population that is increasingly aging, and has mental health and substance abuse issues may be more effective in reducing within facility disruptive behavior by inmates, and in preparing inmates for release.

Healthcare Utilization and Cost Control Strategies

Privatization of the Provision of Correctional Healthcare Services

There are a number of different models for the provision of correctional healthcare: 1) provision by the state, 2) contracting out to private, for profit correctional healthcare provider organizations 3) a hybrid of public/private partnerships. In a fully state-operated system government employees provide medical care and all associated costs are borne by the state. A fully privatized system is similar to a Health Maintenance Organization in that the government pays a private firm a per inmate per month fee to assume the financial risk and organizational responsibilities of providing healthcare. If the private organization can provide care for less than the per inmate per month fee, the reward accrues to the private corporation, but if the cost of care exceeds the per inmate per month fee, the cost is then borne by the private corporation. The Kentucky Department of Corrections is a public/private partnership in which the Kentucky Department of Corrections retains the full financial obligation of inmate healthcare, but a private healthcare management company administers the healthcare provision for a per inmate per month management fee. This relationship is mediated by the University of Kentucky (specifically, the Kentucky Corrections Health Services Network). In Texas, all inmate healthcare is provided under contract to the Texas Department of Criminal Justice by two academic medical centers (the University of Texas Medical Branch and the Texas Tech University Health Sciences Center). The program is managed by a committee made up of members of the Texas Department of Criminal Justice, the

academic medical centers and the public. As in Kentucky, the state bears the cost of inmate medical care.

Advocates of privatization suggest a number of potential benefits. These include cost savings, increases in efficiency and accountability, improvements in the quality of services delivered, increases in competition and innovation, reductions in the number of public employees and the influence of unions, the potential to raise revenue and promote local economic development and the improvement of the operations of government. Opponents of privatization argue that profit maximization by private contractors may result in a decrease in the quality of services provided because there is no guarantee that standards will be upheld, and private firms may cut corners to maximize profits. Those opposed to privatization also cite the potential for low balling (which occurs when a contractor bids too low to secure the contract but then cannot provide the service at the quoted price), corruption (such as payoffs, bid-rigging, price-fixing and kickbacks), lack of control and accountability and concerns regarding equity. Some of the objections to privatization can be ameliorated if 1) the bidding process is carefully constructed and monitored 2) the contract has clear and measurable performance standards, 3) accurate data are collected and reported to track that the performance standards are being met and 4) there is adequate and on-going oversight by the Department of Corrections.

Privatization of prison healthcare services in the United States is a multi-billion dollar industry. A departmental working paper by Bedard and Frech of the Department of Economics at the University of California, Santa Barbara (2007) quotes figures indicating that in 2004, 32 states had contracted out some or all of the provision of health services, and that \$3 billion of the \$7 billion spent on inmate healthcare goes to privately operated prison healthcare corporations. The authors review literature indicating that privatization results in decreases in the cost of providing inmate healthcare. They use Census of Prison data from 1979, 1984 and 1990 and a fixed effects Poisson model to examine the effect of privatization on the quality of inmate health care as measured by mortality rates. The authors find that “a 20 percent increase in percentage of medical personnel employed under contract increases mortality by 2 percent.” (pg 4). They conclude that privatization results in both reduced costs and reduced quality of inmate medical care.

The Use of Telemedicine

Improved communication technology could potentially be used to increase inmates' timely access to healthcare in a cost effective way. Although initial investments in equipment and technology can be high, over the long term, substantial reductions in the unit cost of patient/provider contacts could reduce healthcare costs directly and indirectly if improved access reduces length or severity of morbidity. Utilizing telemedicine involves real time interactions between medical staff and inmates located at the prison and healthcare providers located elsewhere in which all participants are present at the same time. Such contacts may be difficult to schedule. Asynchronous contacts can be more flexible as they allow prison healthcare providers to send inmate healthcare information to outside providers which can be reviewed at a time convenient to the recipient. The advantages of either of these methods are that inmates can benefit from specialized care without necessarily being transported outside the facility and prison healthcare providers have access to the expertise of outside specialists.

Inmate Co-Pays for Medical Care

Many states have instituted co-pays for certain medical services provided to inmates. Vogt (2002) suggests that the courts have found that it is not unconstitutional to charge inmates a small co-pay for medical care as long as those inmates who cannot afford the co-pay are not denied necessary medical care. This policy should ensure that no disparities in the provision of necessary healthcare services arise based on an inmate's financial status. The determination of what constitutes "necessary healthcare services" may, however, differ between providers and inmates. No published articles could be found reporting the results of properly conducted studies examining healthcare utilization patterns prior to and after implementing inmate co-pays. Unintended consequences of the co-pay policy are 1) it is possible that access to both necessary and other care may be curtailed if an inmate cannot afford the co-pay 2) an inmate who cannot afford the co-pay may ignore minor medical complaints which, if untreated, may develop into more serious concerns, 3) inmates may choose to forgo medical care and spend their scarce financial resources on items such as food or toiletries, and 4) the costs of managing a co-pay system may be greater than the revenue collected (Harrison, 1996).

There are three reasons for charging inmates co-pays for medical services: 1) to reduce frivolous healthcare utilization, 2) to instill responsible behavior by inmates that

parallels the co-pay requirements in the non-incarcerated population and 3) to offset the cost of services provided. Vogt makes the unsubstantiated claim that instituting co-pays by inmates for medical care has resulted in decreased healthcare utilization while Rold (1996) expresses concern that the few poorly conducted studies that have been carried out generally report aggregated results of healthcare utilization without taking quality or necessity of care into consideration. These few studies cannot be used to determine if the decrease in healthcare utilization is attributable only to those inmates who abuse the sick call visit process.

The Kentucky Department of Corrections policy on inmate co-pays for medical services is as follows "An inmate shall be charged \$2.00 for each non-emergency visit to sick call unless the inmate is indigent as defined in CPP 15.7. An inmate shall not be charged for chronic care clinics or ongoing sick call services, for example a blood test for diabetes, blood pressure checks for a hypertensive individual or other follow-up services as directed by the medical staff." Policy Number 13.2, Effective Date, February 3, 2006. An indigent inmate is defined as one who has had less than \$5.00 in his/her account for 30 days prior to requesting indigence status. As previously mentioned, the co-pay for medical services is deducted from the inmates prison account. All inmates are required to work while incarcerated unless they are medically excused. To put the value of the co-pay in perspective, daily wages for Kentucky state prison inmates range from 80 cents per day for a four hour job, \$1.30 per day for an eight hour job and \$2 per day for specialized assignments. An inmate may earn "work time credit" which is deducted from his/her sentence, and in this case, the wages specified above are halved. Policy 19.4, Effective Date, February 3 2006.

An innovative approach to inmate co-pays for medical care has been implemented by the Arizona Department of Corrections (Schriro, 2009). Inmates who adhere to healthy lifestyle behaviors such as not using tobacco products, exercising regularly and adhering to medical treatment have lower co-pays than inmates who do not adhere to healthy lifestyle behaviors. The rationale for this policy is that in the non-incarcerated population, individuals with higher health risk behaviors often incur higher insurance premiums or co-pays than individuals who adhere to healthy lifestyle behaviors. This policy creates an economic incentive for inmates to adopt healthy lifestyle behaviors, and potentially reduces the long term cost of inmate healthcare for the state.

Shifting the Cost of Inmate Care to Medicaid/Medicare

State Governments bear the financial cost associated with incarcerating prison and jail inmates. There is an economic incentive for States to seek Medicaid matching funds and Medicare reimbursement from the Federal Government for the cost of providing healthcare to those prison inmates who, if not incarcerated, would qualify for Medicaid or Medicare benefits. Under present legislation, however, states cannot receive matching funds from Medicaid or Medicare reimbursement to offset the cost of inmate healthcare (Social Security Act § 1905(a)(A) and 42 U.S.C. § 1396(d)(a)(27)(A)). A web article by Dr Robert Bernstein, the Executive Director of the Bazelon Center for Mental Health Law suggests that there are two exceptions to this rule: 1) if an inmate is transferred from a correctional facility to an outside hospital for acute healthcare services, in which case the hospital can claim federal Medicaid reimbursement for such services and 2) if an individual is temporarily incarcerated while other more suitable arrangements for care can be finalized, in which case Medicaid eligible services remain reimbursable (42 C.F.R. § 435.1009(b)) (accessed on August 20, 2009 at <http://www.bazelon.org/issues/criminalization/findingthekey.html#23>). Individuals with mental illness may qualify for Medicaid through Supplemental Security Income provisions. If an individual is incarcerated for less than one year, states can choose to suspend rather than terminate Medicaid and Supplemental Security Income eligibility. Incarceration for more than a year results in termination of eligibility, in which case an inmate has to reapply for benefits when released. If an inmate is assisted in making required applications as part of their pre-release planning, this may minimize delays in re-establishing benefits and help ensure greater continuity of medical and mental healthcare upon release. Although current legislation does not allow states to share the cost of inmate healthcare with the federal government, this is an area worthy of continuing political dialogue.

Unintended Consequences of Improving Healthcare Quality

Many inmates can be viewed as having a life-long relationship with Departments of Corrections, either because they are incarcerated for lengthy periods of time, or because they cycle in and out of prison. Improving the health status of inmates could therefore be considered as a long term project. While the cost of providing preventive tests and properly managing chronic conditions may result in increased healthcare

expenditure in the short term, if such expenditure results in reduced morbidity over time, there could be substantial savings in the long term.

Policy Implications for the Kentucky Department of Corrections

Case Management for Inmates with Multiple Comorbidities

Inmates with more problems listed in their electronic health record have more documented encounters with medical and mental health providers and increased odds of receiving secondary care. Providing case management services to individuals with multiple comorbidities while they are incarcerated may produce a number of benefits for those involved in the planning, administration and provision of correctional healthcare; for inmates and for the taxpaying public.

At the organizational level, case managers can assist providers by ensuring that recommended quality of care guidelines are achieved for the chronic conditions examined in this study and for other conditions such as asthma, HIV, seizure disorder, tuberculosis and major mental illness. Case managers can assist with the administrative requirements of disease management, for example, scheduling of appointments, reminders and ensuring that laboratory tests are ordered, and the results entered in the inmates' electronic health record. Improving quality of care has been associated with reduced utilization of healthcare services and reduced healthcare costs in the non-incarcerated population (Cutler, Palmieri, Khalsa & Stebbins, 2007; Wise, Bahl, Mitchell, West, & Carli, 2006; Sidorov, Shull, Tomcavage, Girolami, Lawton & Harris, 2002). Effective disease management of chronic conditions often requires coordination between various healthcare providers which can be facilitated by a case manager. The corrections environment may pose additional administrative challenges unique to this environment. Ensuring that the medical care provided to prisons inmates is consistent with national clinical guidelines may reduce risk of litigation. Appointing a case manager at the bigger prisons, or one to be shared by smaller prisons located in the same part of the state is likely to be less expensive than hiring providers, and in addition, will free the providers to focus on delivering healthcare. Case managers could also assist with the medical component of re-entry planning for inmates about to be released back to their community.

From the inmates' perspective, case managers can promote patient compliance with treatment regimens by monitoring adherence to diet, physical activity and

medication. The results of this study indicate that refusing or missing treatment was statistically significantly associated with more documented encounters with mental health providers. Although not statistically significant ($p = 0.098$), adherence to medication resulted in a 41 percent reduction in the expected rate of documented encounters with mental health providers. Case managers could be used to identify, monitor and manage inmates who refuse or miss treatment and are non-compliant with their medications. Case managers can also coordinate health education for inmates that is culturally appropriate and aimed at the correct education level.

In the long term, case management and disease management may result in more effective utilization of resources and improvements in the quality of care which will be of benefit to the taxpaying public.

In addition to managing inmates with multiple comorbidities, case managers may also be utilized to cost-effectively coordinate the care of elderly prison inmates.

Improving Elder Care

The median age of this sample of the Kentucky inmate population was 48.2 and the mean length of sentence for this sample was 35.8 years. As in other states, the Kentucky inmate population appears to be aging and the results of this research indicate that an aging inmate population is associated with increased odds of receiving secondary care. Providing healthcare to older inmates has been associated with increased expenditure (Kinsella, 2004; Reviere & Young, 2004). A variety of policy approaches have been adopted to deal with the aging inmate population. A number of states have early release programs for terminally ill inmates, many of whom are elderly (Kinsella, 2004). Although releasing inmates to the care of family and friends removes the problem from the jurisdiction of Departments of Corrections, these inmates are likely to impose considerable burden to the communities to which they are returned, particularly if these communities are under resourced in terms of healthcare services. An additional concern is that of public safety. Inmates who appear terminally ill may recover and then are "at large" within the community. For those inmates who remain incarcerated, there is debate about the appropriate housing arrangement for elderly prison inmates, with some states providing segregated housing away from the general inmate population and others providing consolidated housing units within the prisons (Thivierge-Rikard & Thompson, 2007). Using data from the 2000 Bureau of Justice Statistics Census of State and Federal Adult Correctional Facilities Thivierge-Rikard and

Thompson (2007) found that inmates housed in consolidated housing units within the prison received more mental health services than inmates segregated in geriatric units. Providing programs for the elderly that promote healthy “aging in place” may reduce depression and increase functionality among elderly inmates (Allen, Phillips, Roff, Cavanaugh & Day, 2008; Meeks, Sublett, Kostiw, Rodgers, & Haddix, 2008). Instituting policies regarding advance care planning and end-of-life care may facilitate medical decision making for both inmates and correctional health administrators. This may in turn result in more effective utilization of resources. A number of states have instituted hospice services to facilitate death with dignity (Kinsella, 2004; Reviere & Young, 2004). Correctional hospice services have additional challenges not faced by hospice programs for the non-incarcerated. As noted in a recent editorial in the *Journal of Hospice & Palliative Nursing* (2008, p. 258) “It (hospice services) requires that one inmate be given preferential treatment over others, a difficult concept from a logistical and psychosocial perspective for prison staff and inmates.” Many of the corrections based hospice programs use inmate volunteers. Inmates could also potentially be used as community health workers.

Providing Health Education

Providing health education may reduce high risk health behaviors such as poor nutrition, lack of exercise, use of tobacco and non-adherence to medication and/or treatment. An Inmate Health Risk Assessment (I-HRA) which is a self-report assessment of an inmate’s health risk behaviors has been customized for use in the incarcerated population by Curd, Winter & Connell (2005). The administration of this tool, or a similar one, would provide quantifiable information on inmate’s modifiable health risks and allow for targeted health education interventions. Of the modifiable health risk behaviors included in this research, only self-reported adherence to diet was statistically significantly associated with fewer documented encounters with medical healthcare providers. Overweight and obesity have been associated with increased morbidity and mortality, as noted earlier in this research. Ensuring inmates have access to a healthy diet, both in the dining halls and the prison stores, may, in the long term, reduce inmate healthcare utilization.

The effects of the phased-in smoking ban being implemented by the KyDOC on the incidence of acute myocardial infarction and on the number of prescription medications sent to the facilities for asthma and/or chronic obstructive pulmonary

disease (COPD) in the 18 month period pre- and post-ban are currently the subject of further research by members of the Kentucky Corrections Health Services Network. Other studies have noted that smokers at tobacco free facilities can often be considered lifetime smokers and are likely to resume smoking immediately upon release. The policy implication of this is that smoking cessation programs should still be offered, even in tobacco free facilities, particularly as part of pre-release planning (Voglewede & Noel, 2004). In a study of 866 female inmates from Mississippi, Cropsey, Eldridge and Ladner (2004) found that 73.4 percent of the inmates were current tobacco users, 12.5 percent of whom reported a tobacco-related medical problem and that 71.4 percent of heavy smokers reported an interest in enrolling in a smoking cessation program. Instituting risk reduction behaviors pre-release has also been found effective in improving birth control utilization in female offenders. In a study of 484 women incarcerated at Rhode Island Adult Correctional Institute, 39.1 percent of women who were offered contraception just prior to their release reported contraception use in the four weeks post release, compared to only 4.4 percent of women who were offered referrals for contraceptive services at a community health clinic after their release (Clarke, Rosengard, Rose, Hebert, Peipert & Stein, 2006).

Health education may improve health literacy. Although inmate educational level was found not to be statistically significantly associated with healthcare utilization by this sample of inmates, a study of 52 HIV positive inmates from San Francisco who were followed over 7 years from 1999 to 2006 found that a lack of high school education played a prominent role in recidivism (Marlow, White, Tulskey, Estes & Menendez, 2008). In the sample inmate population used for this research, just over 50 percent graduated from high school. Low inmate literacy levels have been identified as a barrier to effective medical decision-making in the inmate population (Enders, Paterniti, & Meyers, 2005).

Using Inmates as Community Healthcare Workers

Inmates are isolated from their families and instead have a peer group who potentially could provide social support. Inmate community health workers could be trained to provide cultural and gender sensitive support to other inmates with chronic conditions and thereby relieve some of the burden of correctional healthcare providers. In the non-incarcerated population, community health workers have been trained to provide culturally appropriate social support for such things as cancer screening and hypertension control in minority groups (Brownstein et al., 2007; Gotay & Wilson, 1998).

Within the inmate community, inmate peer leaders could facilitate health promotion initiatives (Curd, Winter & Connell, 2007).

Limitations and Opportunities for Further Research

Many of the limitations of this research also present opportunities for further research. The sample of inmates all had at least one of three chronic conditions. No comparison data are presented for other subgroups of inmates such as those who do not have chronic disease or those who have other chronic conditions. Future research could expand the inmate sample to include other disease states. This sample had very few female inmates so future research could expand the inmate sample to include more females. As with many data sets, the data used in this research are subject to measurement error. Some of the variables reflect self-reported data by inmates which may not be accurate. There was a considerable amount of missing data for some of the variables. No attempt was made in this research to validate the necessity of the healthcare services provided to inmates, which could potentially be done by an independent chart review of inmates' medical records. Increased within facility healthcare utilization for preventive and diagnostic services may, in the long term be associated with improved health outcomes and reduced healthcare utilization which would be of benefit to both the inmates and Departments of Corrections. Identifying characteristics of inmates who are more likely to engage in frivolous healthcare utilization may be useful to corrections healthcare providers and administrators. The effect of individual provider characteristics on inmate healthcare utilization could be included in future research. These variables might include demographics (gender, age, race), number of years in practice and in corrections practice and type of employment contract (state employee or contracted out). A comparison of inmate healthcare utilization could be conducted between inmates incarcerated at privately operated prisons and inmates incarcerated at state-operated prisons.

In educational research, it has been noted that there are unobservable features of particular schools (for example, peer effects) that affect the outcome of interest of individual students who attend those schools. In the same way, it is possible that there may be unobservable features about prison facilities (for example individual provider practice patterns) that affect the healthcare utilization of inmates who are incarcerated at those facilities. In circumstances where there is clustering of observations within various groups, it is possible that there will be correlation between observations (intra-class

correlation) belonging to particular groups, for example, all inmates at a particular facility might utilize healthcare in a slightly different way compared to inmates at another facility. Such correlation violates one of the assumptions underpinning linear regression modeling – namely that each observation is independent of all other observations in the data set. This would result in mis-estimation of the standard errors which may render significance tests invalid. Typically this would result in Type 1 errors in which the null hypothesis is incorrectly rejected when it is in fact true, or in other words, an effect is observed where none in fact exists. Multilevel modeling has been developed to account for the fact that inmates are clustered within facilities and models the dependence among observations from specific facilities. Kreft and De Leeuw (2007) suggest that to obtain sufficient statistical power, the number of groups should be greater than 20. The data used in this research were extracted from only 12 prisons, of which only four had more than 30 inmates, but in a larger sample, multilevel analysis would be appropriate. Future research should use a larger data set to examine the effect of facility on individual outcomes using multilevel modeling.

Conclusion

The inmate population is increasing, aging and generally in poorer health than the non-incarcerated population. This is likely to place considerable burden on state budgets because of the constitutional mandate that requires that incarcerated individuals be provided with healthcare that is appropriate to prevent mortality, disease and permanent disability. Inadequate provision of healthcare to inmates can result in litigation, with the risk of judicial intervention in the management and administration of prisons, and in additional financial burden on state budgets. Effective strategic planning regarding the provision of healthcare services to this population group requires data-based knowledge of the healthcare utilization patterns of inmates. Little published work is available that examines this important issue, perhaps because many state Departments of Corrections lack adequate health information technology systems which can be used to gather, store and access the necessary data. The recent implementation of a state-wide electronic health record system by the Kentucky Department of Corrections, in combination with the public/private partnership between the University of Kentucky, the Department of Corrections and a private healthcare management company, Correctcare Integrated Health, LLC, has provided a unique opportunity to study the healthcare utilization patterns of Kentucky state prison inmates. This research

has provided a foundation, upon which further research can be based. Much remains to be learned and achieved in this area.

Bibliography

- Ackermann R, Cheadle A, Sandhu N, Madsen L, Wagner E, LoGerfo J. (2003) Community exercise program use and changes in healthcare costs for older adults. *American Journal of Preventive Medicine*. 25(3): 232-237.
- Ahluwalia I, Mack K, Murphy W, Mokdad A, Bales V. (2003) State-specific prevalence of selected chronic disease-related characteristics--Behavioral Risk Factor Surveillance System, 2001. *Morbidity and Mortality Weekly Report, Surveillance Summary*. 52(8):1-80.
- Alguwaihes A, Shah B. (2009) Educational attainment is associated with health care utilization and self-care behavior by individuals with diabetes. *The Open Diabetes Journal*. 2(5): 24-28.
- Allen, R., Phillips, L., Roff, L., Cavanaugh, R., & Day, L. (2008) Religiousness/Spirituality and Mental Health Among Older Male Inmates. *Gerontologist*, 48(5), 692-697.
- American Correctional Association, Government and Public Affairs accessed at <http://www.aca.org/government/population.asp> on July 11, 2009
- American Correctional Association. Healthcare Standards accessed from <http://www.aca.org/standards/healthcare/Standards.asp> on August 4 2008.
- American Diabetes Association, Diabetes Statistics accessed at <http://www.diabetes.org/diabetes-statistics/cost-of-diabetes-in-us.jsp> on June 8, 2009.
- American Heart Association. (2009) Heart Disease and Stroke Statistics – 2009 Update. American Heart Association, Dallas, Texas.
- Anno J, Graham C, Lawrence J, Shansky R. (2004) Correctional Health Care: Addressing the Needs of Elderly, Chronically Ill, and Terminally Ill Inmates. *National Institute of Corrections Publication*. Accession No. 01873
- Baillargeon J, Giordano T, Rich J, Wu Z, Wells K, Pollock B, et al. (2009). Accessing Antiretroviral Therapy Following Release From Prison. *Journal of the American Medical Association*. 301(8): 848-857.
- Baillargeon J, Black SA, Pulvino J, Dunn K. (2000) The disease profile of Texas prison inmates. *Annals of Epidemiology*.10(2):71-73.
- Balkrishnan R, Rajagopalan R, Camacho F, Huston S, Murray F, Anderson R. (2003) Predictors of medication adherence and associated health care costs in an older population with type 2 diabetes mellitus: A longitudinal cohort study. *Clinical Therapeutics*. 25(11): 2958-2971.
- Balu S, Thomas J. (2006) Incremental Expenditure of Treating Hypertension in the United States. *American Journal of Hypertension*. 19: 810–816.
- Basu J, Mobley L. (2008). Trends in Racial Disparities Among the Elderly for Selected Procedures. *Medical Care Research & Review*. 65(5): 617-637.
- Bedard K, Frech T. (2007) Prison Health Care: Is Contracting Out Healthy? University of California at Santa Barbara, Economics Working Paper Series 11-07, Department of Economics, UC Santa Barbara.
- Bernstein A, Hing E, Moss A, Allen K, Siller A, Tiggler R. (2003) Health care in America: Trends in utilization. Hyattsville, Maryland: *National Center for Health Statistics*.

- Bernstein R. (Undated) Finding the Key to Successful Transition from Jail to the Community: An Explanation of Federal Medicaid and Disability Program Rules. Web article accessed on August 20, 2009 at <http://www.bazelon.org/issues/criminalization/findingthekey.html#23>.
- Bertakis K, Azari R, Helms J, Callahan E, Robbins J. (2000) Gender Differences in the Utilization of Health Care Services. *Journal of Family Practice*. 49(2): 147-152.
- Berwick D. (2003) Disseminating Innovations in Health Care. *Journal of American Medical Association*. 289: 1969-1975.
- Bird C, Shugarman L, Lynn J. (2002). Age and Gender Differences in Health Care Utilization and Spending for Medicare Beneficiaries in Their Last Years of Life. *Journal of Palliative Medicine*, 5(5), 705-712.
- Birnbaum H, Kessler R, Joish V, Kelley D, Ben-Hamadi R, Hsieh M, et al. (2009). Healthcare resource utilization and costs of mild, moderate, and severe depression in the workforce in the United States. *European Psychiatry*, 24: S614-S614.
- Borzecki A, Lee A, Kalman D, Kazis L. (2005) Do Poor Health Behaviors Affect Health-related Quality of Life and Healthcare Utilization Among Veterans? *Journal of Ambulatory Care Management*. 28(2): 141-156.
- Boyer E, Nielsen-Thompson N, Hill T. (2002) A comparison of dental caries and tooth loss for Iowa prisoners with other prison populations and dentate U.S. adults. *Journal of Dental Hygiene*. 76(2): 141-150.
- Brownstein, J., Chowdhury, F., Norris, S., Horsley, T., Jack, L., Zhang, X., et al. (2007, May). Effectiveness of Community Health Workers in the Care of People with Hypertension. *American Journal of Preventive Medicine*, 32(5), 435-447.
- Bureau of Justice Statistics Correctional Surveys (2008) The National Prisoner Statistics Program, Annual Survey of Jails, Annual Probation Survey, and Annual Parole Survey accessed on line on February 17 2009 at <http://www.ojp.usdoj.gov/bjs/glance/tables/corr2tab.htm>
- Bureau of Justice Statistics, Key Facts at a Glance accessed at <http://www.ojp.usdoj.gov/bjs/glance/tables/corr2tab.htm> on June 30 2009,
- Burley M. (2009) The costs and frequency of mental health-related hospitalizations in Washington state are increasing. Olympia: Washington State. Institute for Public Policy, Document No. 09-04-3401.
- Burns t, Stalker G. (1961) The Management of Innovation. London, Tavistock.
- Calhoun P, Bosworth H, Grambow S, Dudley T, Beckham J. (2002) Medical Service Utilization by Veterans Seeking Help for Posttraumatic Stress Disorder. *American Journal of Psychiatry*. 159(12): 2081-2086.
- Centers for Disease Control and Prevention, Office of Minority Health and Health Disparities website accessed at <http://www.cdc.gov/omhd/AMH/dbrf.htm> on September 21, 2008)
- Centers for Disease Control and Prevention, Diabetes Faststats accessed at <http://www.cdc.gov/nchs/fastats/diabetes.htm> on June 8 2009.
- Centers for Disease Control and Prevention, Hypertension Faststas accessed at <http://www.cdc.gov/nchs/fastats/hypertens.htm> on June 8, 2009).

- Clark B, Grossman E, White M, Goldenson J, Tulsy J. (2006) Diabetes Care in the San Francisco County Jail. *American Journal of Public Health*. 96(9): 1571-1574.
- Clark D, Fradkin J, Hiss R, Lorenz R, Vinicar G, Warren-Boulton E. (2000). Promoting early diagnosis and treatment of type 2 diabetes. *Journal of American Medical Association*. 284: 363-5.
- Clarke J, Rosengard C, Rose J, Hebert M, Peipert J, Stein M. (2006) Improving Birth Control Service Utilization By Offering Services Prerelease Vs Postincarceration. *American Journal of Public Health*. 96 (5): 840-845.
- Connell A, Curd P. (2006) An Initial Review of Inmate Electronic Health Records. An unpublished report prepared for the Medical Director of the Kentucky Department of Corrections.
- Cooper C. (2007) Drug Courts – Just the Beginning: Getting Other Areas of Public Policy in Sync. *Substance Use & Misuse*. 42: 243-256.
- Cropsey K, Eldridge G, Ladner T. (2004) Smoking among female prisoners: An ignored public health epidemic. *Addictive Behaviors*. 29(2): 425-432.
- Curd P, Winter S, Connell A. (2007). Participative Planning to Enhance Offender Wellness: Preliminary Report of a Correctional Wellness Program. *Journal of Correctional Health Care* 2007; 13(4): 296–308.
- Cutler T, Palmieri J, Khalsa M, Stebbins M. (2007) Evaluation of the relationship between a chronic disease care management program and California pay-for-performance diabetes care cholesterol measures in one medical group. *Journal of Managed Care Pharmacy*. 13(7): 578-588.
- Dartmouth Atlas Project Topic Brief. (2005). Effective Care. 11-15 A.
- Diabetes Control and Complications Trial Research Group. (1993). Expanded role of the dietitian in the Diabetes Control and Complications Trial: Implications for clinical practice. *Journal of the American Dietetic Association* 93 (7): 758 –67.
- Donabedian A. (1980) Explorations in Quality Assessment and Monitoring. Vol. 1. The Definition of Quality and Approaches to its Assessment. Ann Arbor, Mich.: Health Administration Press.
- Donohoe M. (2006) Women's Health in Context: Incarceration Nation - Health and Welfare in the Prison System in the United States. Medscape Ob/Gyn & Women's Health. 2006;11(1) ©2006. Posted 01/20/2006.
- Elhai J, Voorhees S, Ford J, Min K, Frueh B. (2009) Sociodemographic, perceived and objective need indicators of mental health treatment use and treatment-seeking intentions among primary care medical patients. *Psychiatry Research*, 165(1/2), 145-153.
- Enders S, Paterniti D, Meyers F. (2005) An Approach to Develop Effective Health Care Decision Making for Women in Prison. *Journal of Palliative Medicine*. 8(2): 432-439.
- Feldstein P. (2007) Health Policy Issues: An Economic Perspective. 4th edition Published by Health Administration Press, Chicago, Illinois & AUPHA Press, Washington, DC.

- Fickenscher A, Lapidus J, Silk-Walker P, Becker T. (2001). Women Behind Bars: Health Needs Of Inmates In A County Jail. *Public Health Reports*. 116(3): 191-196.
- Fox K, Grandy S. (2008) Out-of-pocket expenses and healthcare resource utilization among individuals with or at risk of diabetes mellitus. *Current Medical Research & Opinion*. 24 (12): 3323-3329.
- Frayne S, Yu W, Yano E, Ananth L, Iqbal S, Thraillkill A, et al. (2007) Gender and Use of Care: Planning for Tomorrow's Veterans Health Administration. *Journal of Women's Health (15409996)*, 16(8), 1188-1199.
- Gibbons J, Katzenbach N. (2006) Confronting Confinement. A Report of The Commission on Safety and Abuse in America's Prisons.
- Gotay C, & Wilson M. (1998). Social support and cancer screening in African American, Hispanic, and Native American women. *Cancer Practice*, 6(1), 31-37.
- Green C, Pope C. (1999) Gender, psychosocial factors and the use of medical services: A longitudinal analysis. *Social Science & Medicine*. 48(10): 1363-1372.
- Grossman M. (1972) On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*. 80 (2): 223-255.
- Gruber J. (2004) Public Finance and Public Policy. 2nd Edition. Worth Publishers.
- Hammett T, Harmon M, Rhodes W. (2002) The Burden of Infectious Disease Among Inmates of and Releasees From US Correctional Facilities, 1997. *American Journal of Public Health*. 92(11): 1789–1794.
- Harrington H. (1991) Business Process Improvement: The breakthrough strategy for total quality, productivity and competitiveness. New York: McGraw-Hill.
- Harrison B. (1996) In the Matter of Correctional Facilities Charging Prisoners for Health Services. *Journal of Correctional Health Care*.3: 109-127.
- Harlow C. (2003) Education and Correctional Populations. *Bureau of Justice Statistics*. NCJ 195670.
- Harzke A, Ross M, Scott D. (2006) Predictors of post-release primary care utilization among HIV-positive prison inmates: A pilot study. *AIDS Care* 18(4): 290-301.
- Hauenstein E, Petterson S, Merwin E, Rovnyak V, Heise B, Wagner D. (2006) Rurality, Gender, and Mental Health Treatment. *Family & Community Health*. 29(3): 169-185.
- Hebb J, Fitzgerald D, Weihong F. (2003) Health care disparities in disadvantaged Medicare beneficiaries: a national project review. *Journal of Health & Human Services Administration*. 26(2):153-173.
- Hill C. (2001) Inmate Health Care – Part I. *Corrections Compendium*. 26 (10): 6 – 18.
- Hiller M, Webster J, Garrity T, Leukefeld C, Narevic E, Staton M. (2005) Prisoners with Substance Abuse and Mental Health Problems: Use of Health and Health Services. *American Journal of Drug & Alcohol Abuse*. 31(1): 1-20.
- Hodgson T, Cai L. (2001) Medical Care Expenditures for Hypertension, Its Complications, and Its Comorbidities. *Medical Care*. 39(6): 599-615.

- Human Rights World Report, 2006 accessed at <http://www.hrw.org/wr2k6/wr2006.pdf>, July 18, 2008.
- Hunkeler E, Spector W, Fireman B, Rice D, Weisner C. (2003) Psychiatric symptoms, impaired function, and medical care costs in an HMO setting. *General Hospital Psychiatry*. 25(3): 178-184.
- Jacobi J. (2005) Prison Health, Public Health: Obligations and Opportunities. *American Journal of Law & Medicine*. 31 (4): 447-478.
- James D, Glaze L. (2008) Mental Health Problems of Prison and Jail Inmates. *Bureau of Justice Statistics Special Report NCJ 213600*.
- Jessa P, Winter S. (2007) Assessment Of KyDOC Inmate Pharmacy Services. An unpublished report prepared for the Medical Director of the Kentucky Department of Corrections.
- Johnson N, Backlund E, Sorlie P, Loveless C. (2000) Marital status and mortality: The National Longitudinal Mortality Study. *Annals of Epidemiology*. 10: 224–238.
- Joung I, Van Der Meer J, Mackenbach J.(1995) Marital Status And Health Care Utilization International Journal of Epidemiology. 24 (3): 569-575.
- Journal of Hospice & Palliative Nursing*, Sep/Oct2008, Vol. 10 Issue 5, p258-259.
- Kane R, Wall M, Potthoff S, McAlpine D. (2004). Isolating the Effect of Alcoholism Treatment on Medical Care Use. *Journal of Studies on Alcohol*. 65(6): 758-765.
- Kaplan R, Norton D. (1992) The balanced scorecard: measures that drive performance. *Harvard Business Review*. Jan – Feb: 71-80.
- Karberg J, James D. (2005) Substance Dependence, Abuse and Treatment of Jail Inmates, 2002. *Bureau of Justice Statistics Special Report*. NCJ 209588.
- Kerr E, McGlynn E, Adams J, Keesey J, Asch S. (2004). Profiling the Quality of Care in Twelve Communities: Results from the CQI Study. *Health Affairs*. 23(3): 247-56.
- Kinsella C. (2004) Trends Alerts: Corrections Health Care Costs. The Council for State Governments. Lexington, Ky.
- Kirkman M, Williams S, Caffrey H, Marrero D. (2002). Impact of a program to improve adherence to diabetes guidelines by primary care physicians. *Diabetes Care*. 25 (11): 1946-51.
- Kim S. (2007) Deaths in the Cook County Jail: 10-Year Report, 1995–2004. *Journal of Urban Health*. 84(1): 70-84.
- Kreft I, De Leeuw J. (2007) *Introducing Multilevel Modeling*. Sage Publications. Great Britain.
- Kreyenbuhl J, Medoff D, Seliger S, Dixon L. (2008) Use of medications to reduce cardiovascular risk among individuals with psychotic disorders and Type 2 diabetes. *Schizophrenia Research*. 101(1-3): 256-265.
- Laditka S, Mastanduno M, Laditka J. (2001). Health Care Use of Individuals With Diabetes in an Employer-Based Insurance Population. *Archives of Internal Medicine*.161:1301-1308.

- Legoretta A, Christian-Herman J, Hasan M, Evans R, Leung K. (2000). Variation in managing asthma: experience at the medical group level in California. *American Journal of Managed Care*. 6: 445-53.
- Leigh J, Hubert H, Romano P. (2005) Lifestyle Risk Factors Predict Healthcare Costs in an Aging Cohort. *American Journal of Preventive Medicine*. 29(5): 379-387.
- Leukefeld C, Hiller M, Webster J, Tindall M, Martin S, Duvall J, Tolbert V, Garrity T. (2006) A Prospective Examination of High-Cost Health Services Utilization Among Drug Using Prisoners Re-Entering the Community. *Journal of Behavioral Health Services & Research*. 33(1): 73-85.
- Leukefeld C, Staton M, Hiller M, Logan T, Warner B, Shaw K, Purvis R. (2002) A descriptive profile of health problems, health services utilization, and HIV serostatus among incarcerated male drug abusers. *The Journal of Behavioral Health Services & Research*. 29(2): 167-175.
- Lindley M, Wortley P, Winston C, Bardenheier B. (2006, October). The Role of Attitudes in Understanding Disparities in Adult Influenza Vaccination. *American Journal of Preventive Medicine*, 31(4), 281-285.
- Lindquist C, Lindquist C. (1999) Health Behind Bars: Utilization and Evaluation of Medical Care among Jail Inmates. *Journal of Community Health*. 24 (4): 285-303.
- Marlow E, White M, Tulsy J, Estes M, Menendez E. (2008) Recidivism in HIV-infected incarcerated adults: influence of the lack of a high school education. *Journal of Urban Health*. 85(4): 585-595.
- Marshall T, Simpson S, Stevens A. (2001) Use of health services by prison inmates: comparisons with the community. *Journal of Epidemiology & Community Health*. 55: 364-365.
- Maruschak L. (2008) HIV in Prisons, 2006 *Bureau of Justice Statistics*. NCJ 222179.
- McGlynn E, Asch S, Adams J, Keesey J, Hicks J, DeCristofaro A, et al. (2003) The quality of health care delivered to adults in the United States. *New England Journal of Medicine*. 348(26): 2635-2645.
- Meeks, S., Sublett, R., Kostiwa, I., Rodgers, J., & Haddix, D. (2008) Treating Depression in the Prison Nursing Home: Demonstrating Research-to-Practice Translation. *Clinical Case Studies*, 7(6), 555-574.
- Menzin J, Langley-Hawthorne C, Friedman M, Boulanger L, Cavanaugh R. (2001) Potential Short-Term Economic Benefits of Improved Glycemic Control: A managed care perspective. *Diabetes Care* 24:51-55.
- Merrill C, Stocks C, Stranges E. (2009) Trends in Uninsured Hospital Stays, 1997-2006. Agency for Healthcare Research and Quality Statistical Brief # 67
- Mixson J, Eplee H, Feil P, Jones J, Rico M. (1990) Oral Health Status of a Federal Prison Population. *Journal of Public Health Dentistry*. 50(4): 257-261.
- Mokdad A, Marks J, Stroup D, Gerberding J. (2004) Actual Causes of Death in the United States, 2000. *Journal of American Medical Association*. 291(10):1238-1245.

- Morrow D, Clark D, Tu W, Wu J, Weiner M, Steinley D, et al. (2006) Correlates of Health Literacy in Patients With Chronic Heart Failure. *Gerontologist*. 46(5): 669-676.
- Mullen J. (1985) Prison Crowding and the Evolution of Public Policy. *Annals of the American Academy of Political and Social Science*. 478:31-46.
- Mumola C. (2007) Medical Causes of Death in State Prisoners, 2001 – 2004. Bureau of Justice Statistics. NCJ 216340.
- Mumola C, Karberg J. (2006) Drug Use and Dependence, State and Federal Prisoners, 2004. *Bureau of Justice Statistics Special Report*. NCJ 213530.
- Natarajan S, Nietert P. (2004) Hypertension, diabetes, hypercholesterolemia, and their combinations increased health care utilization and decreased health status. *Journal of Clinical Epidemiology*. 57: 954–961.
- National Commission on Correctional Health Care. (2008) Standards of Healthcare accessed at http://www.ncchc.org/resources/2008_standards/new_standards_article.html on August 5, 2008.
- National Commission on Correctional Health Care. (2002) The Health Status of Soon to be Released Inmates. A Report to Congress.
- Narevic E, Garrity T, Schoenberg N, Hiller M, Webster , Leukefeld , Tindall M. (2006) Factors Predicting Unmet Health Services Needs Among Incarcerated Substance Users. *Substance Use & Misuse*. 41(8): 1077-1094.
- Nicholson W. (2005) Microeconomic Theory: Basic principles and Extensions. 9th Edition. Published by Thomson, South-Western.
- Nietert P, French M, Kirchner J, Xiaotong H. (2004) Health Services Utilization and Cost for At-Risk Drinkers: Rural and Urban Comparisons. *Journal of Studies on Alcohol*. 65(3): 353-362.
- Nietert P, French M, Kirchner J, Booth B. (2007) Utilization and Cost of Mental Health, Substance Abuse, and Medical Services among At-Risk Drinkers. *Medical Care Research & Review*. 64(4): 431-448.
- Paasche-Orlow M, Wolf M. (2007) The Causal Pathways Linking Health Literacy to Health Outcomes. *American Journal of Health Behavior*. 31(s1): S19-S26.
- Palumbo P, Elveback L, Chu C, Connolly D, Kurland L. (1976). Diabetes mellitus: Incidence, prevalence, survivorship, and causes of death in Rochester, Minnesota 1945 – 1970. *Diabetes* 25(7):566-73.
- Paramore L, Halpern M, Lapuerta P, Hurley J, Frost F, Fairchild D, Bates D. (2001) Impact of Poorly Controlled Hypertension on Healthcare Resource Utilization and Cost. *American Journal Of Managed Care*. 7: 389-398.
- Parker F, Paine C. (1999) Informed consent and the refusal of medical treatment in the correctional setting. *The Journal of Law, Medicine & Ethics*. 27 (3): 240-51.
- Paris J. (1994) Inmate Overutilization of Health Care Is There a Way Out? *Journal of Correctional Health Care*. 1 (2): 73-90.
- Phelps C. (2003) Health Economics. 3rd edition. Published by Addison-Wesley.

- Pladevall M, Williams L, Potts L, Divine G, Xi H, Lafata J. (2004) Clinical Outcomes and Adherence to Medications Measured by Claims Data in Patients with Diabetes. *Diabetes Care*. 27: 2800-2805.
- Reviere R, Young V. (2004) Aging Behind Bars: Health Care for Older Female Inmates. *Journal of Women & Aging*. 16 (1/2): 55-69.
- RAND Health Research Highlights. (1998). Assessing the Appropriateness of Care: How Much is Too Much? RB-4522. © RAND
- Roeder P. (2008) Corrections Medical Staffing: Does Increasing Access to Primary Care Decrease Costs of Secondary Care? An unpublished report prepared for the Medical Director of the Kentucky Department of Corrections.
- Rold W. (1996) Charging Inmates for Medical Care: A Legal, Practical, and Ethical Critique. *Journal of Correctional Health Care*. 3: 129-143.
- Rowan P, Haas D, Campbell J, Maclean D, Davidson K. (2005) Depressive Symptoms Have an Independent, Gradient Risk for Coronary Heart Disease Incidence in a Random, Population-based Sample. *Annals of Epidemiology*. 15(4): 316-320.
- Ruilope L, Burnier M, Muszbek N, Brown R, Keskinaslan A, Ferber P, Harms G. (2008) Public health value of fixed-dose combinations in hypertension. *Blood Pressure*. S 17: 5-14.
- Rundall T, Shortell S, Wang M, Casalino L, Bodenheimer T, Gillies R, et al. (2002) As good as it gets? Chronic care management in nine leading US physician organizations. *British Medical Journal*. 325: 958-961.
- Sabol W, Couture H. (2008) Prison Inmates at Midyear 2007. Bureau of Justice Statistics NCJ 221944
- Sabol W, Minton R, Harrison P. (2007) Prison and Jail Inmates at Midyear 2006. *Bureau of Justice Statistics Bulletin*. NCJ 217675.
- Saleh S, Hannan E, Ting L. (2005). A Multistate Comparison of Patient Characteristics, Outcomes, and Treatment Practices in Acute Myocardial Infarction. *American Journal of Cardiology*, 96(9): 1190-1196.
- Samuelson P. (1954) The Pure Theory of Public Expenditure. *Review of Economics and Statistics*. 36(4): 387-389.
- Schneider A, Ingram H. (1993) Social Construction of Target Populations: Implications for Politics and Policy. *American Political Science Review*. 87(2):334-347.
- Schoepflin H, Thrailkill K. (1999) Pediatric diabetes management in Appalachian Kentucky: Adherence of primary care physicians to ADA guidelines. *Journal of Kentucky Medical Association*. 97(10): 473-81.
- Schiro D, (2009) Remaking Prison Life to Prepare Inmates for Reentry. National Institute of Justice. An Interview with Dora Schiro, former Director of the Arizona Department of Corrections accessed at http://www.ojp.usdoj.gov/nij/topics/corrections/NIJ_Audio_Player_schiro.html on August 20, 2009.
- Shalev V, Chodick G, Heymann A, Kokia E. (2005) Gender differences in healthcare utilization and medical indicators among patients with diabetes. *Public Health*. 119(1): 45-49.

- Shen C, Sambamoorthi U, Rust G. (2008) Co-occurring Mental Illness and Health Care Utilization and Expenditures in Adults with Obesity and Chronic Physical Illness. *Disease Management*. 11(3): 153-160.
- Sheps SB, Schechter MT, Prefontaine RG. (1987) Prison health services: a utilization study. *Journal of Community Health*.12(1):4-22.
- Shimkus J. (2004). The Graying of America's Prisons: Corrections Copes With Care for the Aged. *CorrectCare*. Summer 2004.
- Sidorov J, Shull R, Tomcavage J, Girolami S, Lawton N, Harris R. (2002) Does diabetes disease management save money and improve outcomes? *Diabetes Care*.25: 684 – 689.
- Smith R, Beaglehole R, Woodward D, Drager N. (2003) Global public goods for health: Health economic and public health perspectives. Oxford University Press. Oxford.
- Song J, Chang R, Manheim L, Dunlop D, (2006) Gender Differences across Race/Ethnicity in Use of Health Care among Medicare-Aged Americans. *Journal of Women's Health*. 15(10): 1205-1213.
- Sorlie PD, Backlund E, Keller JB. (1995) US mortality by economic, demographic, and social characteristics: the National Longitudinal Mortality Study. *American Journal of Public Health*. 85(7): 949-56.
- Staton M, Leukefeld C, Logan T. (2001) Health service utilization and victimization among incarcerated female substance abusers. *Substance Use Misuse*. 36 (6&7): 701 – 716.
- Staton-Tindall M, Duvall J, Leukefeld C, Oser C. (2007) Health, mental health, substance use, and service utilization among rural and urban incarcerated women. *Womens Health Issues*. 17(4):183-92.
- Stephan J. (2004) State Prison Expenditure, 2001. *Bureau of Justice Statistics*. NCJ 202949
- Stephan J, Karberg J. (2003) Census of State and Federal Correctional Facilities, 2000. *Bureau of Justice Statistics*. NCJ 198272
- Sun S, Liu G, Christensen D, Fu A. (2007) Review and analysis of hospitalization costs associated with antipsychotic nonadherence in the treatment of schizophrenia in the United States. *Current Medical Research & Opinion*. 23(10): 2305-2312.
- Sung J, Nichol M, Venturini F, Bailey K, McCombs J, Cody M. (1998) Factors affecting patient compliance with antihyperlipidemic medications in an HMO population. *American Journal of Managed Care*. 4: 1421-1430.
- Taylor A, Larson S, Correa-de-Araujo R. (2006) Women's health care utilization and expenditures. *Women's Health Issues*. 16(2): 66-79.
- Thivierge-Rikard R, Thompson M. (2007) The Association Between Aging Inmate Housing Management Models and Non-Geriatric Health Services in State Correctional Institutions. *Journal of Aging & Social Policy*., 19(4): 39-56.
- Torrey E. (1995) Jails and prisons--America's new mental hospitals. *American Journal of Public Health*. 85: 1611-1613.

- Travis J. (2007) Back-end Sentencing: A Practice in Search of a Rationale. *Social Research*. 74(2): 631-644.
- Trogdon J, Finkelstein E, Nwaise I, Tangka F, Orenstein D. (2007) The economic burden of chronic cardiovascular disease for major insurers. *Health Promotion Practice*. 8(3): 234-242.
- Twaddle A. (1976). Utilization of medical services by a captive population: An analysis of sick call in a state prison. *Journal of Health and Social Behavior* (17): 236-248.
- Udesky L. (2005) Court takes over California's prison health system. *The Lancet*. 366: 796-797.
- Voglewede J, Noel N. (2004) Predictors of current need to smoke in inmates of a smoke-free jail. *Addictive Behaviors*, 29(2): 343-348.
- Vogt R. (2002) Inmate Co-Pay Finds Support in the Courts. *CorrectCare*. National Commission on Correctional Health Care: Legal Affairs, accessed on August 19 2009 at http://www.ncchc.org/pubs/CC_archive/co-pay.html.
- Wagner E, Sandhu N, Newton K, McCulloch D, Ramsey S, Grothaus L. (2001) Effect of Improved Glycemic Control on Health Care Costs and Utilization. *Journal of American Medical Association*. 285:182-189.
- Wagner J, Pietrzak R, Petry N. (2008) Psychiatric disorders are associated with hospital care utilization in persons with hypertension. *Social Psychiatry & Psychiatric Epidemiology*. 43(11): 878-888.
- Walmsley R. (2007) World Prison Population List (Seventh Edition). Kings College, London. International Centre for Prison Studies accessed on line on July 15, 2007 at <http://www.kcl.ac.uk/depsta/law/research/icps/downloads/world-prison-pop-seventh.pdf>
- Walker R, Staton M, Leukefeld C. (2001) History of Head Injury Among Substance Users: Preliminary Findings. *Substance Use & Misuse*. 36(6-7): 757-769.
- Warner B, Leukefeld C. (2001) Rural-Urban Differences In Substance Use And Treatment Utilization Among Prisoners. *American Journal of Drug & Alcohol Abuse*. (27)2: 265 – 281.
- Welch V, Vukshich Oster N, Gazmararian J; Rask K, Schild L, Cutler C, Spettell C, Reardon M. (2006) Impact of a Diabetes Disease Management Program by Race and Ethnicity.. *Disease Management & Health Outcomes*. 14(4): 245-252.
- White J, Vanderplas A, Chang E, Dezii C, Abrams G. (2004) The Costs of Non-Adherence to Oral Antihyperglycemic Medication in Individuals with Diabetes Mellitus and Concomitant Diabetes Mellitus and Cardiovascular Disease in a Managed Care Environment. *Disease Management & Health Outcomes*. 12(3): 181-188.
- Williams B, Lindquist K, Sudore R, Strupp H, Willmott D, Walter L. (2006) Being old and doing time: functional impairment and adverse experiences of geriatric female prisoners. *Journal of the American Geriatrics Society*. 54(4): 702-707.
- Wilper A, Woolhandler S, Boyd, W, Lasser K, McCormick D, Bor D, Himmelstein D. (2009) The Health and Health Care of US Prisoners: Results of a Nationwide Survey. *American Journal of Public Health*. 99(4):666-672.

- Wise C, Bahl V, Mitchell R, West B, Carli T. (2006) Population-based medical and disease management: an evaluation of cost and quality. *Disease Management*. 9(1): 45- 55.
- Wolf A, Finer N, Allshouse A, Pendergast K, Sherrill B, Caterson I, Hill J, Aronne L, Hauner H, Radigue C, Amand C, Despres, J-P. (2008) PROCEED: Prospective Obesity Cohort of Economic Evaluation and Determinants: baseline health and healthcare utilization of the US sample. *Diabetes, Obesity & Metabolism*. 10(12):1248-1260.
- Young A, Klap R, Sherbourne C, Wells K. (2001) The quality of care for depressive and anxiety disorders in the United States. *Archives of General Psychiatry*. 58: 55-61.

Vita

Date of Birth:

April 16, 1963

Place of Birth:

Gweru, Zimbabwe

Educational Institutions Attended and Degrees Already Awarded:

Master of Health Administration

Martin School of Public Policy and Administration
University of Kentucky, Lexington, Kentucky, USA
May, 2006

Bachelor's Degree in Accounting (Equivalent)

South African Institute of Chartered Secretaries & Administrators
Cape Town, South Africa
November 1987

Scholastic and professional honors:

Honor Society Award of Upsilon Phi Delta for distinction in healthcare administration,
May 2008.

1st Place – Graduate Student Poster Session, American Correctional Association
Conference, Charlotte, NC, Aug 2006.

Most Outstanding Graduating Student Award, MHA program, May 2006.

Professional publications:

Winter S. (2008) Improving the Quality of Health Care Delivery in a Corrections Setting.
Journal of Correctional Health Care. 14 (3): 168 – 182.

Curd P, Winter S, Connell A. (2007). Participative Planning to Enhance Offender Wellness: Preliminary Report of a Correctional Wellness Program. *Journal of Correctional Health Care* 2007; 13(4); 296 – 308

Curd, P. R., Winter, S. J. (2007). How to Implement a Corrections Wellness Program. 2006 *The State of Corrections*. Proceedings of the 2006 American Correctional Association annual meeting.

Name of student:

Sandra Jane Winter