THE EFFECTS OF REDUCTIONS IN PUBLIC PSYCHIATRIC HOSPITAL BEDS ON CRIME, ARRESTS, AND JAIL DETENTIONS OF SEVERELY MENTALLY ILL PERSONS

Jangho Yoon

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Policy and Administration, School of Public Health

Chapel Hill
2007

Approved by:

Marisa E. Domino (Advisor)

Edward C. Norton

Joseph P. Morrissey

Gary S. Cuddeback

Jeffrey W. Swanson

ABSTRACT

JANGHO YOON: The Effects of Reductions in Public Psychiatric Hospital Beds on Crime, Arrests and Jail Detentions of Severely Mentally Ill Persons
(Under the direction of Marisa E. Domino, Ph.D.)

This dissertation analyzed the effect of reduced psychiatric bed supply on criminal justice outcomes. Three studies were conducted. The first two studies – Study 1 and Study 2 – explored the relationships between the supply of hospital psychiatric beds and the number of crimes, arrests, and jail inmates, using state-level panel data on 50 U.S. states and the District of Columbia for the years 1982 to 1998.

There was no evidence of the relationship between the total number of psychiatric beds and these criminal justice outcomes. However, hospital type was found to have differential effects on the criminal justice outcomes. A decrease in public psychiatric hospital beds was found to increase both violent and property crimes. In contrast, an increase in private psychiatric hospital beds appears to increase property crimes. Decreased public psychiatric hospital beds also negatively affected arrests for serious property crimes and drug violations as well as the number of jail inmates.

Study 3 of this dissertation analyzed the impact of the supply of hospital psychiatric beds on an individual's likelihood of jail detention among persons with severe

mental illness, rigorously exploring mechanisms by which reduced psychiatric bed availability would increase jail detention. The empirical analysis was based on unique longitudinal data that provide information on the use of the mental health and substance abuse treatment systems as well as the jail system in King County, Washington over the periods July 1993 through December 1998. A decrease in total psychiatric beds was found to increase the probability of jail detention among persons with mental illness – in particular black women with severe mental illness – mainly via an increase in minor offenses. Importantly, mental health service use and substance abuse were identified as the main pathways by which decreased psychiatric bed availability increases jail detention among persons with severe mental illness.

A synthesis of findings reassures the importance of close, continuous communication and collaboration within and across sub-systems of a community including the inpatient mental health system, the outpatient mental health system, the substance abuse treatment system, and the criminal justice system.

To Hyunsook Kim, my angel here on earth.

ACKNOWLEDGEMENTS

First and foremost, I am grateful to Dr. Marisa Domino for her guidance as my academic advisor and dissertation chair. Without her scholarly guidance and support, it would have been impossible to complete this project. I also recognize the members of my dissertation committee, Drs. Edward Norton, Gary Cuddeback, Joseph Morrissey, and Jeffrey Swanson, for the valuable contributions, advice, and support.

I am very grateful to my wife, Hyunsook, for her infinite love and immense friendship on this voyage. Thank you so much for always being behind me 200%. I also want to thank my parents in Virginia and Seoul, Korea, and friends in faith for their constant love and prayers. Most of all, I am eternally grateful to my Father in heaven, who is my ever-loving, wholly present Sustainer and Nourisher.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

2SLS	Two Stage Least Squares
3SLS	Three Stage Least Squares
ADA	Americans with Disability Act
AHA	American Hospital Association
BEA	Bureau of Economic Analysis
BJS	Bureau of Justice Statistics
BLS	Bureau of Labor Statistics
BLUE	Best Linear Unbiased Estimator
CHARS	Comprehensive Hospital Abstract Reporting System
CJEE	Employment
DWH	Durbin-Wu-Hausman
FBI	Federal Bureau of Investigation
FGLS	Feasible Generalized Least Squares
FIML	Full Information Maximum Likelihood
GMM	Generalized Method of Moments
IV	Instrument Variable
LPM	Linear Probability Model

NRI	National Association of State Mental Health Program Directors Research Institute
OLS	Ordinary Least Squares
PCSE	Panel Corrected Standard Errors
S.D.	Standard Deviation
SMHA	State Mental Health Agency
STRIDE	System to Retrieve Information from Drug Evidence
TARGET	Treatment and Assessment Report Generation Tool
TSCS	Time Series Cross Section
UCR	Uniform Crime Reporting Program

CHAPTER I

INTRODUCTION

1.1 Problem Statement

1.1.1 Relevance between Changes in the Mental Health System and Mentally Ill Offenders in the Criminal Justice System

Major changes in the financing and delivery of mental health services have been on-going in the U.S. over the past several decades: the locus of mental health care has been shifted from inpatient to outpatient care; the infrastructure for providing mental health treatments in community-based settings has been further developed; managed behavioral health care has been expanded; the capacity of non-traditional psychiatric institutions such as private psychiatric hospitals and psychiatric units in general hospitals have experienced a huge growth; inpatient psychiatric care has been more privatized; and effective newer medications and therapies continue to develop (Grob 2001; Frank and McGuire 2000). Among the changes, one of the most distinguished, on-going changes is *community mental health movements* which have led to the shift of the location of treatment of persons with severe mental illness from public psychiatric hospitals to community-based mental health centers (Grob 1994). Gradually, funding for community

mental health programs has been increasing, so does the number of community-based outpatient psychiatric facilities (Manderscheid et al. 2004; Lutterman and Hogan 2004).

A crucial aspect of the community mental health movements is significant declines in the availability of inpatient psychiatric services. In particular, the precipitous decline in the inpatient treatment beds of public psychiatric hospitals has been of particular interest to mental health professionals and policymakers because the declining capacity of public psychiatric hospitals may jeopardize treatment for many severely mentally ill and indigent patients, especially those in need of intensive levels of treatment but with no other alternatives in the community (Lamb and Weinberger 1998). Between 1970 and 2000, the number of hospital psychiatric beds nationwide dropped remarkably from 264 per 100,000 persons to 77. Treatment beds of public psychiatric hospitals experienced even more substantial drops from 207.4 beds per 100,000 in 1970 to 21.2 in 2000 (Mandersheid et al. 2004). In contrast, the number of inpatient beds in private psychiatric hospitals and psychiatric units of general hospitals exhibited a substantial growth from 1970 until the mid-1990's when it started to reduce slowly (Manderscheid et al. 2004). In 2000, private psychiatric and general hospitals accounted for 24 and 46 percent of all inpatient treatment episodes, respectively, compared to only 12 percent in state psychiatric hospitals (Manderscheid et al. 2004). Nevertheless, public psychiatric hospitals remain the leading provider of psychiatric care for the nation's most difficult

and indigent patients while other institutional care providers serve more short-stay and profitable patients (Milazzo-Sayre et al. 2001).

On the other hand, there is an increasing concern that local jails are significantly overpopulated with severely mentally ill offenders. Approximately 6 to 16 percent of jail inmates have been reported to have severe mental illness (New Freedom Commission on Mental Health 2003; Fisher et al. 2000; Ditton 1999; Teplin 1990; Steadman, McCarty, and Morrissey 1989). Several critics have often related the disproportionate presence of individuals with severe mental illness in the correctional facilities to substantial reductions in the supply of psychiatric beds and underfunded community mental health programs (Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998; Torrey 1995; Mechanic and Rochefort 1990; Teplin 1984; Telpin 1983; Lamb and Grant 1982; Abramson 1972). Yet, this observation has not been fully supported by empirical evidence.

1.1.2 Limitations of Existing Literature

Since the late-1970's in the U.S., several studies have empirically examined the relationships between the capacity of inpatient psychiatric services and the involvement with the criminal justice system among persons with severe mental illness (Markowitz 2006; Raphael 2000; Palermo, Smith & Liska 1991; Grunberg et al. 1987; Steadman et al. 1984; Sosowsky 1978; Steadman, Cocozza, and Melick 1978; Steadman, Vanderwyst,

and Ribner 1978). While suggestive of the close interaction between the mental health and criminal justice systems, there are important pitfalls in the previous literature.

Previous research often focused only on the public inpatient mental health system, omitting possible confounders in estimation such as the capacity of inpatient care in non-public institutional providers as well as the growth of the public outpatient mental health system. Since the decreased availability of public mental hospital beds may be supplemented to some extent by the increased availability of the non-public counterparts such as private psychiatric and general hospitals, the methodological weakness in prior research precludes causal inferences about the reduction in psychiatric beds and the criminal justice outcomes.

In addition, despite enormous social costs of crime possibly associated with reductions in psychiatric bed supply (Miller et al. 1996), there has been little emphasis on crime. Only one study explicitly explored the link between the availability of psychiatric beds and crime (Markowitz 2006). However, a sample of a few cities and cross-sectional nature of data limit meaningful interpretation and generalization of the results to other areas and time periods. On the other hand, previous literature on other criminal justice outcomes such as arrests and correctional incarcerations are relatively abundant. Nevertheless, previous studies often drew conclusions based on simple correlations and tend to focus on restricted geographic areas.

Several prior studies followed patients discharged from psychiatric hospitals and compared the rates of arrests and incarceration in correctional facilities between the discharged patients and general public with no prior records of psychiatric hospitalization (Grunberg et al. 1987; Sosowsky 1978; Steadman, Cocozza, and Melick 1978; Steadman, Vanderwyst, and Ribner 1978). However, a follow-up study of discharged patients inherently disregards persons who have never been identified as mentally ill just because they have not previously had psychiatric hospitalization, and consequently are likely to underestimate the effect that decreased psychiatric bed supply has on criminal justice outcomes.

Considering that different types of psychiatric hospitals are associated with patients with different characteristics, changes either in the number or in relative market share of psychiatric beds of different hospital types may have a different effect on criminal justice outcomes. However, except Markowitz (2006), this issue has been previously overlooked. Even Markowitz (2006) failed to fully control for confounding factors such as the availability of other types of hospital psychiatric beds and the growth of the public outpatient mental health system.

Finally, despite its enormous policy implications, the theoretical understanding on the mechanisms though which a change in the supply of psychiatric beds may affect criminal justice outcomes has not been previously suggested nor tested. For findings of

previous research to be more meaningful to policymakers, it is necessary to explicitly examine pathways that link reduced psychiatric bed availability and changes in the criminal justice outcomes, in particular with individual-level data because an individual-level analysis is more convincing for a test of a theory formulated for individual behaviors (Levitt 2001).

1.2 Study Aims

Addressing the shortcomings in prior research, the dissertation examines the decades-old question of whether a reduction of hospital psychiatric beds affects the criminal justice system. This research focuses on three criminal justice outcomes: crime, arrests, and jail detention.

Specifically, the dissertation examines whether a reduction in hospital psychiatric beds increases the numbers of *crimes, arrests*, and *jail inmates*, using 17-year panel data on all 50 U.S. states and the District of Columbia from 1982 to 1998. Analyses on crime focus on serious crimes due to the unavailability of data on minor crimes. Separate analyses are conducted on various measures of serious crimes, including violent and property crimes. Analyses on arrests are conducted for both serious and minor crimes. The size of the jail population is measured by annual average number of jail inmates.

This study also conducts individual-level analyses to analyze the effect of a decrease in psychiatric bed availability on an individual's likelihood of jail detention,

particularly for persons with severe mental illness. Data include 11 half-yearly observations on 42,511 individuals in King County, Washington for the years 1993 through 1998. Importantly, the individual-level analysis explores mechanisms through which a reduction in psychiatric bed supply may affect jail detention for persons with severe mental illness.

1.3 Significance of the Study

A direct ramification of reductions in the capacity of inpatient psychiatric services is the increasing pool of individuals with severe mental illness in the community. The patient right movements exemplified in Title II of the 1990 Americans with Disability Act (ADA), in particular the Olmstead vs. Lois Curtis and Elaine Wilson Supreme Court decision in 1999, is expected to further increase the number of persons with severe mental illness who may suffer from adverse psychiatric symptoms but remain untreated in the community. Specifically, the Olmstead vs. Lois Curtis and Elaine Wilson Supreme Court decision prohibits treatment of persons with cognitive disabilities only in an institutional setting when they could be served equally as well in a community-based setting. As a result, the supply of psychiatric beds, which was slowed down during the 1990's (Mandersheid et al. 2004), may experience greater reductions again. Surveys of State Mental Health Agencies (SMHA)' administrators indicate that in 2006, more than 7 states planned to close state psychiatric hospitals over the next two years (NRI 2006). The

surveys also revealed that downsizing of psychiatric hospitals may have been influencing other aspects of the mental health system such as a shortage of psychiatric inpatient treatment beds and increased waiting lists for psychiatric hospital admissions.

Efforts to effectively integrate persons with severe mental illness in the community and consequently avoid expensive inpatient expenditures remain on-ongoing. However, whether a reduction in psychiatric bed supply would affect criminal justice outcomes remain unanswered. Findings of this research would not only add to scientific knowledge by addressing the gaps in our knowledge about the inter-relationship between the mental health and criminal justice systems, but provide crucial information for policymakers when they struggle to develop a more effective and efficient mental health system. Importantly, an identification of channels that link the supply of psychiatric beds and criminal justice involvement among persons with severe mental illness would yield insight on policy interventions that may contribute to more effective community integration of persons with severe mental illness.

1.4 The Three Studies: Rationales and Specific Goals

This dissertation comprises three studies. This section introduces these three studies, summarizing rationales and purposes of each study.

Study 1, which is entitled**,** "Linking Psychiatric Beds to Crime", investigates the relationship between the supply of psychiatric beds and crime. Most of prior studies on

this topic are based on a simple comparison of the proportion of persons with severe mental illness detained in jails or prisons over time when the US mental health system experienced rapid reductions in psychiatric beds. Direct measures of crime such as reports from law enforcement agencies are rarely used. In addition, only a limited number of studies have examined the extent to which a decrease in psychiatric beds is associated with an increase in crime. Given large social costs of crime (Miller, Cohen and Wierama 1996), even small changes in crime associated with changes in the supply of psychiatric beds may have substantial economic impacts.

Addressing these shortcomings, the first study explores the following five specific questions: (1) Is a reduction in the total number of psychiatric beds associated with changes in the level of crime?; (2) Does the effect of the number of psychiatric beds on crime vary by hospital types, which include public psychiatric hospitals, private psychiatric hospitals, public general hospital, and private general hospitals?; (3) Does the market composition of psychiatric beds of each hospital type have an effect on crime, holding the total number of beds fixed?; (4) Is there a relationship between crime and states' expenditures on community mental health and substance abuse treatment programs?; and finally, (5) If any, to what degree does a change in available psychiatric beds have a monetary impact on society through its effect on crime?

Study 2 is entitled, "Do Changes in the Supply of Psychiatric Beds Spill-Over to the Criminal Justice System? Evidence from Arrests and Jail Population." This study explores the link between the supply of psychiatric beds and the number of arrests and jail inmates. It is important to note that although arrests may be a function of crime, even with the absence of the effect of psychiatric bed supply on crime, arrests could be affected depending on how law enforcement agencies respond to the scene of crime or nuisance crimes involving persons who are experiencing adverse psychiatric symptoms. So are jail detentions.

The second study examines four main questions: (1) Is there a relationship between the number of hospital psychiatric beds and arrests?; (2) Is there a relationship between the number of hospital psychiatric beds and the size of jail population?; (3) Do the relationships vary by hospital types?; and (4) Do increased community mental health substance abuse treatment resources have an effect on arrests and jail detention in the community?

Study 3 is entitled, "The Effect of Reductions in Psychiatric Beds on Jail Use by Persons with Severe Mental Illness." The main question examined is whether a decrease in psychiatric beds increases an individual's likelihood of jail detention. Compared with the first and second studies of the dissertation, the third study is unique in many ways. First, as compared to the first two studies which use data aggregated at the state-level

from 1982 to 1998, Study 3 uses individual-level panel data to overcome potential aggregation bias that may present in aggregated data (Levitt 2001). Second, Study 3 examines the effect of psychiatric bed supply on an individual's likelihood of jail detention separately for three subpopulations of different severity of mental illness, including persons with severe mental illness, persons with non-severe mental illness, and persons with no evidence of mental illness. Thus, results from the third study would be useful in testing whether findings in the first two studies either can be corroborated or should be doubted because the effect of the supply of psychiatric beds on criminal justice outcomes should be through persons with mental illness, in particular persons with severe mental illness. Third, the third study explicitly tests mechanisms by which a decrease in the supply of psychiatric beds may affect the likelihood of jail detention. Specifically, this study develops a simultaneous equations model of jail detention that enables the examination of two important pathways: mental health service use and substance abuse. Finally, this study further explores subgroups of persons with mental illness to identify a group of individuals who are the most likely to be affected by a change in the supply of psychiatric beds, which would yield more meaningful policy implications.

REFERENCES

Abramson, M.F. 1972. "The criminalization of mentally disordered behavior: possible side-effect of a new mental health law." *Hospital and Community Psychiatry* 23 (4):101-5.

Ditton, P.M. 1999. "Mental Health Treatment of Inmates and Probationers." Washington DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics.

Fisher, W.H., I.K. Packer, L.J. Simon, and D. Smith. 2000. "Community Mental Health Services and the Prevalence of Severe Mental Illness in Local Jails: Are They Related." *Administration and Policy in Mental Health* 27 (6):371-82.

Frank, R.G., and T.G. McGuire. 2000. "Economics and Mental Health." In Culyer, A.J. and Newhouse, J.P. (eds.), *Handbook of Health Economics*, Vol. 1B. Elsevier, Amsterdam.

Grob, G.N. 2001. "Mental Health Policy in the 20th-Century America." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Grob, G.N. 1994. "The Mad Among Us: A History Of The Care Of America's Mentally Ill." New York: Free Press.

Grunberg, F., B.I. Klinger, and B.R. Grument. 1997. "Homicide and the Deinstitutionalization of the Mentally Ill." *American Journal of Psychiatry* 134;685-7.

Lutterman, T. and M. Hogan. 2004. "State Mental Health Agency Controlled Expenditures and Revenues for Mental Health Services, FY 1981 to FY 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Mandersheid, R.W., J.E. Atay, A. Male, B. Blacklow, C. Forest, L. Lngram et al. 2004. "Highlights of Organized Mental Health Services in 2000 and Major National and State Trends." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2002*. Washington, D.C.: U.S. Government Printing Office.

Lamb, H.R., and L.E. Weinberger. 2005. "The Shift of Psychiatric Inpatient Care From Hospitals to Jails and Prisons." *Journal of American Academic Psychiatry and Law* 33:529-34.

Lamb, H.R., and L.E. Weinberger. 2003. "One-Year Follow-Up of Persons Discharged From a Locked Intermediate Care Facility." *Psychiatric Services* 56(2):198-201.

Lamb, H.R., and R.W. Grant. 1982. "The Mentally Ill in an Urban County Jail." *Archives of General Psychiatry* 39:17-22.

Lamb, H.R., and L.E. Weinberger. 1998. "Persons With Severe Mental Illness in Jails and Prisons: A Review." *Psychiatric Services* 49:483-92.

Lamb, H.R., L.E. Weinberger, and B.H. Gross. 2004. "Mentally Ill Persons in the Criminal Justice System: Some Perspectives." *Psychiatric Quarterly* 75 (2):107-26.

Levitt, S. 2001. "Alternative Strategies for Identifying the Link Between Unemployment and Crime." *Journal of Quantitative Criminology* 17(4):377-90.

Markowitz, F.E. 2006. "Psychiatric Hospital Capacity, Homelessness, and Crime and Arrest Rates." *Criminology* 44 (1) 45-72.

Mechanic, D., and D.A. Rochefort. 1990. "Deinstitutionalization: An Appraisal of Reform. *Annual Review of Sociology* 16:301-27

Milazzo-Sayre, L.J., M.J. Henderson, R.W. Manderscheid, M.C. Bokossa, C. Evans, A.A. Male. 2001. "Persons Treated in Specialty Mental Health Care Programs, United States, 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Miller, T.R., M.A. Cohen, and B. Wierama. 1996. "Victim Costs and Consequences: A New Look." U. S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

National Association of State Mental Health Program Directors Research Institute, Inc (NRI). 2006. "State psychiatric hospitals:2006." NASMHPD Research Institute, Inc, Alexandria, VA. Pub. No. 06-4.

New Freedom Commission on Mental Health. 2003. "Achieving the Promise: Transforming Mental Health Care in America: Final Report." DHHS Pub. No. SMA-03-3832. Rockville, MD.

Palermo, G.B., M.B. Smith, and F.J. Liska. 1991. "Jails Versus Mental Hospitals: A Social Dilemma." International Journal of Offender Therapy and Comparative Criminology 35:97-106.

Raphael, S. 2000. "The Deinstitutionalization and the Mentally Ill and Growth in the U.S. Prison Population: 1971 to 1996." Unpublished manuscript. University of California, Berkely, CA.

Sosowsky, L. 1978. "Crime and Violence Among Mental Patients Reconsidered in View of the New Legal Relationship Between the State and the Mentally Ill." *American Journal of Psychiatry* 135:33-42.

Steadman, H.J., J.J. Cocozza, and M.E. Melick. 1978. "Explaining the Increased Arrest Rate Among Mental Patients: The Changing Clientele of State Hospitals." *American Journal of Psychiatry* 135 (7):816-20.

Steadman, H.J., D.W. McCarty, and J.P. Morrissey. 1989. "The Mentally Ill in Jail: Planning for Essential Services." New York: Guildford Publications.

Steadman, H.J., J. Monahan, B. Duffee, E. Hartstone, and P.C. Robbins. 1984. "The Impact of State Mental Hospital Deinstitutionalization on United State Prison Populations, 1968-1978." *The Journal of Criminal Law and Criminology* 75 (2):474-90.

Steadman, H.J., D. Vanderwyst, and S. Ribner, 1978. "Comparing Arrest Rates of Mental Patients and Criminal Offenders." *American Journal of Psychiatry* 135 (10):1218-20.

Teplin, L.A. 1990. "The prevalence of severe mental disorder among male urban jail detainees: comparison with the Epidemiologic Catchment Area Program." *American Journal of Public Health* 80(6):663-9.

Teplin, L.A. 1984. "Criminalizing Mental Disorder: The Comparative Arrest Rate of the Mentally Ill." *American Psychologist* 39:794-803.

Teplin, L.A. 1983. "The Criminalization of the Mentally Ill: Speculation in Search of Data." *Psychological Bulletin* 94:54-67.

Torrey, E.F. 1995. "Jails and Prisons – America's New Mental Hospitals." *American Journal of Public Health* 85:1611-3.

CHAPTER II

STUDY 1:
Linking Psychiatric Beds to Crime

Abstract

Despite a growing concern that a decrease in inpatient capacity of the mental health system may contribute to a larger number of persons with severe mental illness in the correctional system, only a limited number of studies have examined the association between the availability of hospital psychiatric beds and crime. This study examined the relationship between the supply of psychiatric beds – first for total number of beds and then separately by hospital type including public and private psychiatric hospitals and public and private general hospitals - and crime and associated social costs, using state-level data on crime and hospital capacity from 1982 to 1998. The study further explored whether the market composition of psychiatric beds of each type relative to public psychiatric hospital beds is associated with crime rates because changes in either absolute number or relative market share of psychiatric beds of each type may affect the delivery of inpatient psychiatric care and thus the mix of individuals served. There was no evidence of the relationship between the total number of psychiatric beds and crime. Interestingly, however, the relationship was found to vary by hospital types. The number of public psychiatric hospital beds was negatively associated with both violent and property crimes. In contrast, the number of private psychiatric hospital beds was positively associated with property crimes. There was a positive association between a ratio of private to public psychiatric hospital beds and crime, holding the total number of

beds constant. Using our estimates and published social cost data, I found enormous monetary social losses from crimes associated with changes in the availability of psychiatric beds during our study period. Thus, in an era with increasing emphasis on downsizing of public psychiatric hospital capacity with partly offsetting increases in private psychiatric hospitals and increased emphasis on community treatment of persons with severe mental illness it is important to factor in the spillover effects these inpatient reductions may have on crime.

2.1 Introduction

There has been an increasing concern that U.S. correctional facilities are significantly overpopulated with severely mentally ill offenders. Although the prevalence of severe mental illness varies depending on how severe mental illness is defined and which demographic groups are studied, approximately 10 to 15 percent of prisoners and 6 to 16 percent of jail inmates has been reported to have severe mental illness (New Freedom Commission on Mental Health 2003; Fisher et al. 2000; Ditton 1999; Teplin 1990; Steadman, McCarty, and Morrissey 1989). Critics have often related the disproportionate presence of individuals with severe mental illness in the correctional facilities to substantial reductions in the supply of psychiatric beds (Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998; Torrey et al. 1993; Mechanic and Rochefort 1990; Teplin 1984; Telpin 1983; Lamb and Grant 1982; Abramson 1972). Yet, most of the previous evidence was based on a simple comparison of the proportion of persons with severe mental illness detained in jails or prisons over time when the US mental health system experienced rapid reductions in psychiatric beds. Only a limited number of studies have examined the extent to which the decrease in psychiatric beds is associated with an increase in criminal justice outcomes, especially crime. Given

enormous social costs of crime (Miller et al. 1996), even small changes in crime influenced by changes in the supply of psychiatric beds may have substantial economic impacts.

There is a reason to believe that the number of psychiatric beds may affect subsequent crime in the community. A possible pathway is through the effect of changes in the number of psychiatric beds on mental health status and subsequently on time preference among persons with severe mental illness. A standard economic framework is to model criminal behavior as a rational choice between immediate benefits and uncertain costs in future time periods from criminal activity. However, in the analysis of crime among individuals with mental illness, one natural question is whether the standard assumption of rational behavior applies. Nonetheless, rationality may still be assumed to guide their criminal behavior because criminality can be thought of as a tendency to think in terms of short-term rather than long-term planning horizons (Wilson and Herrnstein, 1985). In other words, criminality may be associated with individual time preference. Time preference of persons with severe mental illness probably affects their criminal behavior since the rate at which future benefits or penalties are discounted must bear directly on the individual's current choice. According to Becker and Mulligan (1997), anything that lowers future utility may lead to higher time preference, i.e., present-oriented tendency of decision-making. Thus, if a change in the supply of psychiatric beds adversely affects mental health treatment among persons with severe mental illness, which would decrease future utility, the change in available psychiatric beds could increase time preference and subsequent crime.

Moreover, the increased time preference due to inadequate mental health treatment may lead persons with severe mental illness to self-medicate their psychiatric symptoms with addictive substances (Harris and Edlund 2005; Pristach and Smith 1996;

Whitmer 1980) because persons with higher time preference would be more likely to seek current consumption of addictive goods rather than seeking mental health treatments that increase utilities in later periods (Becker and Murphy 1988). In the end, inadequate treatment may result in an increase in crime either induced by or involving addictive substances such as alcohol and illicit drugs.

This research did not seek an empirical examination of the mechanisms through which the number of psychiatric beds affects crime, but merely point the ways in which psychiatric beds may be linked to crime. Building on the conceptual proposition described above, the present study aimed to examine the relationship between the availability of psychiatric beds and crime rates in the community. This study addressed the following specific questions. First, the study examined whether a reduction in the total number of psychiatric beds was associated with changes in the level of crime. Second, this study measured the effect of the number of psychiatric beds of each hospital type on crime rates. Since psychiatric hospitals of different types may be systematically different from one another in terms of differences in mission, case mix, and different opportunities and constraints and thus operate according to different objective functions, inpatient psychiatric facilities were separated into four different categories: public psychiatric hospitals, private psychiatric hospitals, public general hospitals, and private general hospitals. Third, this study investigated whether the market composition of psychiatric beds of each hospital type (such as private psychiatric hospitals and private and public general hospitals) relative to public psychiatric hospital beds has a different effect on crime because changes in either absolute number or relative ratio of psychiatric beds of each type may affect the delivery of inpatient psychiatric care and thus the mix of individuals served. Fourth, the study explored an association between the total state expenditures on community mental health systems and crime by including State Mental

Health Agencies' (SMHA) total expenditures on community mental health programs in all models. Lastly, this research quantified the monetary impact of changes in available beds on society through crime.

No significant association was found between the total number of psychiatric beds and crime, but there was interesting association by hospital type. Findings indicate that the number of public psychiatric hospital beds was negatively associated with total serious crimes, total property crimes, murder and burglary. In contrast, an increase in private psychiatric hospital beds was associated with total serious crimes, total property crimes, burglary, larceny, and motor vehicle theft. Findings also suggest a positive association between a ratio of private to public psychiatric hospital beds and crime rates. Expenditures on community mental health programs had no effect on crime. Finally, when dollar amounts were assigned to the type of crime committed according to Lochner and Moretti (2004) and Miller and colleagues (1996), even small changes in bed availability were found to have economically significant impacts on society through crime.

The remainder of the paper is organized as follows. Background information is provided regarding changes in the variables of main interest such as inpatient and outpatient psychiatric services and crime, as well as a discussion of prior analysis of the effect of psychiatric bed supplies on criminal justice outcomes. Then, I present a theoretical framework which links the supply of psychiatric beds and crime. In the Method section, data sources and variables and our empirical estimation strategy are described. Finally, this paper presents results and conclusions.

2.2 Background

2.2.1 Decreases in psychiatric beds and developments of community mental health treatment

Over the last several decades, significant changes in the provision of mental health services have been on-going, among which one of the most distinguished changes in the mental health system was *deinstitutionalization*, a process whereby persons with mental illness are shifted from institutional care to treatment at community-based settings (Grob 1994). This shift was driven by community mental health and patient rights movements, the improvement of medication treatment and other therapies, and economic incentives created by social welfare programs such as Medicaid and Medicare (Grob 2001; Mechanic and Rochefort 1990; Morrissey 1989). As a result, the number of treatment beds in psychiatric facilities in the U.S. significantly declined and a gradually increasing number of patients with severe mental illness have been treated in the community.

In particular, the precipitous decline in public psychiatric hospital beds has been of interest because of their function as an institutional provider for the nation's most severely mentally ill and indigent patients. Data from the Center for Mental Health Services, Substance Abuse and Mental Health Services Administration showed that the number of psychiatric beds nationwide dropped remarkably from 264 per 100,000 persons in 1970 to 77 in 2000, mostly due to the decrease in public psychiatric hospitals from 207.4 beds per 100,000 in 1970 to 21.2 in 2000 (Mandersheid et al. 2004.). Although the size and time series of the number of the psychiatric beds varied across states (Mechanic and Rochefort 1990; Morrissey 1989), the number of public psychiatric hospital beds continues to decrease in most states. Survey data from the State Mental Health Agency (SMHA) Profile System showed that 23 states planned to close more than 1,000 beds by 2005. In 2003, 22 of 41 responding agencies reported their states were experiencing a shortage in psychiatric beds; 14 states experienced increased waiting lists for state psychiatric hospital beds, overcrowding in state psychiatric hospitals was

reported in 11 states, and seven states were experiencing increased resistance to the additional closure of state psychiatric beds (NRI 2004).

In contrast, private psychiatric hospitals and separate psychiatric units in public and private general hospitals have gradually gained more importance in treatment of mental illness. The number of treatment beds in private psychiatric hospitals and psychiatric units of general hospitals exhibited a substantial growth from 1970 until the mid-1990's when it started to reduce slowly (Manderscheid et al. 2004). In 2000, private psychiatric and general hospitals accounted for 24 and 46 percent of all inpatient treatment episodes, respectively, compared to only 12 percent in state psychiatric hospitals (Manderscheid et al. 2004). Part of this shift has to do with the federal Medicaid regulations, which preclude payments for stays in public psychiatric hospitals (Frank, Goldman and Hogan 2003). Nevertheless, public psychiatric hospitals remain the leading provider of psychiatric care for the nation's most difficult and indigent patients while other institutional care providers serve more short-stay and profitable patients. For example, in 1997 approximately 64 percent of patients in public psychiatric hospitals were principally diagnosed with schizophrenia, which is one of the most debilitating and costly mental illnesses, as compared to 20 percent in private psychiatric hospitals and 30 percent in general hospitals (Milazzo-Sayre et al. 2001). Lengths of stay for chronic patients in private psychiatric and general hospitals are relatively shorter than for individuals in public psychiatric hospitals and these non-public counterparts provide little community follow-up service (Grob 2001; Morrissey 1989).

Other characteristics such as the compositions of minority patients and insured patients vary by the different hospital types. Fifty-six percent of Blacks and Hispanics in inpatient psychiatric treatment are in state and county facilities, compared to 47 percent of whites (Milazzo-Sayre et al. 2001). In contrast, of those treated in private psychiatric

hospitals, over 85 percent are white, most are admitted voluntarily (86 percent), and have private insurance (68 percent) (Koslowe et al. 1991). Private hospitals are more likely to serve those with private insurance and less severe mental illness, but are less likely to admit patients who are uninsured especially in areas with higher competition among private psychiatric hospitals and with less public psychiatric beds (Mechanic 1999; Schlesinger and Gray 1999).

Meanwhile, psychiatric hospitals operate at relatively full capacity. Psychiatric hospital occupancy rates, in general, have remained over 84 percent between 1975 and 2000[1]. The high rates of occupancy indicate that states' capacities to manage people with most debilitating psychiatric symptoms may be jeopardized.

The location of psychiatric care has shifted from inpatient to outpatient settings. The number of psychiatric facilities that provide outpatient services increased consistently between 1970 and 1998 from 2,156 to 4,386. The percentage of outpatient service users was 58 percent of 4.2 million patients in 1971 and further increased to 78 percent of 11 million patients in 2000 (Manderscheid et al. 2004). The growing availability of mental health treatment in community outpatient settings provided access to the mental health system to new patients with no access to psychiatric treatment in the past (Grob 2001; Morrissey 1989; Whitmer 1980). Meanwhile, the increased emphasis on high-quality community treatment, such as intensive case management and assertive community treatment[2], and a variety of tools being used to improve adherence to psychiatric

[1] Authors' calculation using figures from Tables 2 and 5 in Manderscheid et al. (2004). The rates are calculated by taking the number of residents in psychiatric hospitals on Jan. 1 for each year and dividing by the number of psychiatric beds on Jan. 1 for that year.

[2] Assertive community treatment (ACT) is a comprehensive and treatment-team-based model of mental health service delivery for persons with severe mental illness. It provides highly customized services directly to consumers to help them out of psychiatric hospitals (Phillips et al. 2001; Stein and Test 1980).

treatment in the community, such as involuntary outpatient commitment[3], have been shown to be effective in treating patients with severe mental illness in the community (Lamb and Weinberger 2005; Swanson et al. 2000). Community-based treatments are now receiving substantially more funds than state psychiatric inpatient services. In 1997, community mental health programs accounted for 56 percent of state mental health agencies' expenditures, a 70 percent increase from 33 percent in 1981. Over the same period, spending on state psychiatric hospital services experienced about a 30 percent decrease (Lutterman and Hogan 2004).

2.2.2 Trends in crime rates

Over the period during which the mental health system has undergone the continuous decline in inpatient psychiatric beds, the criminal justice system has also experienced changes in crime rates. Based on data from the Federal Bureau of Investigation's (FBI) Uniform Crime Reporting Program (UCR), national time-series trends in the total serious crimes[4] experienced an overall increase with some fluctuations between 1980 and 1991 and then decreased steadily. A similar pattern was observed for every category of serious crimes (O'Brien 2003; Donohue and Levitt 2000; Blumstein and Rosenfeld 1998).

The media and researchers have provided plausible explanations for the changes in crime rates, including increases in the number of police and arrest rates, growing number of prisoners, decreases in the crack cocaine trade, legalization of abortion, changing demographics, improved policing strategies, death penalty laws, and concealed handgun control policies (Levitt 2004; O'Brien 2003; Donohue and Levitt 2001;

[3] Involuntary outpatient commitment refers to community treatment orders as a legal intervention intended to improve treatment adherence among persons with serious mental illness (Swanson et al. 2000).

[4] UCR Part I crimes consist of serious crimes such as murder, rape, robbery, aggravated assault, burglary, larceny, auto theft, and arson.

Donohue 1998). Among these, the first four factors in particular explained the unexpected drop in crime since the early 1990s (Levitt 2004). Nonetheless, the above possible causes do not satisfactorily explain the crime experience before the early 1990s (Levitt 2004). Despite a longstanding history shared by the mental health and criminal justice systems, the availability of psychiatric beds is conspicuously missing from the list of possible correlates.

2.2.3 Previous studies on the relationship between the capacity of inpatient psychiatric care and criminal justice outcomes

In 1939, Penrose reported a negative correlation between the proportion of people institutionalized in psychiatric facilities and the proportion of people who committed serious offenses such as murder using data from 14 European countries. Following this lead, researchers from other countries have tested whether a similar relationship could be found in their own countries. For example, in Australia, 34 years after Penrose' pioneering work, Biles and Mulligan (1973) found an inverse relationship between psychiatric hospital beds and imprisonment rates, but no relationship between the amount of crime in a community and the number of psychiatric hospital beds.

In the US, an array of studies in the late-70's and early 80's compared crime and arrest rates between patients discharged from psychiatric hospitals and general public before and after a rapid reduction of psychiatric beds. While suggestive of the interaction between the mental health and criminal justice systems, their findings on the link between the availability of psychiatric beds and crime are mixed. While some researchers found that former psychiatric hospital patients without prior arrest records were no more likely to be arrested than the general public (Steadman, Cocozza, and Melick 1978; Steadman, Vanderwyst, and Ribner 1978), others reported that the arrest rate of former patients without prior arrests was higher than that of the general public (Steadman et al. 1984;

Sosowsky 1980&1978). Steadman and colleagues (1984) also observed significant increases in the percentage of prisoners with prior psychiatric hospitalization in three states (California, Texas, and Iowa) and comparatively small but statistically insignificant decreases in other states (New York, Arizona, and Massachusetts). In contrast, however, Grunberg and colleagues (1987) documented that the proportion of murders committed by patients diagnosed with schizophrenia in Albany, New York, increased between two time periods, 1963-69 and 1970-75.

These earlier studies drew conclusions exclusively based on simple correlations or just on descriptive statistics. Their findings often rested on a sample of few states, a single state, or a small local county, which makes up only small portion of the U.S. population. In addition, follow-up studies of discharged patients with severe mental illness disregarded persons who have never been identified as mentally ill because they had no record of psychiatric hospitalization.

A recent body of evidence suggests a negative relationship between the availability of psychiatric beds and the size of the incarcerated population in the correctional facilities (Raphael 2000; Palermo, Smith, and Liska 1991). In particular, a 2006 study examined the association between the number of public hospital beds and homelessness, crime, and arrests at the city-level using a sample of 81 U.S. cities in 1990 (Markowitz 2006). The author found a negative association between the number of beds in public psychiatric hospitals and homelessness as well as between public hospital beds and crimes and arrests for violent crime. The reduction in public psychiatric hospital capacity was suggested to be associated with modest increases in violent crime and arrests through increased homelessness. This is the only study that explicitly explored the link between the availability of psychiatric beds and crime. However, the sample of a few

cities and the cross-sectional nature of this study limit meaningful generalization of the results to other areas and time periods.

In addition to the caveats mentioned above, significant gaps were identified in the literature in our knowledge about the relationship between the capacity of psychiatric inpatient care and crime. First, there has been little emphasis on crime. Second, most of the previous research focused on the link between the capacity of public psychiatric hospitals and criminal justice outcomes, omitting in estimation possible confounders such as the capacity of inpatient care in other institutional providers as well as the growth of community mental health programs. Since the decreased availability of beds in public psychiatric hospitals may be offset to some extent by the availability of the non-public counterparts, the methodological weakness in prior research preclude causal inferences about the reduction in psychiatric beds and the criminal justice outcomes. Finally, considering that different types of psychiatric facilities are associated with patients with different characteristics, changes in the number and in relative market share of psychiatric beds may have a different effect on criminal justice outcomes by hospital characteristics. However, with the exception of Markowitz (2006), this issue has been previously disregarded. Even Markowitz (2006) failed to fully control for confounding factors such as the availability of other types of psychiatric beds and the growth of the community mental health system.

In order to address these limitations, the present study examined the relationship between psychiatric beds and crime rates by explicitly controlling for possible confounding factors, using more recent 17-year state panel data from 50 U.S. states and the District of Columbia. In addition, a macro-level analysis employed in this study overcomes the limitations of previous patient follow-up studies by including all persons with severe mental illness irrespective of whether they had psychiatric hospitalizations.

2.3 Conceptual Framework

For a change in the number of psychiatric beds to affect crime, the effect should be through persons with severe mental illness residing in the community, whose mental health relies on the effectiveness of the mental health system. Since Becker (1968), economists have often modeled crime as a choice by an independent and rational decision maker weighing the benefits and costs of criminal activity. This study extends Becker's framework to provide more reasonable explanations in criminal behavior among persons with mental disorders and in the process explain how changes in the supply of psychiatric beds might affect crime rates in the community. I propose that changes in the psychiatric bed supply may affect time preference among individuals with severe mental illness in the community and the changes in time preference subsequently influence their criminal behavior. I begin by combining elements of several economic models to produce an overall theoretical framework that explains the interdependence of behavioral health care use and crime among persons with severe mental illness.

2.3.1 Use of behavioral health care, time preference, and crime

In Grossman's health capital model (1972), individuals maximize utility obtained from health, consumption of goods and leisure time. This objective is constrained by a health production function, income and assets, and available time. Health inputs produce health and thus augment utility. As with the health production function in the Grossman model, I consider that one's mental health level depends on the quantity of resources allocated to the production of mental health. Put differently, the mental health production function summarizes the relationship between mental health and inputs into mental health such as visits to psychiatric providers, adherence to medication and treatment, etc. Following Grossman (1972), it was assumed that among persons with severe mental illness, the use of mental health service, either inpatient or outpatient, in the current

period produces mental health and in turn augments utility in subsequent time periods while the utility derived from a normal consumption good is immediate. In addition, decisions to seek treatment depend on opportunity cost of investing in health; opportunity cost will be higher if a person is more present-oriented, i.e., if he has higher time preference. Thus, the higher the rate of time preference, larger consumption in normal goods and less investment in mental health occur.

Economists have recognized the significance of the rate of time preference in health outcomes. For example, Fuchs (1982) showed that differences in the rate of time preference play an important role in various health-related choices such as smoking and exercise. Ehrlich and Chuma (1990) showed that individuals with higher rates of time preference are less inclined to make investments in health. Time preference plays an important role in decision-making among persons with severe mental illness as it does for persons without mental disorders. For example, Rosenheck and colleagues (2000) examined the factors that affected the receipt and denial of Social Security benefits among homeless veterans with severe mental illness in an outreach program. Using a measure of personal time preference developed by Fuchs (1982), they found that veterans with lower time preference scores were more likely to receive the benefits, suggesting that recipients were patient enough to go through various steps to receive benefits.

Meanwhile, Becker and Mulligan (1997) indicate that time preference can be endogenously affected by the level of unobservable future-oriented capital, which is determined by various factors such as education, time and effort spent appreciating the future, certain goods such as newspaper which lead us to take more account of the future, etc. They show that there exists *complementarity* between future utility and higher time preference; that is, a decrease in the future utilities raises time preference. In the mental health context, anything that hinders mental health service use would increase time

preference because inadequate mental health treatment which decreases future utility may lower the level of future-oriented capital and subsequently increase time preference. Meanwhile, the endowed time preference and initial stock of future oriented capital are important determinants of the demand for mental health services. Thus, unless the rate at which the future-oriented capital increases time preference at the initial stage is higher enough to encourage treatment-seeking, a person with severe mental illness may discount the future too excessively to seek mental health treatment in the community.

Using this behavioral model, we can obtain insight into the effect of inadequate mental health treatment on the decision to commit crime. A key individual-level factor associated with criminality is the tendency to think in terms of short-term rather than long-term planning horizons (Wilson and Herrnstein, 1985). The rewards from not committing crime almost always are in the future, while the rewards from committing it are almost always in the present. To simplify the discussion without losing generality, I develop a simple two-period model. If I assume that a person lives two periods, his expected utility of committing a crime in the current period 1 is

$$EU_1 = \pi_1 \cdot \left[U_1\left(Y_1 - \sum_{t=1}^{2} \left(\left(\frac{1}{1+\sigma} \right)^{t-1} \left(F_t + P_t \right) \right) \right) \right] + (1-\pi_1) \cdot U_1(Y_1 - P_1) \qquad (1)$$

where expected utility is derived from the probability of arrest (π_1) in the current period, both monetary and psychiatric rewards of crime in the current period (Y_1), monetary costs of crime in the current and next periods (F_1 and F_2), psychiatric costs of crime (P_1 and P_2), and his time preference (σ). The individual will commit crime if the expected utility of crime is positive (Becker 1965). By differentiating Equation (1) with respect to the time preference, I obtain

$$\frac{\partial EU_1}{\partial \sigma} = \pi_1 \cdot \left(\frac{1}{1+\sigma} \right)^2 \cdot (F_2 + P_2) \cdot U_1'(\cdot) > 0 . \qquad (2)$$

as long as the marginal utility of rewards is positive. Therefore, inadequate mental health treatment among persons with severe mental illness increases time preference for this population, and subsequently raises crime rates for either violent and property offenses.

Meanwhile, inadequate mental health treatment may lead to substance dependence. According to the rational addiction model developed by Becker and Murphy (1988), an individual with high time preference is more likely to become addicted to addictive goods. Therefore, lack of adequate mental health treatment increases the use of addictive substances, which increases crime because the use of illegal substance is a crime. In addition, the use of addictive goods subsequently raises time preference because of the complementarity between future utilities and heavy future discounting, and thus leads to less investment into mental health promotion. Subsequently, worsened mental health again leads to an increase in crime rates in the community. However, it should be noted that most people with severe mental illness do not commit crime. Rather, a possible increase in crime is a result of worsening of symptoms among a subgroup of persons with severe mental illness who otherwise do not commit crimes.

2.3.2 Link between the availability of psychiatric beds and crime

To establish the relationship between the availability of psychiatric beds and crime, it is crucial to examine whether a change in the availability of psychiatric beds has a negative impact on access to mental health services among persons with severe mental illness. One of the possible consequences of a decrease in psychiatric beds is that persons with severe mental illness might have limited access to mental health services either because inpatient psychiatric services may be unavailable for those who need them or because community mental health resources may be insufficient to serve a growing body of mentally ill persons in the community, especially those with the most serious psychiatric symptoms. Thus, the reduced availability of psychiatric beds could leave

persons with severe mental illness without adequate level of treatment in the community. However, because it is uncertain whether the decreases in psychiatric beds over the last several decades have been substituted for by the advances of other alternative treatment options in the community, whether reduced availability of psychiatric beds has increased crime is an empirical question. Considering only a small proportion of persons with severe mental illness commit crime, the magnitude of the effect should be explored empirically as well.

On the other hand, not only may inadequate mental health service receipt raise criminal activities, but other individual– and macro–level factors such as stressful life events and *social capital*[5] may also influence mental health and crime among persons with severe mental illness. The latter is because individuals with more socially supportive resources or relationships may be more likely to receive psychosocial and structural support and exert *social control* over their behavior (Silver 2006). Recently, mental health researchers have emphasized disadvantaged neighborhood environment and stressful mental health shocks as important factors contributing to mental health problems, violence, and drug use among mentally ill persons residing in the community (Silver and Teasdale 2005; Silver, Mulvey and Swanson 2002). As a consequence of continued closure or downsizing of public psychiatric hospitals, an increased volume of persons with severe mental illness now reside in disadvantaged neighborhoods, of whom a large proportion may not have adequate levels of social supports, such as family, friends, employment opportunities, and housing (Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998; Mechanic and Rochefort 1990). Therefore, as much as severely mentally ill persons in the community experience stressful events or the lack of

[5]*Social capital* or *social support* can be defined as the collective value of community resources including support from social networks or connections (such as family, friends, and other important persons), employment opportunities, housing, community mobility, and neighborhood environment. See Silver (2006) and Paldam (2000) for the concept and a review of the literature.

supportive environments when the supply of psychiatric beds declines, these individuals would be at an increased risk of committing crime.

Finally, the effect of changes in available psychiatric beds on crime may vary by different hospital characteristics since different hospital types may operate under different objective functions. Studies have found that heterogeneous groups of patients are served by public psychiatric hospitals and non-traditional psychiatric facilities. For example, private psychiatric hospitals are more likely to serve those with private insurance and less severe mental illness as well as for shorter inpatient stays. They are less likely to admit patients who are indigent and uninsured (Mechanic 1999; Schlesinger and Gray 1999). Schlesinger and colleagues (1997) found that general and private psychiatric hospitals may be reluctant to serve difficult and costly patients particularly under the increased level of market competition among institutional psychiatric providers. As a result, an increase in non-traditional psychiatric beds, which may reflect increased market competition among these providers, may lead persons with severe mental illness to experience increasing difficulties in obtaining treatment in the community. They also indicate that non-traditional institutional psychiatric providers may engage in the practice of transferring indigent and expensive patients to community mental health centers especially in areas where the capacity of public psychiatric hospitals was smaller. Thus, under circumstances of continued reductions in public psychiatric hospital beds, an increase in non-traditional psychiatric facilities may disrupt treatment for mentally ill persons the community unless community mental health resources are expanded to serve a growing body of mentally ill persons in the community. Because of the complexity of the interaction among hospitals of different characteristics and community mental health programs, the question of whether different characteristics of hospitals matter in terms of their effects on crime should be empirically examined.

2.4 Method

2.4.1 Data

Building upon the conceptual model developed here, study questions of this research are explored using interstate variation in the supply of psychiatric beds, community mental health expenditures, and crime rates over time. Thus, to isolate the effect of changes in psychiatric beds on crime, state-level information should be controlled for, which otherwise confounds results. This study utilizes the state-level data from a variety of sources over 17 years from 1982 to 1998 for all 50 states and the District of Columbia. Table 2.1 provides definitions, data sources, and summary statistics for the variables used in this study.

2.4.1.1 Dependent variables

Data on dependent variables came from the FBI's Uniform Crime Reporting (UCR) program from 1982 to 1998. The UCR provides the number of crimes for serious offenses such as murders, rapes, robberies, aggravated assault, burglary, larceny and motor vehicle theft. The first four offenses are classified as violent crimes and the last four as property crimes. The UCR provides information only on offenses known to the police but remains the only source of national time-series crime data that can be aggregated at the state level for all U.S. states and the District of Columbia. Data from UCR are widely used by researchers. Thus, the dependent variables in our analysis include (1) the total number of serious crime per 100,000 persons in the relevant community, (2) the total number of violent crimes, (3) the total number of property crimes, and (4) the above eight individual crimes.

2.4.1.2 Main independent variables

Several sets of independent variables were examined. First, to examine whether the total number of psychiatric beds was associated with crime rates, the total number (contemporaneous) of psychiatric beds was included as a main independent variable. Then, to answer the question of whether the number of psychiatric beds of different hospital characteristics affected crime rates differently, the total number of psychiatric beds was replaced with a set of variables including the number of psychiatric beds in public psychiatric hospitals, private psychiatric hospitals, public general hospitals, and private general hospitals. Finally, to address whether crime rates were determined by a relative market composition of psychiatric beds of each type, a group of variables capturing the ratio of psychiatric beds of each type to public psychiatric hospital beds were used. Thus, the set of variables included a ratio of private to public psychiatric hospital beds, a ratio of psychiatric beds in private general hospitals to public psychiatric hospital beds, and a ratio of psychiatric beds in public general hospitals to public psychiatric hospital beds. The total number of psychiatric beds was also included to isolate the effect of the market share holding the total number of beds constant. In addition, state mental health agencies' expenditures on community mental health programs were included in all models as a proxy for the contemporaneous capacity of providing mental health care through the community mental health system.

The annual number of psychiatric beds came from American Hospital Association's (AHA) Annual Survey of Hospitals from 1982 to 1998. The AHA Annual Survey data contain hospital characteristics that are derived from hospital surveys and other proprietary sources. This survey has been conducted annually since 1946, and is widely regarded as the most authoritative and comprehensive source of individual hospital data available (AHA 1995). Psychiatric care facilities in the survey used to obtain the number of psychiatric beds include public and private mental hospitals and psychiatric

units in general hospitals. Some observations have missing values for intervening years. These missing values were filled in by linear interpolation separately for each hospital. Observations were then collapsed at the state level.

Data on state mental health agencies' (SMHA) expenditures on community-based mental health programs came from the National Association of State Mental Health Program Directors Research Institute (NRI). NRI has intermittently conducted the SMHA revenues and expenditures study in 1981, 1985, 1987, 1990, 1993, 1997 and 2001. The expenditure data for the intervening years were linearly interpolated. The data include SMHA-controlled expenditures on mental health including medications and drug and alcohol programs. The sources of funds for SMHAs include states' general funds and special appropriations, Federal Mental Health Block Grant funds, Medicaid, Medicare, other federal funds such as demonstration grants, state-required local government match, and various first-and third-party funds. The SMHA expenditure data excluded Medicaid expenditures and local community programs that are not directly administered by the SMHAs. In 1997, the data source included about 65 percent ($7.3 billion) of total expenditures ($11.2 billion) on community mental health programs. The amount of expenditures that were not directly controlled by SMHA varied by state. In some states such as Delaware, Hawaii, Idaho, Montana, Nevada, and South Carolina, almost all community mental health expenditures are controlled by SMHAs. In other states such as Iowa, Indiana, Utah, Arkansas, and Nebraska, over 65 percent of the expenditures are not controlled by SMHA. Although the data are limited in that part of community mental health spending in a state was included and the difference with total community mental health expenditures varied across states, there is no other source of information on state expenditures on community mental health programs. Despite the limitation, consistency

in the data collection methods across states and over time renders a valid comparison across states and years (Lutterman and Hogan 2004).

2.4.1.3 Covariates

State-level policing policy variables were included since our estimates would have biased if, for example, states that had a precipitous drop in psychiatric beds over time are also more likely to experience a continual decrease in the crime rates for that time period presumably due to other criminal justice policies. The policing policy variables include arrest rates and the total number of police per 100,000 residents. Using the UCR, arrest rates were defined as a ratio of arrests to the number of crimes reported to the police. Information on the number of police came from the CJEE Extract file (The Expenditure and Employment Data for the Criminal Justice System [United States]: Extract File).

The empirical model also controlled for state-level socio-economic and demographic factors, data on which came from a variety of sources such as the US Census Bureau, the Bureau of Economic Analysis (BEA), and the Bureau of Labor Statistics (BLS). Data on state population came from the US Census Bureau. State-level socioeconomic factors include the proportion of metropolitan residents, poverty rates, state unemployment rates, state per-capita income, and the proportion of Medicaid and welfare (AFDC/TANF) recipients. Demographic controls such as the state compositions of race and age were included in the model because proportions of young adults, non-whites in a community are closely related to crime rates. Race categories consist of the proportions of blacks, and non-white-non-black. Age categories include the proportions of the state residents 19-29, 30-34, 35-44, 45-54, 55-64, and over 65.

2.4.2 Empirical specification and estimation

The following equation was estimated to answer the questions raised in this study.

$$Crime_{st} = \beta \cdot Beds_{st} + \delta \cdot SMHA_{st} + \eta \cdot X_{st} + S_s + Y_t + S_s * T + \varepsilon_{st}, \qquad (3)$$

where $Crime_{st}$ is the number of crimes per 100,000 persons in state *S* and in time *t*. Since the dependent variables were slightly skewed and a national log transformation is often done in the criminology literature, a logged transformation of a dependent variable was considered and tested using a method suggested by Wooldridge (2003). For all dependent variables except arson, the Wooldridge test favored the unlogged functional form.

Beds and *SMHA* are the main independent variables of interest. *Beds* corresponds to either the number or ratio of psychiatric beds. As described above, different variables in *Beds* were specified according to specific study questions. SMHA refers to state mental health agencies' expenditures on community mental health programs and allows us to control for the expansion of public community mental health treatment as well as isolate the effect of public community mental health capacity on crime rates.

X refers to a vector of time-varying state-level policing policy, socio-economic, and demographic variables to control for factors that might determine the crime rate. Policing policy variables, such as arrest rates and the number of police with arrest power per 100,000 residents, were once-lagged to minimize endogeneity between these variables and crime rates (Donohue & Levitt 2001; Corman & Mocan 2000; Levitt 1997). *S* and *Y* represent state and year fixed effects respectively, and ε is an i.i.d. error term. The state fixed effects were included to control for all unobserved state differences that do not change over time. Year dummies were included to account for secular changes in crime rates over time, which are common to all states. Year dummies also control to some extent for advances of newer psychotropic medications. In addition to the extensive set of controls, remaining unobserved heterogeneity was further tested by including linear time trends *T* interacted with states which allows us to control for remaining differences from state specific trends in crime. The interaction terms were tested using the F-test for joint

significance and visual examination of whether the coefficient estimates of the main independent variables are substantially affected by the inclusion of the interaction terms because in this case an omitted variable bias is a concern. Visual examination was also conducted to check whether other covariates are as expected with or without the interactions since an inclusion of the state-specific time trends may be highly correlated with one or more of the independent variables, which, in turn, may pick up too much variation and lead to peculiar results. In addition, R^2 was used as additional criteria of a model choice. In the end, the interaction terms were included in all models.

The above empirical specification, Equation (3), was estimated using weighted least squares with state populations as weights since the null hypothesis of homoskedasticy was rejected in all models. Unweighted estimates would produce heteroskedasticity because the magnitude of the error terms may be inversely correlated with the population size. For example, the crime rates may fluctuate more in the states with smaller population because small changes in the number of offenses yield larger changes in the ratio in the states with smaller population.

In particular, this study address the following potential violations of OLS standard assumptions in panel data: (1) panel heteroskedasticity, i.e. each state may have its own error variance; (2) contemporaneous correlation, i.e. the error variance for one state may be correlated with the errors for other states; and (3) serial correlation, i.e. the errors for a given state are correlated with the previous errors for that state. In the presence of the violation of any of the assumptions, ordinary least squares (OLS) is not the best linear unbiased estimator (BLUE) and may produce incorrect inferences due to incorrect standard errors. Also, it should be noted that the data for this study are distinguished from panel data usually found in health services research. While most common panel data in health services research have fairly large units of observations with small time periods,

the data used for the study have small observations (51 units of observations) with relatively large time periods (17 years), which are often called time-series-cross-section (TSCS) data[6]. Although usual panel data techniques could be used for the TSCS data, simulations reported by Beck and Katz (2004, 1996 & 1995) indicate that the method of panel corrected standard errors (PCSE) developed by the authors has excellent statistical properties for the TSCS data especially when time periods exceed 15. The Beck-Katz method has recently received a wide acceptance as a standard econometric technique by political scientists and social researchers. Although this technique is rarely employed by health services researchers yet, it addresses important issues related to correct inferences in the current analysis. Thus, using the PCSE method, I control for the remaining heteroskedasticity after the weighting as well as for contemporaneous correlation across states.

A crucial assumption for the method of PCSE is that the errors are free of serial correlation because the OLS estimator is biased if the errors are serially correlated. Thus, a series of F-test for serial correlation (AR(1)) in panel data models developed by Wooldridge (2002) were conducted. Some models did not reject the null hypothesis of no serial correlation. These models are indicated in the result tables. Models without evidence of AR(1), were estimated using OLS with PCSEs. When there was evidence of AR(1), serial correlation was eliminated using the Prais-Winsten method, a variant of feasible generalized least squares (FGLS), as suggested by Plumper and colleagues (2005). Thus, reported in the tables in the result section is either OLS estimates with PCSE or Prais-Winsten estimates with PCSE.

2.5 Results

2.5.1 Description on national time-trends in the number of psychiatric beds, market

[6] A good summary of difference between the two types of data is found in Beck (2001).

shares of psychiatric beds of different type, and crime rates

To make the trends comparable to one another, percent changes from the initial year 1982 were calculated. Figure 2.1 displays the trends in various crime outcomes during our study period. With the exception of rape, the other 10 categories of crime decreased until 1984. All categories except burglary sharply increased until the early 90's with a decrease around 1987. Burglary exhibited a decreasing trend since 1986. Total serious crime, larceny, and motor vehicle theft showed almost identical patterns of change. So did total violent crime, murder, and robbery.

Figure 2.2 depicts the changes in the number of psychiatric beds over time. Two major patterns were identified. The total number of psychiatric beds, the number of public psychiatric hospital beds, and the number of psychiatric beds in public general hospitals almost constantly decreased during our study period. In contrast, the number of psychiatric beds in private psychiatric hospitals and private general hospitals exhibited periods of increase, stability, and decrease. Particularly, the number of private psychiatric hospital beds showed the time-series pattern found in crime rates.

Figure 2.3 shows trends in the relative compositions of psychiatric beds in private psychiatric hospitals and public and private general hospitals to public psychiatric hospitals. This provides useful information on an often under-examined change in the mental health system over the past several decades. The relative market composition of private psychiatric hospital beds showed an overall increase from 14 percent in 1982 to 39 percent in 1998 with a decrease between 1991 and 1996. Private general hospitals had a constant and substantial increase in the relative composition from 24 to 117 percent over the period. The relative composition of public general hospitals constantly increased.

Taken together, at the national level, there was no clear pattern systematically linking changes in psychiatric beds and crime rates. The only exception is the changes in

private psychiatric hospital beds which almost concurred with the changes in the crime rates.

2.5.2 Combined effect of the number of psychiatric beds on crime

No significant association was found between the total number of psychiatric beds and any of our crime outcomes (Table 2.2). SMHA's expenditures on the community mental health in general were not significant. However, a significant and positive association was found between SMHA's expenditures and murder and robbery.

With regard to the other control variables, the signs of the estimated coefficients were in general as expected. For example, unemployment rates were positively associated with the crime rates. The proportion of the black population and a large proportion of younger populations were positively associated with violent crime. Higher proportions of older ages were often negatively associated with crime rates.

At this point, it is not clear why the positive coefficients on the total number of psychiatric beds are observed although they are statistically insignificant. I proceed by providing the results of the effect of psychiatric beds of each hospital type. The results in Tables 2.3 and 2.4 suggest important aspect of hospital type regarding its impacts on crime.

2.5.3 The effect of psychiatric beds on crime by different hospital characteristics

The number of public psychiatric hospital beds was negatively associated with the total number of serious crimes and the coefficient was significant at the conventional levels (Table 2.3). One-bed decrease per 100,000 persons in public psychiatric hospitals was associated with an increase of approximately 6 offenses of any type per 100,000. In contract, there was a significant and positive coefficient on the number of private psychiatric hospital beds. An increase in private psychiatric hospital bed was associated

with an increase of about 27 total serious crimes. The coefficients on the number of psychiatric beds in public and private general hospitals were positive and negative, respectively, but none of them were significant. SMHA expenditures on community mental health were not significant. Results for total property crimes were almost identical to total serious crimes. However, the number of public and private psychiatric hospital beds was not associated with total violent crimes. Rather, the coefficients on public and private general hospital beds were positive and negative, respectively, and were significant. One psychiatric bed increase in public general hospital was associated with about an increase of three violent crimes while the same increase in private general hospitals decreased violent crime by three offenses.

In terms of the eight individual crimes, our results indicate a negative relationship between the availability of public psychiatric hospital beds and murder. For example, a 100-bed decrease was associated with an increase of about three murders. The estimated effect does not look substantial; however, considering murder is a rare event, this figure may be a cause for concern. There was a negative association between private psychiatric hospital beds and rape. Public and private general hospital beds were associated with increased and decreased rates of aggravated assaults, respectively.

With regard to individual property crimes, one-bed decrease in public psychiatric hospital beds was associated with an increase of about three burglaries. Private psychiatric hospital beds were positively associated with burglary, larceny, and motor vehicle theft.

2.5.4 Market share of psychiatric beds of different hospital types and crime

The coefficient estimates of the relative market share of private and general to public psychiatric hospital beds in general confirm the results in Table 2.3 (see Table 2.4). The results identify the relative proportion of beds in private psychiatric hospitals as a

crime-affecting factor. For example, a one percentage point increase in the ratio of private to public psychiatric hospital beds holding total beds constant was associated with an increase of about three crimes per 100,000 persons for total serious crimes. There was a significant, positive relationship between the ratio of private to public psychiatric hospital beds and violent crime (aggravated assault), but the magnitude was small. Property crimes such as burglary and motor vehicle theft showed a significant positive relationship with the ratio, and the size of the association was larger than violent crimes.

2.5.5 Social costs or savings from changes in crime associated with psychiatric beds

Using the estimates from Table 2.4 and social costs data from Lochner and Moretti (2004), I calculated social costs and savings from changes in crime rates associated with the changes in the number of public and private psychiatric hospital beds and in the ratio of private to public psychiatric hospital beds. As shown in Table 2.5, costs to society from reduced public psychiatric hospital beds were large. Social costs from murder and burglary associated with a unit decrease in public psychiatric hospital beds per 100,000 persons are $81,658 and $2,704, respectively, in 1996 dollars. Given that during the study period, the number of public psychiatric hospital beds decreased by 2,066 beds per 100,000 persons nationally, the decrease was responsible for approximately $174.3 million losses per 100,000 persons ($168.7 million from murder and $5.6 million from burglary). A one bed increase in the number of private psychiatric hospital beds yielded social costs from burglary, larceny, and motor vehicle theft, but overall resulted in social savings due to the substantial decrease in rape. The estimated social savings from the increase of 246 private psychiatric hospital beds per 100,000 persons between 1982 and 1991 was about $0.3 million per 100,000. However, a 131-bed decrease in private psychiatric hospital beds over our study period was responsible for $0.15 million social costs per 100,000. A one percentage point increase in the ratio of

private to public psychiatric hospital beds was estimated to have $3,146 monetary losses per 100,000. Thus, a 25 percentage point increase in the relative market composition of private to public psychiatric hospital beds was associated with about $79,000 per 100,000 persons. In sum, the decrease in public psychiatric hospital beds and the increase in private psychiatric hospital beds between 1982 and 1998 are estimated to yield social costs of about $174.5 million per 100,000 largely due to costs from violent crimes.

2.6 Sensitivity Analysis

The robustness of our results was assessed in many ways. First, because the results are from weighted-least-squares which places greater weights on states with larger population, all regression models in Table 2.2 – Table 2.4 were re-estimated dropping observations from 5 largest states – California, Texas, New York, Florida, and Pennsylvania in the descending order. The alternative models were estimated omitting one state at a time and then all five states together. Also, the sensitivity of the results was examined by removing five states with highest crime rates, one state at a time and then all five states together. These states include Wisconsin, Texas, Washington D.C., Florida, and Arizona. The results from these models were quantitatively identical to those reported in this study.

Since the legalized abortion and concealed-handgun regulations have been cited as important factors that affected changes in crime rates in the literature (Donohue and Levitt 2001; Lott and Mustard 1997), the robustness of the results of this study was tested by adding two additional variables in estimation. 15-year lagged variables indicating whether a state had the abortion law and dummy variables indicating the presence of concealed-handgun laws were included. No significant changes in the main results of this study were found.

Finally, when there is evidence of serial correlation, a strategy employed in this study was to deal with the serial correlation using the Prais-Winsten method; however, Beck and Katz (1996) suggest a different method. They suggest including the lagged dependent variable in the right-hand side variables to eliminate serial correlation of the errors. However, whether one can use the lagged dependent variable to control for serial correlation is somewhat controversial in the literature. Plumper and colleagues (2005) argue that Beck-Katz's method for dealing with an autocorrelation overestimates the serial correlation coefficient and results in an underestimation of the parameters. The robustness analysis showed that this is generally true in our data. However, there was no significant difference in our coefficients from the Beck-Katz and Prais-Winsten methods.

2.7 Conclusion

Several important facts emerged from this study. The findings reported here indicate that despite no observed relationship between the total number of psychiatric beds and crime, there was interesting association by hospital type. The results indicate that other conditions being unchanged – e.g., the number of non-traditional psychiatric beds does not increase in response to reduced public psychiatric beds, a decrease in the number of public psychiatric hospital beds may have a sizable effect on crime rates mainly via both violent and property crimes such as murder and burglary. On the contrary, an increase in the number of private psychiatric hospital beds may increase property crimes such as burglary, larceny, and motor vehicle theft, if increased private psychiatric hospital beds do not drive changes in the psychiatric market. Also, the magnitude of the effect appears to be much larger than influences of public psychiatric hospital beds. A relative market composition of psychiatric beds of the different hospital types may have a significant effect on crime as well. One important implication of this result is that changes in either absolute number of different types of psychiatric beds or relative market share of

psychiatric beds may play an important role in determining crime rates. Thus, it is important to consider the spillover effects of inpatient reductions may have on crime when redesigning more effective mental health systems. Importantly, retaining the capacity of public psychiatric hospital beds may prevent a possible increase in crime unless the psychiatric market expands community resources enough to absorb an increased volume of mentally ill persons in the community.

The changes in the number of psychiatric beds and in the relative market share of private to public psychiatric hospital beds may impose enormous social savings or costs. Our results on these estimates have several important implications. First, an economic impact of changes in the number of psychiatric beds is more significant than that of changes in the relative market composition of psychiatric beds of different hospital types. Second, social costs or savings from violent crimes caused by changing supplies of psychiatric beds are much more substantial than the monetary impact from property crimes. Lastly, although our main results showed that the magnitude of the coefficients on private psychiatric hospital beds was much larger than public psychiatric hospital beds, changes in public psychiatric hospital beds may have larger economic impacts on society.

Three important questions emerge from the findings of this study: (1) why does the increase in private psychiatric hospital beds lead to an increase in crime?; (2) why does the increased expenditures on community mental health programs have no effect on crime and in some cases increase crime?; and (3) why is only murder affected among violent crimes?

One possible explanation to the first question is that as discussed in the conceptual framework section, private psychiatric hospitals may avoid difficult and unprofitable patients especially where the level of market competition among private psychiatric hospitals is high (Mechanic 1999; Schlesinger and Gray 1999; Schlesinger et al. 1997).

Thus, as much as the increase in the number of private psychiatric hospital beds reflects increased market competition, it may hamper the delivery of mental health services to indigent patients with more severe psychiatric symptoms and in turn raise crime. Similarly, as the ratio of private psychiatric hospital beds to public psychiatric hospital beds increases, the care for those with the most debilitating symptoms of mental illness may be exacerbated in part due to private psychiatric hospitals' reluctance to serve unprofitable patients. Another explanation would be that private psychiatric hospitals may not inherently address the treatment needs of a subgroup of patients with severe mental illness and thus are incapable of successfully integrating them into the community. For example, a California-based study of 101 patients discharged from a highly structured inpatient setting such as a locked private community intermediate care facilities suggests that community treatment of severely mentally ill persons with special needs may not be successful. Over one-year follow-up period 46 percent of the discharged patients used acute psychiatric hospitals, and the intermediate care facility, or jail, 67 percent of which were institutionalized in those facilities for more than half the year. An additional 10 percent used other highly restrictive community facilities and had more than five acute hospitalizations (Lamb and Weinberger 2005).

A possible answer for the second question is that under-funding of community mental health programs may hinder community mental health programs from effectively meeting the needs of a subgroup of the patients (Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998). An alternate explanation would be similar to the second argument above in that the community mental health system may not inherently address the treatment needs of some patients with severe mental illness. A recent Massachusetts-based study found that even nation's highest level of community mental health services did not decrease the proportion of severely mentally ill offenders in jail. Fisher and

colleagues (2000) compared the prevalence of severe mental illness in jail detainees in western Massachusetts and central Massachusetts. Western Massachusetts closed a state hospital in 1993 and has developed a comprehensive array of community programs such as community-based outpatient mental health services, case management, emergency respite, and mobile crisis. Central Massachusetts, in contrast, experienced a slow growth of community-oriented mental health programs. Findings showed that in 1996 the prevalence of severe mental illness in local jails was considerably close between those areas but more severely mentally ill offenders were found in the jails in western Massachusetts.

A possible reason for the third issue is similar to the speculation for the first question. Possibly, both an increase in private psychiatric hospital beds and a decrease in public psychiatric hospital beds may create a gap in treatments of those with the most debilitating symptoms such as schizophrenia. Interestingly, although the causal interpretation remains inconclusive (Arboleda-Florez, Holley and Crisanti 1998), studies have found an increased risk of murder among persons with schizophrenia as compared with non-disordered persons (Erb et al. 2001; Wallace et al. 1998; Eronen et al. 1996; Taylor and Gunn 1984). Thus, the changes in the delivery of psychiatric inpatient care may have negatively affected those with more severe mental illness, which may contribute to our finding of the increased rate of murder.

The examination of these issues is beyond the scope of the present analysis. However, whatever the actual reason is, the findings of this research suggest that retaining the availability of public psychiatric hospital beds may have a crime-prevention effect. Also, the market share of psychiatric beds of different hospital characteristics should be closely monitored.

In addition, the present study only examined the effect on serious crime due to the unavailability of crime data on minor offenses. Considering severely mentally ill offenders are often charged with minor crime (Morrissey, 2004; Torrey, 1995; Valdiserri, Carroll, & Hartl, 1986; Lamb & Grant 1982; Sosowsky 1980; Steadman, Cocozza, & Melick 1978; Abramson 1972), the effect of a decrease in psychiatric beds may occur largely though an increase in minor crimes. Thus, it is likely that the relationship between the number of psychiatric beds and crime is larger than what is reported in this study.

The present research did not intend to identify a group of persons with severe mental illness with special needs such as those who are uninsured and economically disadvantaged, due to limitation in the available data. For example, lack of insurance among severely mentally ill persons acts as a significant barrier to access to mental health providers in the community (Wells et al. 2002; McAlpine and Mechanic 2000; Rabinowitz et al. 1998; Landerman et al. 1994). Moreover, uninsured mentally ill persons are more likely to have substance abuse problems than persons with any type of insurance such as Medicaid, Medicare and private insurance. Persons with severe mental illness are more likely than persons with non-severe or no disorders to be economically disadvantaged. They are more likely to have less education and lower family income (Wells et al. 2002; McAlpine and Mechanic 2000). Blacks are less likely to obtain mental health treatment than whites (Snowden & Thomas 2000; Young et al. 2001). Thus, considering most patients can be successfully treated and maintained in the community, future research should identify the population which is more likely to be affected by changes in psychiatric beds according to their socioeconomic and demographic characteristics as well as types of mental illness.

Another important limitation of the present study is that the empirical model did not control for direct measures of *social capital*. In this study, the degree of social capital

is expected to be partly captured by the socioeconomic and demographic variables. In addition, as much as social capital changed gradually or linearly over time, the state-specific time trends would account for this unobserved factor. However, it cannot be ruled out that changes in social capital over the study period are non-linear. Clearly, interactions between psychiatric beds supply, social capital, and crime deserve further study.

Finally, in interpreting the results presented here, it is noteworthy that the research design of this study was to model a contemporaneous relationship between a change in psychiatric bed supply and crime. This study used an econometric treatment of the correlational data from all US states and the District of Columbia over relatively long time periods for an identification of causal effects. More specifically, the empirical model of this study used interstate variation in the supply of psychiatric beds and crime rates over time, focusing on minimizing omitted variable bias as a potential treat to causality by controlling for state and year fixed effects and state-specific time trends as well as the extensive set of state-level control variables. In addition, there is no reason to believe that reverse causality prohibits causal interpretations of the findings because an increase in crime, for example, would not reduce the supply of hospital psychiatric beds. Nevertheless, it is important to keep in mind that this study did not empirically model causal ordering between the availability of psychiatric beds and crime rates. In addition, as long as the state-specific linear time trends do not adequately control for unobserved factors which may explain temporal trends in crime rates – e.g., changes in social capital and mental health workforce, omitted variable bias would contaminate the results reported here. Future studies should explicitly examine a causal sequence of the effect of a change in psychiatric bed supply on crime.

REFERENCES

Abramson, M.F. 1972. "The criminalization of mentally disordered behavior: possible side-effect of a new mental health law." *Hospital and Community Psychiatry* 23 (4):101-5.

American Hospital Association. 1995. "1994 Annual Survey of Hospitals Data Base Documentation Manual".

Arboleda, J., H. Holley, and A. Crisanti. 1998. "Understanding Causal Paths Between Mental Illness and Violence." *Soc Psychiatry Psychiatr Epidemiol* 33:S38-S46.

Beck, N., and J. Katz. "Time Series-Cross Section Issues: Dynamics, 2004." Working Paper, July 24, 2004.

Beck, N. 2001. "Time-Series Cross-Section Data: What Have We Learned in the Past Few Years?" *Annual Review of Political Science* 4:271-93.

Beck, N., and J. Katz. 1996. "Nuisance vs. Substance: Specifying and Estimating Time-Series—Cross-Section Models." *Political Analysis* 6:1-36.

Beck, N., and J. Katz. 1995. "What to Do (And Not Do) with Time-Series Cross-Section Data." *American Political Science Review* 89:634-47.

Becker, G.S. 1968. "Crime and Punishment: An Economic Approach." *The Journal of Political Economy* 76(2):169-217.

Becker, G.S., and C.B. Mulligan. 1997. "The Endogenous Determinatin of Time Preference." *The Quarterly Journal of Economics* 112(3):729-58.

Becker, G.S. and K.M. Murphy. 1988. "A Theory of Rational Addiction" *The Journal of Political Economy* 96(4):675-700.

Biles, D., and G. Mulligan. 1973. "Mad or Bad? The Enduring Dilemma." *British Journal of Criminology* 13;275-9.

Blumstein, A., and R. Rosenfeld. 1998. "Explaining Recent Trends in U.S. Homicide Rates." *The Journal of Criminal Law and Criminology* 88(1):1175-216.

Corman, H. and H.N. Mocan. 2000. "A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City**"** *The American Economic Review* 90(3):584-604.

Ditton, P.M. 1999. "Mental Health Treatment of Inmates and Probationers." Washington DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics.

Donohue, J.J., and S.D. Levitt. 2001. "The Impact of Legalized Abortion on Crime." *The Quarterly Journal of Economics* 116(2):379-420.

Donohue, J.J. 1998. "Understanding the Time Path of Crime." *The Journal of Criminal Law and Criminology* 88(4):1423-51.

Ehrlich, I. and H. Chuma. 1990. **"**A Model of the Demand for Longevity and the Value of Life Extension". *The Journal of Political Economy* 98(4):761-82.

Erb, M., S. Hodgins, R. Freese, R. Muller-Isberner, and D. Jockel. 2001. "Homicide and Schizophrenia: maybe treatment does have a preventive effect." *Criminal Behavior and Mental Health* 11:6-26.

Eronen, M., J. Tilhonen, and P. Hakola. 1996. "Schizophrenia and Homicidal Behavior." *Schizophrenia Bulletin* 22:83-90.

Fisher, W.H., I.K. Packer, L.J. Simon, and D. Smith. 2000. "Community Mental Health Services and the Prevalence of Severe Mental Illness in Local Jails: Are They Related." *Administration and Policy in Mental Health* 27 (6):371-82.

Frank, R.G., H.H. Goldman and M. Hogan. 2003. "Medicaid and Mental Health: Be Careful What You Ask For." Health Affairs 22(1):101-13.

Fuchs, V.R. "Economic Aspects of Health." Chicago, University of Chicago Press, 1982.

Grob, G.N. 2001. "Mental Health Policy in the 20th-Century America." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Grob, G.N. 1994. "The Mad Among Us: A History Of The Care Of America's Mentally Ill." New York: Free Press.

Grossman, M. 1972. "On the Concept of Health Capital and the Demand for Health." *The Journal of Political Economy* 80(2):223-255.

Grunberg, F., B.I. Klinger, and B.R. Grument. 1997. "Homicide and the Deinstitutionalization of the Mentally Ill." *American Journal of Psychiatry* 134;685-7.

Harris, K.M., and M.J. Edlund. 2005. "Self-Medication of Mental Health Problems: New Evidence from a National Survey." *Health Services Research* 40 (1):117-34.

Kessler, R.C., P.A. Berglund, E.E. Walters, P.J. Leaf, A.C. Kouzis, M.L. Bruce et al. 1999. "Population-Based Analyses: A Methodology for Estimating the 12-month Prevalence of Serious Mental Illness." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 1998* (pp. 99-109). Washington, D.C.: U.S. Government Printing Office.

Kessler, R.C., P.A. Berglund, M.D. Glantz, D.S. Koret, K.R. Merikangas, E.E. Walters et al. 2004. In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2002* (pp. 155-164). Washington, D.C.: U.S. Government Printing Office.

Koslowe, P.A., M.J. Rosenstein, L.J. Milazzo-Sayre, and R.W. Mandersheid. 1991. "Characteristics of Persons Served By Private Psychiatric Hospitals, United States: 1986." *Mental Health Statistical Note* 201:1-25.

Lamb, H.R., and R.W. Grant. 1982. "The Mentally Ill in an Urban County Jail." *Archives of General Psychiatry* 39:17-22.

Lamb, H.R., and L.E. Weinberger. 2005. "The Shift of Psychiatric Inpatient Care From Hospitals to Jails and Prisons." *J Am Acad Psychiatry Law* 33:529-34.

Lamb, H.R., and L.E. Weinberger. 1998. "Persons With Severe Mental Illness in Jails and Prisons: A Review." *Psychiatric Services* 49:483-92.

Lamb, H.R., L.E. Weinberger, and B.H. Gross. 2004. "Mentally Ill Persons in the Criminal Justice System: Some Perspectives." *Psychiatric Quarterly* 75 (2):107-26.

Landerman, L.R., B.J. Burns, M.S. Swartz, H.R. Wagner, and L.K. George. 1994. "The Relationship Between Insurance Coverage and Psychiatric Disorder in Predicting Use of Mental Health Services." *American Journal of Psychiatry* 151 (12):1785-90.

Levitt, S.D. 2004. "Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six that do Not." *Journal of Economic Perspective* 18(1):163-90.

Lochner, L., and E. Moretti. 2004. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports." American Economic Review 94(1):155-189.

Lott, J.R. and D.B. Mustard. 1997. "Crime, Deterrence, and Right-to-Carry Concealed Handguns." *Journal of Legal Studies*.

Lutterman, T. and M. Hogan. 2004. "State Mental Health Agency Controlled Expenditures and Revenues for Mental Health Services, FY 1981 to FY 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Mandersheid, R.W., J.E. Atay, A. Male, B. Blacklow, C. Forest, L. Lngram et al. 2004. "Highlights of Organized Mental Health Services in 2000 and Major National and State Trends." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2002*. Washington, D.C.: U.S. Government Printing Office.

Markowitz, F.E. 2006. "Psychiatric Hospital Capacity, Homelessness, and Crime and Arrest Rates." Criminology 44 (1) 45-72.

McAlpine, D.D., and D. Mechanic. 2000. "Utilization of Specialty Mental Health Care Among Persons with Severe Mental Illness: The Roles of Demographics, Need, Insurance, and Risk." *Health Services Rearch* 35 (1):278-92.

Mechanic, D. 1999. "Mental Health and Social Policy: The Emergence of Managed Care." Boston, MA: Allyn and Bacon.

Mechanic, D., and D.A. Rochefort. 1990. "Deinstitutionalization: An Appraisal of Reform. *Annu. Rev Sociol* 16:301-27

Milazzo-Sayre, L.J., M.J. Henderson, R.W. Manderscheid, M.C. Bokossa, C. Evans, A.A. Male. 2001. "Persons Treated in Specialty Mental Health Care Programs, United States, 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Miller, T.R., M.A. Cohen, and B. Wierama. 1996. "Victim Costs and Consequences: A New Look." U. S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

Morrissey, J.P. 1989. "The Changing Role of the Public Mental Hospital." in *Handbook on Mental Health Policy in the United States*, Ed. Rochefort, Westport, Conn.: Greenwood.

National Advisory Mental Health Council (NAMHC). 1993. "Health Care Reform for Americans with Severe Mental Illnesses." *Am J Psychiatry* 150:1447-65.

National Association of State Mental Health Program Directors Research Institute (NRI). 2004. "Closing and reorganizing state psychiatric hospitals:2003." NASMHPD Research Institute, Inc, Alexandria, VA.

New Freedom Commission on Mental Health. 2003. "Achieving the Promise: Transforming Mental Health Care in America: Final Report." DHHS Pub. No. SMA-03-3832. Rockville, MD.

O'Brien, R.M. 2003. "UCR Violent Crime Rates, 1958-2000: Recorded and Offender-Generated Trends." *Social Science Research* 32:499-518.

Palermo, G.B., M.B. Smith, and F.J. Liska. 1991. "Jails Versus Mental Hospitals: A Social Dilemma." International Journal of Offender Therapy and Comparative Criminology 35:97-106.

Penrose, L.S. 1939. "Mental Disease and Crime: Outline of a Comparative Study of European Statistics." *British Journal of Medical Psychology* 18:1-15.

Plumper T, V.E. Troeger, and P. Manow. 2005. "Panel Data Analysis in Comparative Politics: Linking Method to Theory." *European Journal of Political Research* 44:327-354.

Pristach, C.A., and C.M. Smith. 1996. "Self-Reported Effects of Alcohol Use on Symptoms of Schizophrenia." *Psychiatr Services* 47:421-3.

Rabinowitz, J., E.J. Bromet, J. Lavelle, K.J. Severance, S.L. Zariello, and B. Rosen. 1998. "Relationship Between Type of Insurance and Care During the Early Course of Psychosis." *American Journal of Psychiatry* 155 (10):1392-97.

Raphael, S. 2000. "The Deinstitutionalization and the Mentally Ill and Growth in the U.S. Prison Population: 1971 to 1996." Unpublished manuscript. University of California, Berkely, CA.

Rosenbeck, R.A., D.J. Dausey, L. Frisman, and W. Kasprow. 2000. "Outcomes After Initial Receipt of Social Security Benefits Among Homeless Veterans With Mental Illness." *Psychiatric Services* 51(12): 1549-54.

Paldam, M. 2000. "Social Capital: One or Many? Definition and Measurement." *Journal of Economic Survey* 14(5):629-53.

Schlesinger, M. and B. Gray. 1999. "Institutional change and its consequences for thedelivery of mental health services: Definitions and perspectives." In A. Horwitz & T. Scheid (Eds.), A handbook for the study of mental health: Social contexts, theories, and systems (pp. 427-448). Cambridge: Cambridge University Press.

Schlesinger, M., R. Dorwart, C. Hoover and S. Epstein. 1997. "The determinants of dumping: a national study of economically motivated transfer involving mental health care." *Health Services Research* 32 (5):561-76.

Silver, E. 2006. "Understanding the Relationship Between Mental Disorder and Violence: The Need for a Criminological Perspective." *Law and Human Behavior* 30(6):685-706.

Silver, E., E.P. Mulvey, and J.W. Swanson. 2002. "Neighborhood Structural Characteristics and Mental Disorder: Faris and Dunham Revisited." *Social Science & Medicine* 55:1457-70.

Silver, E., and B. Teasdale. 2005. "Mental Disorder and Violence: An Examination of Stressful Life Events and Impaired Social Support." *Social Problems* 52(1):62-78.

Smith, L.D. 1989. "Medication Refusal and the Rehospitalized Mentally Ill Inmates." *Hosp Community Psychiatry* 40:491-6.

Snowden, L.R., and K. Thomas. 2000. "Medicaid and African American Mental Health Treatment." *Mental Health Service Research* 2(2):115-120.

Sosowsky, L. 1980. "Explaining the Increased Arrest Rate Among Mental Patients: A Cautionary Note." *American Journal of Psychiatry* 137:1602-05.

Sosowsky, L. 1978. "Crime and Violence Among Mental Patients Reconsidered in View of the New Legal Relationship Between the State and the Mentally Ill." *American Journal of Psychiatry* 135:33-42.

Steadman, H.J., J.J. Cocozza, and M.E. Melick. 1978. "Explaining the Increased Arrest Rate Among Mental Patients: The Changing Clientele of State Hospitals." *American Journal of Psychiatry* 135 (7):816-20.

Steadman, H.J., D.W. McCarty, and J.P. Morrissey. 1989. "The Mentally Ill in Jail: Planning for Essential Services." New York: Guildford Publications.

Steadman, H.J., J. Monahan, B. Duffee, E. Hartstone, and P.C. Robbins. 1984. "The Impact of State Mental Hospital Deinstitutionalization on United State Prison Populations, 1968-1978." *The Journal of Criminal Law and Criminology* 75 (2):474-90.

Steadman, H.J., D. Vanderwyst, and S. Ribner, 1978. "Comparing Arrest Rates of Mental Patients and Criminal Offenders." *American Journal of Psychiatry* 135 (10):1218-20.

Swanson, J.W., M.S. Swartz, R. Borum, V.A. Hiday, H.R. Wagner, and B.J. Burns. 2000. "Involuntary Out-Patient Commitment and Reduction of Violent Behavior in Persons With Severe Mental Illness." *British Journal of Psychiatry* 176:324-31.

Taylor P.J., and J. Gunn. 1984. "Violence and Psychosis." British Medical Journal 288:1945-1949; 289:9-12.

Teplin, L.A. 1990. "The prevalence of severe mental disorder among male urban jail detainees: comparison with the Epidemiologic Catchment Area Program." *American Journal of Public Health* 80(6):663-9.

Teplin, L.A. 1984. "Criminalizing Mental Disorder: The Comparative Arrest Rate of the Mentally Ill." *American Psychologist* 39:794-803.

Teplin, L.A. 1983. "The Criminalization of the Mentally Ill: Speculation in Search of Data." *Psychological Bulletin* 94:54-67.

Torrey, E.F. 1995. "Jails and Prisons – America's New Mental Hospitals." *American Journal of Public Health* 85:1611-3.

US Dept. of Justice, Bureau of Justice Statistics. Annual Survey of Jails: Jurisdiction-Level Data, 1998 [Computer file]. Conducted by US Dept. of Commerce, Bureau of the Census. ICPSR ed. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [producer and distributor], 2001.

US Dept. of Justice, Federal Bureau of Investigation. Uniform Crime Reporting Program Data [United States]. County-Level Detailed Arrest and Offense Data, 1998 [Computer file]. 2nd ICPSR ed. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [producer and distributor], 2001.

Valdiserri, E.V., K.R. Carroll, and A.J. Hartl. 1986. "A Study of Offenses Committed by Psychotic Inmates in a County Jail." *Hospital and Community Psychiatry* 37 (2):163-6.

Wallace, C., P. Mullen, P. Burgess et al. 1998. "Serious Criminal Offending and Mental Disorder." *British Journal of Psychiatry* 172:477-484.

Wells, K.B., C.D. Sherbourne, R. Strum, A.S. Young, and M.A. Burnam. 2002. "Alcohol, Drug Abuse, and Mental Health Care for Uninsured and Insured Adults." *Health Services Research* 37 (4): 1055-66.

Whitmer, G.E. 1980. "From Hospitals to Jails: The Fate of California's Deinstitutionalized Mentally Ill." *American Journal of Orthopsychiatry* 50:65-75.

Wilson, J.Q. and Herrnstein R.J. 1985. "Crime and Human Nature: The Definitive Study of the Causes of Crime." The Free Press 1985.

Wooldridge, J.M. 2003. "Introductory Econometrics: A Modern Approach, second edition." Cincinnati, OH: South-Western College Publishing.

Wooldridge, J.M. 2002. "Econometric Analysis of Cross Section and Panel Data." Cambridge, MA: The MIT Press.

Young A.S., R. Klap, C.D. Sherbourne, and K.B. Wells. 2001. "The Quality of Care for Depressive and Anxiety Disorders in the United States." *Arch Gen Psychiatry* 58(1):55-61.

Figure 2.1 Time-Series of the Number of Offenses Per 100,000, 1982-1998

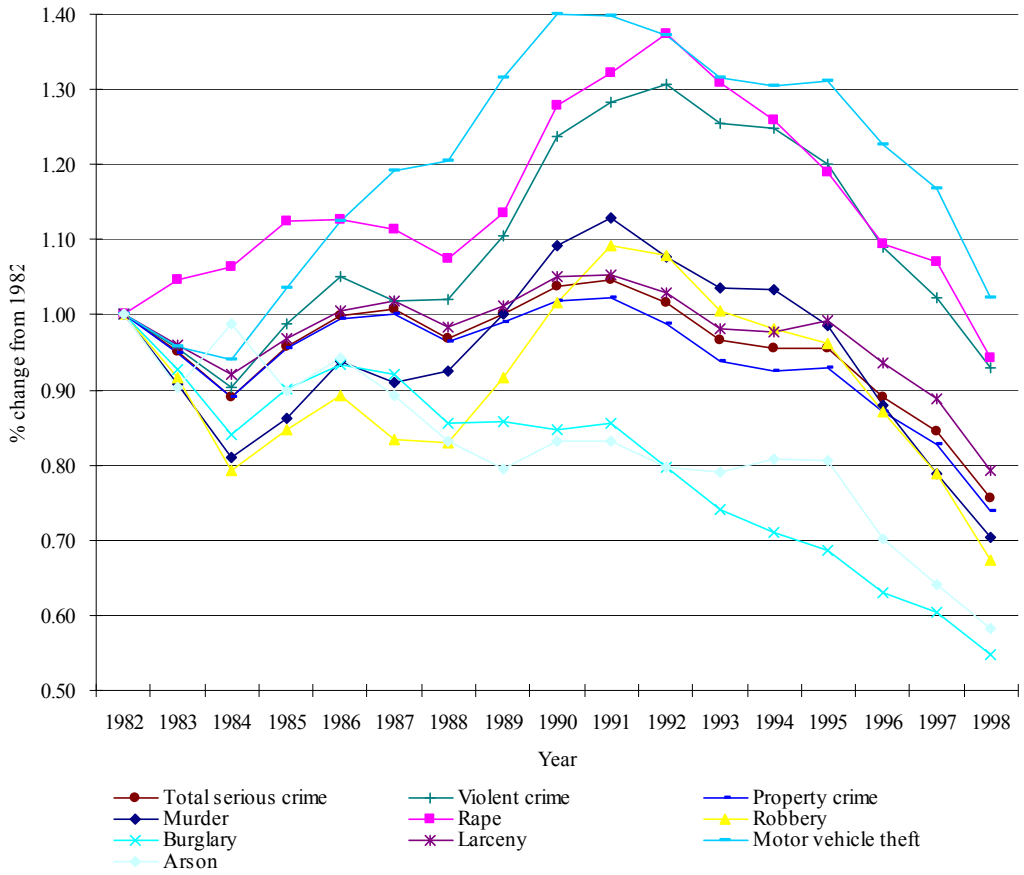

Figure 2.2 Time-Series of the Number of Psychiatric Beds Per 100,000, 1982-1998

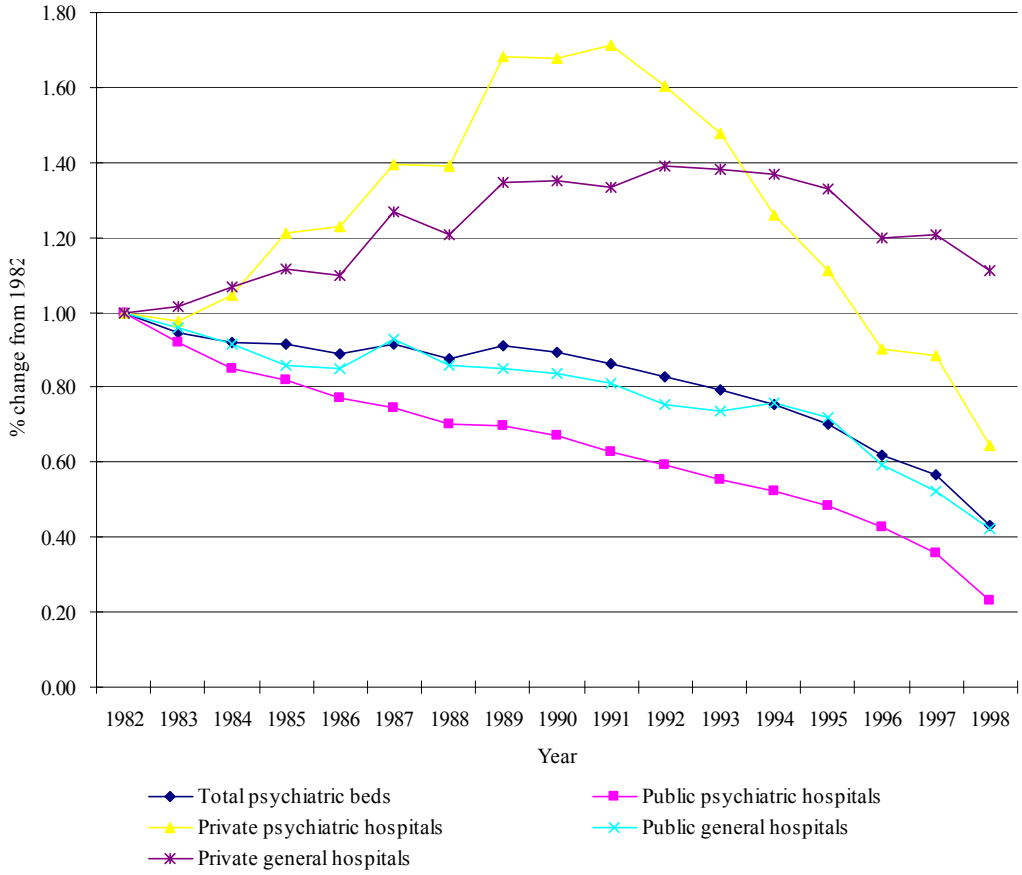

Figure 2.3 Proportion of Psychiatric Beds of Each Hospital Type Relative to Public Psychiatric Hospital Beds, 1982-1998.

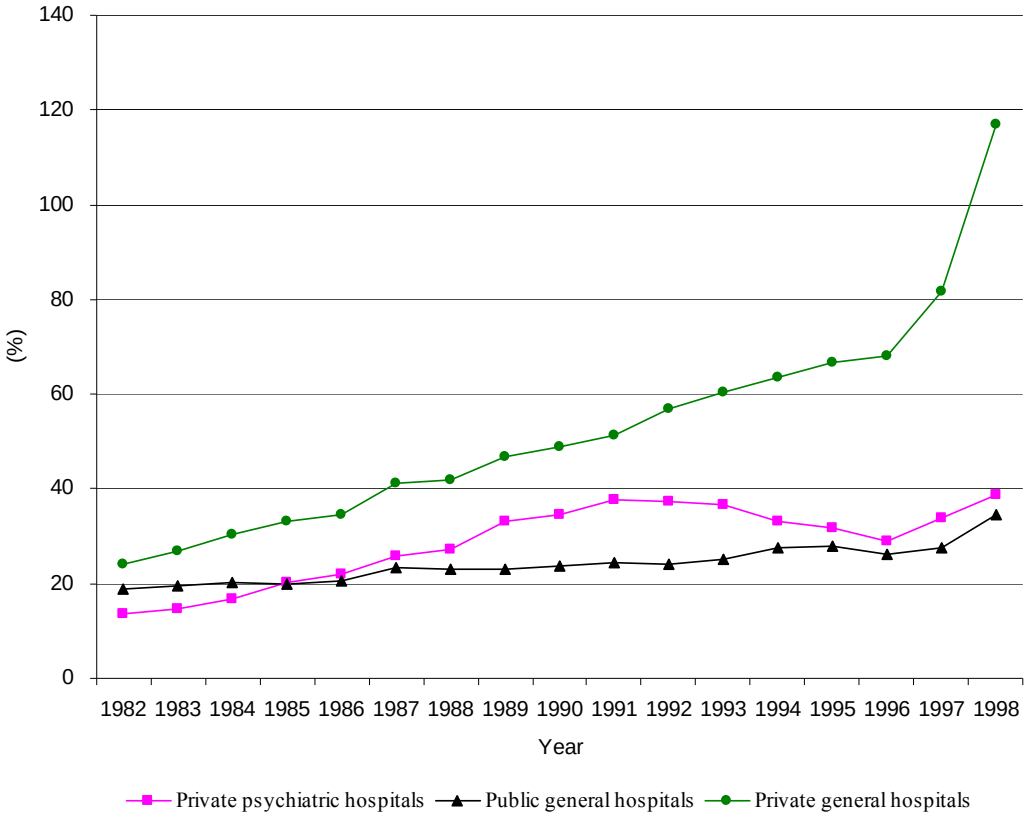

Table 2.1 Variable Definitions, Summary Statistics and Data Sources.

Variables	Definitions	Mean	Standard Deviation	Sources
Dependent Variables				
Total Serous Crime	The number of total serious crime (UCR's Part I Crime total), total violent crime, total property crime, and individual crime per 100,000 persons.	4968	1814	UCR
Violent Crime Total		508	350	
Murder		7.29	8.08	
Rape		34.9	15.5	
Robbery		162	170	
Aggravated Assaults		304	188	
Property Crime Total		4458	1572	
Burglary		1056	410	
Larceny		2939	1053	
Motor Vehicle Theft		427	263	
Arson		36.8	58.4	
Main Independent Variables				
Psychiatric Beds per 100,000				
Total	The number of psychiatric beds per 100,000 persons.	66.2	40.1	AHA
Public Psychiatric Hospital		34.0	31.7	
Private Psychiatric Hospital		9.04	6.83	
Public General Hospital		7.82	6.03	
Private General Hospital		15.6	8.90	
Proportion of psychiatric beds (%)				
Private Psychiatric Hospital	The ratio of the number of psychiatric beds of each type to the number of public psychiatric hospital beds	42.6	58.4	
Public General Hospital		32.1	30.6	
Private General Hospital		65.5	62.1	
CMHA's Expenditures	Community-based outpatient mental health expenditures by state mental health agencies measured in millions of dollars per 100,000 persons	2.33	1.94	NRI
Covariates				
Police Policing				
Arrest Rates (once-lagged)	The ratio of the number of arrests to the total number of crime reported to the police			UCR
UCR Part I Crime Total		0.26	0.83	
Violent Crime Total		0.42	0.13	
Murder		0.92	0.32	
Rape		1.02	9.66	
Robbery		0.30	0.11	
Aggravated Assaults		0.47	0.18	
Property Crime Total		0.24	0.87	
Burglary		0.14	0.04	
Larceny		0.20	0.50	
Motor Vehicle Theft		1.39	19.67	
Arson		0.32	0.96	
Police per 100,000 (Once-lagged)	The number of the full- and Part-time police with arrest power per 100,000 persons	397	200	CJEE Extracts
Socioeconomic factors				
Per-Capita Income	State per-capita income	21703	4016	BEA
Unemployment Rates	State unemployment-to-population ratio	0.063	0.022	BLS
Poverty Rates	Proportion of the poor	0.146	0.042	
Metropolitan Population Rates	Proportion of residents in metropolitan areas	0.66	0.22	
Medicaid Recipients	Proportion of Medicaid	0.101	0.051	

Welfare Recipients (AFDC/TANF)	recipients Proportion of AFDC/TANF recipients	0.040	0.017	Census Bureau
Racial Composition				
White	Proportion of residents of each race	0.85	0.14	
Black		0.11	0.12	
Non-White-Non-Black		0.044	0.089	
Age Structure				
Under 19	Proportion of residents within each category of age	0.296	0.027	
20-24		0.078	0.011	
25-34		0.164	0.018	
35-44		0.148	0.017	
45-54		0.106	0.014	
55-64		0.086	0.009	
65+		0.123	0.021	

Table 2.2 Effect of the Total Number of Psychiatric Beds on Crime Rates Per 100,000 Persons.

	Total Serious Crime	Violent Crime					Property Crime				
		Total [a]	Murder [a]	Rape	Robbery [a]	Aggravated Assaults [a]	Total	Burglary	Larceny	Motor Vehicle Theft [a]	Arson [b]
Main Independent Variables											
Total	1.16	0.41	−0.006	−0.019	−0.01	0.40	0.82	0.12	1.10	−0.15	−0.0017
Psychiatric Beds	(1.33)	(0.34)	(0.010)	(0.025)	(0.19)	(0.32)	(1.20)	(0.47)	(0.79)	(0.39)	(0.0028)
CMHA's	49.38	16.93	0.51**	−0.08	16.09**	0.46	32.0	9.34	4.30	10.61	−0.024
Expenditures	(39.17)	(9.24)	(0.16)	(0.25)	(5.26)	(5.85)	(29.5)	(10.13)	(13.14)	(8.10)	(0.041)
Covariates											
Policing variables											
Arrest rates $_{t-1}$	1.04**	23.91	0.11	−0.034	57.35**	−8.42	1.12	−1261**	−1269*	−0.027	−0.041
	(14.04)	(37.12)	(0.21)	(0.054)	(20.78)	(20.48)	(14.03)	(326)	(587)	(0.020)	(0.052)
Police $_{t-1}$	0.44	0.057	0.0022	−0.0028	0.001	0.054	0.28	0.13	0.28	−0.091	0.0006
	(0.36)	(0.078)	(0.0019)	(0.0039)	(0.044)	(0.045)	(0.29)	(0.11)	(0.16)	(0.056)	(0.0004)
Socio−economic & demographics											
Per−capita	−0.045	−0.001	4.57E−05	−0.00029	−0.0011	−0.0001	−0.049	−0.025	−0.033	−0.011	−3.4E−05
Income	(0.051)	(0.011)	(0.00024)	(0.00043)	(0.0046)	(0.0064)	(0.044)	(0.014)	(0.025)	(0.011)	(0.00004)
Poverty	−4.83	0.20	−0.010	0.03	−0.29	0.40	−5.72	−0.24	−8.35	0.21	−0.0073
	(10.8)	(1.56)	(0.034)	(0.11)	(0.76)	(1.06)	(9.61)	(2.45)	(5.42)	(1.62)	(0.0084)
Unemployment	96.48**	3.61	−0.003	−0.17	5.39*	−1.77	97.19**	43.16**	51.88**	5.47	0.019
	(33.2)	(5.22)	(0.12)	(0.21)	(2.61)	(3.14)	(28.36)	(7.53)	(14.04)	(5.32)	(0.024)
Metropolitan	20.28	−1.25	−0.037	−0.04	−2.05*	0.91	18.56	3.72	7.46	0.85	−0.029
	(13.7)	(1.98)	(0.031)	(0.17)	(0.96)	(1.36)	(11.51)	(2.35)	(6.73)	(2.98)	(0.018)
Medicaid	−143	−159	−6.71	16.0	−136	−11.6	−1340	−727	−262	−352	0.77
	(221)	(244)	(5.98)	(13.1)	(116)	(132)	(1906)	(464)	(853)	(260)	(0.78)
AFDC/TANF	254	−134	−10.7	52.9	−512	365	2148	−424	1491	−535	−7.00
	(501)	(1059)	(23.6)	(49.3)	(594)	(669)	(4092)	(1629)	(1726)	(837)	(5.52)
Racial composition											
Black	1253	8628**	167.5**	−84.5	4819**	3680*	2785	−11451**	7617	7100	21.06
	(1416)	(2254)	(41.7)	(116)	(1572)	(1529)	(12539)	(1958)	(5644)	(4463)	(20.38)
Non−white-Non−black	−3092*	11946**	40.2	−563**	1272	10867**	−39830**	−11746*	−34368**	14442**	−27.01*
	(1422)	(3812)	(88.9)	(164)	(2500)	(1786)	(11583)	(5333)	(5559)	(4228)	(13.20)
Age structure											

20−24	−909 (1298)	2345 (2156)	62.9 (41.5)	−19.5 (94.8)	662 (919)	1604 (1334)	−2196 (11667)	191 (3058)	−9767 (6812)	8726** (2259)	−9.70 (7.94)
25−34	1884 (1184)	859 (2658)	−18.8 (37.5)	−131 (123)	1729 (1204)	−562 (1602)	20244* (9779)	6434* (3086)	4423 (4216)	13820** (2638)	9.57 (7.43)
35−44	−1991 (1790)	−6544 (3698)	−75.4 (45.7)	284 (178)	−3513 (1802)	−3091 (2020)	−10716 (14446)	−6782 (4898)	3705 (5740)	592 (3115)	7.50 (9.36)
45−54	−1660 (1659)	2107 (4131)	16.9 (55.7)	545** (187)	−299 (2159)	1964 (2700)	−17158 (13395)	−6451 (5752)	1062 (5995)	−817 (3781)	51.4** (13.3)
55−64	−79613** (2649)	−1075 (5970)	−19.5 (92.1)	636** (205)	−3360 (2446)	1542 (4224)	−71514** (22945)	−5970 (9429)	−29807** (11194)	−16874** (5252)	−9.37 (23.2)
Over 65	−35094 (20394)	−8120* (4032)	−86.7 (86.9)	−246* (103)	−2500 (2120)	−5399* (2148)	−25035 (17128)	4210 (4273)	−29998** (8848)	−5557 (4192)	14.2 (13.8)
R^{-2}	0.9549	0.9813	0.9666	0.9352	0.9806	0.9667	0.9538	0.9517	0.9610	0.9642	0.6380
N	768	770	770	768	770	770	768	768	770	770	755

* significant at the 0.05 level; ** significant at the 0.01 level. State and year dummy variables and additional state−linear time interactions are included in all models.

[a] Models reject the null of no autocorrelation (based on Wooldridge's test for AR (1) autocorrelation in panel data) and therefore Prais−Winsten estimates with PCSEs are reported. Otherwise, the models were estimated using OLS with PCSEs.

[b] The dependent variable is logged. Otherwise, it is unlogged.

Table 2.3 Effect of the Number of Psychiatric Beds of Different Hospital Type on Crime Rates Per 100,000 Persons.

	Total Serious Crime	Violent Crime					Property Crime				
		Total [a]	Murder [a]	Rape	Robbery [a]	Aggravated Assaults [a]	Total	Burglary	Larceny	Motor Vehicle Theft [a]	Arson [b]
Number of Psychiatric Beds											
Public Psychiatric Hospitals	−5.74**	0.38	−0.027*	0.005	−0.18	0.59	−5.72**	−2.74**	−1.36	−0.66	−0.0063
	(2.14)	(0.45)	(0.013)	(0.030)	(0.32)	(0.34)	(1.82)	(0.64)	(1.12)	(0.47)	(0.0043)
Private Psychiatric Hospitals	27.31**	1.32	0.047	−0.153**	0.57	0.56	24.64**	6.60**	11.43**	2.98*	0.0023
	(5.37)	(1.15)	(0.032)	(0.053)	(0.49)	(0.79)	(4.67)	(1.53)	(2.63)	(1.51)	(0.0037)
Public General Hospitals	11.96	3.23*	0.047	0.008	0.96	2.08**	8.06	0.30	5.27	1.68	0.0134
	(9.40)	(1.29)	(0.033)	(0.083)	(0.71)	(0.77)	(7.92)	(2.33)	(4.52)	(1.39)	(0.0077)
Private General Hospitals	−14.02	−2.84**	0.006	0.090	−0.76	−2.10**	−9.79	0.22	−1.66	−2.60	0.0092
	(7.86)	(0.99)	(0.017)	(0.093)	(0.41)	(0.78)	(7.29)	(2.40)	(4.15)	(1.52)	(0.0073)
CMHA expenditures	37.8	13.98	0.53**	−0.11	15.53**	−1.96	23.79	0.75	7.12	9.74	−0.017
	(37.2)	(9.38)	(0.16)	(0.28)	(5.46)	(5.79)	(30.27)	(10.85)	(13.01)	(9.29)	(0.049)

Note: I report only the coefficients on the four main independent variables and suppress the coefficients on other control variables to focus on the main results. * significant at the 0.05 level; ** significant at the 0.01 level. State and year dummy variables and additional state−linear time interactions are included in all models.

[a] Models reject the null of no autocorrelation (based on Wooldridge's test for AR (1) autocorrelation in panel data) and therefore Prais−Winsten estimates with PCSEs are reported. Otherwise, the models were estimated using OLS with PCSEs.

[b] The dependent variable is logged. Otherwise, it is unlogged.

Table 2.4 Effect of the Composition of Psychiatric Beds of Each Hospital Type Relative to Public Psychiatric Hospital Beds on Crime Rates Per 100,000 Persons.

	Total Serious Crime	Violent Crime					Property Crime				
		Total [a]	Murder [a]	Rape	Robbery [a]	Aggravated Assaults [a]	Total	Burglary	Larceny	Motor Vehicle Theft [a]	Arson [b]
Ratio of psychiatric beds of each type to public psychiatric hospital beds (%)											
Private psychiatric hospital	2.77***	0.26*	0.0031	−0.0103	0.119	0.158*	2.49***	0.78***	0.63	0.65***	0.040
	(0.77)	(0.13)	(0.0032)	(0.0065)	(0.76)	(0.069)	(0.66)	(0.21)	(0.41)	(0.17)	(0.042)
Public general hospital	−0.23	−0.01	0.0043	0.0181	−0.043	−0.01	−0.16	−0.11	−0.18	0.05	−0.005
	(1.00)	(0.16)	(0.0045)	(0.0095)	(0.071)	(0.16)	(0.93)	(0.23)	(0.47)	(0.21)	(0.043)
Private general hospital	−0.40	−0.086	−0.0006	0.0003	0.024	−0.107*	−0.32	−0.14	0.08	−0.15	−0.016
	(0.47)	(0.064)	(0.0013)	(0.0055)	(0.036)	(0.050)	(0.42)	(0.12)	(0.26)	(0.11)	(0.022)

* significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level. State and year dummy variables and additional state−linear time interactions are included in all models.

[a] Models reject the null of no autocorrelation (based on Wooldridge's test for AR (1) autocorrelation in panel data) and therefore Prais−Winsten estimates with PCSEs are reported. Otherwise, the models were estimated using OLS with PCSEs.

[b] The dependent variable is logged. Otherwise, it is unlogged.

Table 2.5 Social Costs Per 100,000 Persons from Crimes Associated with Changes in Psychiatric Beds.

Crime Categories	Total costs per crime	Estimated effect on crimes			Social costs		
		Unit change in psychiatric beds		1 % point increase in the ratio of private psychiatric hospital beds to public psychiatric hospital beds	Unit change in psychiatric beds		1 % point increase in the ratio of private psychiatric hospital beds to public psychiatric hospital beds
		1-bed decrease in public psychiatric hospital bed	1-bed increase in private psychiatric hospital beds		1-bed decrease in public psychiatric hospital beds	1-bed increase in private psychiatric hospital beds	
	(1)	(2)	(3)	(4)	(1) x (2)	(1) x (3)	(1) x (4)
Murder	$3,024,259	0.027	0	0	$81,656	$0	$0
Rape	$89,221	0	−0.153	0	$0	−$13,650	$0
Assaults	$9,917	0	0	0.158	$0	$0	$1,567
Burglary	$987	2.74	6.60	0.78	$2,704	$6,514	$770
Larceny	$198	0	11.43	0	$0	$2,263	$0
Vehicle theft	$1,245	0	2.98	0.65	$0	$3,701	$809
Total social costs					$84,360	−$1,172	$3,146

Notes: Total costs per crime come from Table 13 of Lochner and Moretti (2004). Total costs include victim and property costs as well as jail and prison incarceration costs. All dollar amounts are in 1996 dollars. Costs to victims of crime include tangible losses such as property loss, general medical and psychiatric treatment expenses, police expenses, expenditures on victim services, loss of productivity, and drug abuse. Also, monetary values of intangible losses are included such as pain, suffering, and reduced quality of life by analyzing jury awards to victims. However, the cost of illegal drug abuse itself was not included. Expenditures on crime prevention, long-term consequences on victim earning are excluded as well.

CHAPTER III

STUDY 2:
Do Changes in the Supply of Psychiatric Beds Spill-Over to the Criminal Justice System? Evidence from Arrests and Jail Population.

Abstract

The purpose of this study is to examine the relationships among the number of psychiatric hospital beds, arrests, and populations of local jails, using state-level panel data on arrests, jails and hospital capacity for the years 1982 to 1998. Empirical models were estimated using weighted least squares with state populations as weights and panel corrected standard errors (PCSE). The Prais-Winsten method was employed to correct for serial correlation. Empirical models controlled for an extensive set of covariates including state-level measures of community mental health and substance abuse spending, state and year fixed effects, and state-specific time trends. There was no significant association between the total number of psychiatric beds and the number of arrests and jail inmates. However, the relationship among psychiatric beds, arrests, and jail populations varied by hospital type. A negative association was found between the number of public psychiatric hospital beds and an aggregate measure of arrests for property crimes and motor vehicle thefts. Interestingly, a one-bed decrease in public psychiatric hospital beds was associated with an increase of about the same number of arrests for drug possession, while not related to arrests for total drug violations or drug sales. The number of private psychiatric hospital beds was associated with arrests for property crimes, increasing or decreasing the number of arrests depending on

types of crimes. There were strong positive relationships between private general hospital beds and arrests for both serious and minor crimes. States' expenditures on community mental health and substance abuse were, in general, negatively associated with the number of arrests and jail inmates. The results of this research suggest that the effect of changes in the supply of psychiatric beds on arrests and jail incarceration varies by different hospital types, so that a change in the market structure of inpatient psychiatric care should be closely monitored. Policymakers should be aware that an array of efforts to improve the mental health system through community-oriented treatment of persons with mental illness may place a burden on the criminal justice system and also that other conditions being unchanged, retaining the capacity of public psychiatric hospitals may prevent its negative effect on the criminal justice system. Interestingly, the findings of this study suggest that increasing community mental health expenditures would decrease the number of arrests and jail inmates. Consistent with the literature, results suggest that a significant proportion of mentally ill offenders are arrested for using illegal drugs, which implies that substance abuse treatment among persons with severe mental illness may be critical to reducing future contacts with the criminal justice system.

3.1 Introduction

The U.S. mental health system has witnessed substantial changes in financing and delivery of mental health services over the past several decades: the locus of mental health care has been shifted from inpatient to outpatient care; the infrastructure for providing mental health treatments in community-based settings has been further developed; managed

behavioral health care has been expanded; the capacity of non-traditional psychiatric institutions such as private psychiatric hospitals and psychiatric units in general hospitals have experienced a huge growth; inpatient psychiatric care has been more privatized; and effective newer medications and therapies continue to develop (Grob 2001; Frank and McGuire 2000).

As researchers have investigated the implications of the changing landscape of the mental health system, many have become increasingly concerned about the overlaps between the mental health and criminal justice systems. While some researchers have explored the intersection between public mental health financing and criminal justice outcomes (Morrissey et al. 2006; Norton et al. 2005; Domino et al. 2004), others have become more concerned about a declining capacity of public mental hospitals because of public mental hospitals' function as a safety net provider for persons with the most debilitating mental health symptoms. In particular, reductions in inpatient capacity of the public mental health system have been suggested as a possible contributing factor for the over-representation[1] of mentally ill people in the criminal justice system (2004; Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998; Torrey et al. 1993; Mechanic and Rochefort 1990; Teplin 1984; Telpin 1983; Lamb and Grant 1982; Abramson 1972).

A body of research has tried to tease out the relationship between the availability of public mental hospital beds and criminal justice outcomes such as crime, arrests, and correctional incarceration. Early studies in the 70's and 80's, however, reached mixed conclusions on the link between the availability of public mental hospital beds and the criminal justice outcomes. For example, some researchers found that former mental hospital

[1] Studies have reported that approximately 10 to 15 percent of prisoners and 6 to 16 percent of jail inmates have severe mental illness (New Freedom Commission on Mental Health 2003; Fisher et al. 2000; Ditton 1999; Teplin 1990; Steadman, McCarty, and Morrissey 1989).

patients without prior arrest records were no more likely to be arrested than the general public during the period which the mental health system experienced rapid reductions in hospital psychiatric beds (Steadman, Cocozza, and Melick 1978; Steadman, Vanderwyst, and Ribner 1978). Whereas, others reported that the arrest rate of former patients without prior arrests was higher than that of the general public (Steadman et al. 1984; Sosowsky 1980&1978). Steadman and colleagues (1984) also observed significant increases in the percentage of prisoners with prior psychiatric hospitalization in three states (California, Texas, and Iowa) and comparatively small but statistically insignificant decreases in other states (New York, Arizona, and Massachusetts). In contrast, however, Grunberg and colleagues (1987) documented that the proportion of murders committed by patients diagnosed with schizophrenia in Albany, New York, increased between two time periods, 1963-69 and 1970-75.

While suggestive of the interaction between the mental health and criminal justice systems, there are important caveats of the early studies. They often drew conclusions based on simple correlations or just on descriptive statistics. Their findings often rested on a sample of few states, a single state, or a small local county, which makes up only small portion of the U.S. population. Moreover, several studies followed patients discharged from mental hospitals and compared the rates of arrests and incarceration in correctional facilities between the discharged patients and general public with no prior records of psychiatric hospitalization. However, a follow-up study of discharged patients inherently disregards persons who have never been identified as mentally ill just because they have not used mental hospitals previously.

A recent body of evidence suggests a negative relationship between the availability of pubic mental hospital beds and the size of the incarcerated population in prisons (Raphael 2000; Palermo, Smith, and Liska 1991). In particular, Markowitz (2006) examined the association between the number of public hospital beds and homelessness, crime, and arrests at the city-level using a sample of 81 U.S. cities in 1990. She found a negative association between the number of beds in public psychiatric hospitals and homelessness as well as between public hospital beds and crimes and arrests for violent crime. The reduction in public psychiatric hospital capacity was suggested to be associated with modest increases in violent crime and arrests through increased homelessness. However, the sample of a few cities and the cross-section nature of this study limit meaningful generalization of the results to other areas and time periods.

Study 1 of this dissertation estimated the effect of the supply of psychiatric beds on crime, using state-level data on crime and hospital capacity for the years 1982 to 1998. Although Study 1 did not find an evidence of the relationship between the total number of psychiatric beds and crime, the availability of psychiatric beds of different hospital characteristics was found to have differential effects on crime. Study 1 found a negative association between the number of public mental hospital beds and both violent and property crimes. In contrast, an increase in the number of private psychiatric hospital beds was positively associated with property crimes. A positive association was also found between crime and a market share of private psychiatric hospital beds relative to public psychiatric hospital beds.

Despite the contribution of the prior studies to our knowledge about the relationship between the capacity of psychiatric inpatient care and the criminal justice outcomes,

significant gaps were identified. First, most of the previous research focused on the link between the capacity of only public mental hospitals and criminal justice outcomes. Second, possible confounders were omitted in estimation such as the capacity of inpatient care in other institutional providers as well as the growth of community mental health programs. Since the decreased availability of public mental hospital beds may be supplemented to some extent by the increased availability of the non-public counterparts such as private psychiatric and general hospitals, the methodological weakness in prior research precludes causal inferences about the reduction in psychiatric beds and the criminal justice outcomes. Third, considering that different types of mental hospitals are associated with patients with different characteristics, changes either in the number or in relative market share of psychiatric beds of different hospital types may have a different effect on criminal justice outcomes. However, with the exception of Study 1 of this dissertation and Markowitz (2006), this issue has been previously disregarded. Even Markowitz (2006) failed to fully control for confounding factors such as the availability of other types of hospital psychiatric beds and the growth of the community mental health system. Fourth, most previous findings often rested on a sample of few states, a single state, or a small local county, which makes up only small portion of the U.S. population. Finally, follow-up studies of discharged patients with severe mental illness disregarded persons who have never been identified as mentally ill because they had no record of psychiatric hospitalization.

Addressing these limitations, this study examined the relationship between the number of psychiatric beds and the number of arrests and jail population size by explicitly controlling for possible confounding factors, using more recent 17-year state panel data from 50 U.S. states and the District of Columbia. In addition, a macro-level analysis was adopted

to overcome the limitation of previous patient follow-up studies and thus all persons with severe mental illness are analyzed whether they had psychiatric hospitalizations or not.

The research presented here addresses three main questions: (1) Is there a relationship between the number of mental hospital beds and arrests?; (2) Is there a relationship between the number of mental hospital beds and the size of jail population?; and (3) Do either of these relationships vary by hospital type? Since psychiatric hospitals of different types may be systematically different from one another in terms of differences in mission, case mix, and different opportunities and constraints and thus operate according to different objective functions, inpatient psychiatric facilities are divided into four different categories: public psychiatric hospitals, private psychiatric hospitals, public general hospitals, and private general hospitals. In addition, in a follow-up analysis to question 3, the study further explores whether relative market compositions of psychiatric beds of different hospital types have a different effect on arrest and jail incarceration rates because in addition to the changes in the absolute number of psychiatric beds, changing ratios of psychiatric beds of each type (such as private psychiatric hospitals and private and public general hospitals) to public psychiatric hospital beds may affect the delivery of inpatient psychiatric care and thus the mix of individuals served. In addition, this study explores the relationship between the capacity of community mental health system, arrests, and the size of jail population.

3.2 Community Mental Health Movements and Trends in Hospital Psychiatric Beds

The U.S. mental health system has witnessed significant changes in the delivery, organization, and financing of mental health services over the last several decades. The changing landscape of the mental health system has been driven by several factors such as patient rights movements, efforts to control rising costs of care, the improvement of

medication treatment and other therapies, and economic incentives created by social welfare programs such as Medicaid and Medicare (Grob 2001; Mechanic and Rochefort 1990; Morrissey 1989). Among the changes, one of the most distinguished, on-going changes is community mental health movements that have led to the shift of the location of treatment of persons with severe mental illness from public psychiatric hospitals to community-based mental health centers (Grob 1994). Gradually, the number of patients with severe mental illness who are treated in community outpatient settings has been increasing.

The capacity of the mental health system has been largely expanded to provide outpatient services. The number of psychiatric facilities that provide outpatient-based treatments increased consistently from 2,156 in 1970 to 4,386 in 1998. The proportion of patients who used outpatient services has largely increased. Out of 4.2 million psychiatric patients in 1971, about 58 percent of them used outpatient services. The proportion further increased to 78 percent of 11 million patients in 2000 (Manderscheid et al. 2004). The growing availability of mental health treatment in community outpatient settings improved access to the mental health system for new patients who had no access to psychiatric treatment in the past (Grob 2001; Morrissey 1989; Whitmer 1980). In addition, the increased emphasis on high-quality community treatment, such as intensive case management and assertive community treatment[2], and a variety of tools being used to improve adherence to psychiatric treatment in the community, such as involuntary outpatient commitment[3], have been shown to be effective in treating patients with severe mental illness in the community

[2] Assertive community treatment (ACT) is a comprehensive and treatment team-based model of mental health service delivery for persons with severe mental illness. It provides highly customized services directly to consumers to help keep them out of psychiatric hospitals (Phillips et al. 2001; Stein and Test 1980).

[3] Involuntary outpatient commitment refers to community treatment orders as a legal intervention intended to improve treatment adherence among persons with serious mental illness (Swanson et al. 2000).

(Lamb and Weinberger 2005; Swanson et al. 2000). Community mental health treatments are now receiving substantially more funds than state psychiatric inpatient services. In 1997, community mental health programs accounted for 56 percent of state mental health agencies' expenditures, a 70 percent increase from 33 percent in 1981. Over the same period, spending on state psychiatric hospital services experienced about a 30 percent decrease (Lutterman and Hogan 2004).

In contrast, the supply of psychiatric hospital beds has been significantly declining. In particular, the precipitous decline in public psychiatric hospital beds has been of interest to mental health professionals and policymakers because the declining capacity of public psychiatric hospitals may jeopardize treatment for the nation's most severely mentally ill and indigent patients, especially those in need of intensive and highly-structured levels of treatment but with no other alternatives in the community. Between 1970 and 2000, the number of psychiatric beds nationwide dropped remarkably from 264 per 100,000 persons to 77. Treatment beds of public psychiatric hospitals experienced even more substantial drops from 207.4 beds per 100,000 in 1970 to 21.2 in 2000 (Mandersheid et al. 2004). Although the size and time series of the number of the psychiatric beds varied across states (Mechanic and Rochefort 1990; Morrissey 1989), the number of public psychiatric hospital beds continues to decrease in most states. Survey data from the State Mental Health Agency (SMHA) Profile System showed that 23 states planned to close more than 1,000 beds by 2005. In 2003, 22 of 41 responding agencies reported their states were experiencing a shortage in psychiatric beds; 14 states experienced increased waiting lists for state psychiatric hospital beds, overcrowding in state psychiatric hospitals was reported in 11 states, and seven states were experiencing increased resistance to the additional closure of state psychiatric beds (NRI 2004).

Meanwhile, private psychiatric hospitals and separate psychiatric units in public and private general hospitals have gradually gained more importance in treatment of mental illness. The number of treatment beds in private psychiatric hospitals and psychiatric units of general hospitals exhibited a substantial growth from 1970 until the mid-1990's when it started to reduce slowly (Manderscheid et al. 2004). In 2000, private psychiatric and general hospitals accounted for 24 and 46 percent of all inpatient treatment episodes, respectively, compared to only 12 percent in state psychiatric hospitals (Manderscheid et al. 2004). Part of this shift has to do with the federal Medicaid regulations, which preclude payments for stays in public psychiatric hospitals (Frank, Goldman and Hogan 2003).

The market shares of psychiatric beds in these different hospitals consistently changed during the 1980's and 90's. The ratio of private to public psychiatric hospital beds showed an overall increase from 14 percent in 1982 to 39 percent in 1998 with a decrease between 1991 and 1996. The market composition of private general hospital beds relative to public psychiatric hospital beds had a constant and substantial increase from 24 to 117 percent during the period 1982-1998. The relative composition of public general hospital beds constantly increased (AHA 1982-1998).

Nevertheless, public psychiatric hospitals remain the leading provider of psychiatric care for the nation's most difficult and indigent patients while other institutional care providers serve more short-stay and profitable patients. For example, in 1997 approximately 64 percent of patients in public psychiatric hospitals were principally diagnosed with schizophrenia, which is one of the most debilitating and costly mental illnesses, as compared to 20 percent in private psychiatric hospitals and 30 percent in general hospitals (Milazzo-Sayre et al. 2001). Lengths of stay for chronic patients in private psychiatric and general

hospitals are relatively shorter than for individuals in public psychiatric hospitals and these non-public counterparts provide little community follow-up service (Grob 2001; Morrissey 1989).

Other characteristics such as the compositions of minority patients and insured patients vary by the different hospital types. Fifty-six percent of Blacks and Hispanics in inpatient psychiatric treatment are in state and county facilities, compared to 47 percent of whites (Milazzo-Sayre et al. 2001). In contrast, of those treated in private psychiatric hospitals, over 85 percent are white, most are admitted voluntarily (86 percent), and have private insurance (68 percent) (Koslowe et al. 1991). Private hospitals are more likely to serve those with private insurance and less severe mental illness, but are less likely to admit patients who are uninsured especially in areas with higher competition among private psychiatric hospitals and with less public psychiatric beds (Mechanic 1999; Schlesinger and Gray 1999).

Despite the discrepancies in time-series of bed capacity and patient mix between different hospitals, psychiatric hospitals, either public or private, operate at relatively full capacity. Psychiatric hospital occupancy rates, in general, have remained over 84 percent between 1975 and 2000[4]. The high rates of occupancy indicate that states' capacities to manage people with most debilitating psychiatric symptoms may be jeopardized.

3.3 Conceptual Framework

Theories and empirical evidence suggest several pathways that the availability of psychiatric beds may affect criminal justice outcomes. The starting point of the pathways is

[4] Authors' calculation using figures from Tables 2 and 5 in Manderscheid et al. (2004). The rates are calculated by taking the number of residents in psychiatric hospitals on Jan. 1 for each year and dividing by the number of psychiatric beds on Jan. 1 for that year.

that changes in the availability of psychiatric beds may have an impact on access to mental health services among persons with severe mental illness. One of the possible consequences of a decrease in psychiatric beds is that persons with severe mental illness might have limited access to mental health services due to either the unavailability of beds or the lack of community mental health resources in serving a growing body of mentally ill persons in the community, especially those with the most serious psychiatric symptoms. Thus, the reduced availability of psychiatric beds could leave them without adequate level of treatment in the community. Since one's mental health level may depend on the quantity of resources allocated to the production mental health following Grossman (1972), lack of mental health treatment, either inpatient or outpatient, among persons with severe mental illness would worsen their mental health and in turn reduce utility or individual well-being.

Becker and Mulligan (1997) showed that anything that lowers future utility may lead to higher time preference, i.e., present-oriented tendency of decision-making. Thus, if a change in the supply of psychiatric beds adversely affects mental health treatment among persons with severe mental illness, which would decrease future utility, the change in available psychiatric beds could increase time preference. An increase in time preference has three consequences. First, persons with high rates of time preference have high opportunity costs of investing in mental health and thus are less likely use mental health services. This would decrease utility in later time periods and further worsen their mental health status. Second, the increase in time preference may raise criminal activities because persons with high time preference are more likely to make present-oriented decisions by discounting future penalties of their current criminal behavior more heavily. Lastly, the increased time preference due to inadequate mental health treatment may lead persons with severe mental

illness to self-medicate their psychiatric symptoms with addictive substances (Harris and Edlund 2005; Pristach and Smith 1996; Whitmer 1980) because persons with higher time preference would be more likely to seek current consumption of addictive goods (Becker and Murphy 1988).

The use of addictive substances in turn has two consequences. It increases the amount of crime because using illegal substance, such as illicit drugs, is a violation of law. On the other hand, the use of addictive substances of any kind, such as alcohol and illicit drugs, increases the rate of time preference because it reduces future utilities. Increased time preference again would increase crime.

In addition, inadequate *social capital*[5] may also increase criminal activities among persons with severe mental illness (Silver 2006). Recent studies have found that stressful life events, inadequate social supports, and living in a disadvantaged community increase mental health problems, violence, and substance abuse among mentally ill persons residing in the community (Silver and Teasdale 2005; Silver, Mulvey and Swanson 2002). Thus, as much as a reduced capacity of public psychiatric hospitals leads to a growing body of persons with severe mental illness residing in disadvantaged neighborhoods where they do not receive adequate levels of social supports, criminal activities among persons with severe mental illness in the community may increase.

Meanwhile, it may be assumed that the number of arrests is a function of the amount of crime. If more mentally ill individuals get involved in criminal offenses as a result of a decrease in psychiatric beds, this may result in increased arrests. However, while some mentally ill individuals are arrested because they have committed actual crimes, others may

[5]*Social capital* can be defined as emotional and structural support in a community from social networks or connections (such as family, friends, and other important persons), employment opportunities, housing, community mobility, and neighborhood environment. See Silver (2006) and Paldam (2000) for details.

be arrested just because they exhibit psychiatric symptoms in public without committing actual crimes (Lamberti and Weisman 2004). Some mentally ill persons may be arrested first to be diverted to mental health providers. Some police officers may believe that arresting them is a more effective way of handling mentally ill persons because the mentally ill individuals may receive psychiatric evaluation and treatment by mental health professionals associated with courts or jails (Lamb and Weinberger 1998). Thus, even without the effect of psychiatric beds on crime, it is possible that arrests increase because the number of arrests is a function of both the number of actual crimes and the treatment of mentally ill persons by law enforcement authorities.

Similarly, it may be reasonable to assume that the number of jail inmates depends on the number of arrests and length of jail stay among persons with severe mental illness. A study showed that only a small number of mentally ill offenders were sent to a hospital at the time of the arrest while many were subsequently taken to jail (McFarland et al. 1989). Once severely mentally ill offenders are arrested, they are less likely to post bail and gain release, which results in increased jail days (Lamberti and Weisman 2004; Lovell, Gagliardi, and Peterson 2002). Persons who are arrested for serious offenses, no matter how mentally ill, would normally be sent to a jail (Lamb and Weinberger 1998). Offenders with severe mental illness also tend to stay at most six times longer in jail than other jail detainees (McNiel et al. 2005; Axelson and Wahl 1992). Thus, increased arrests of mentally ill offenders may lead to a greater number of jail inmates.

However, in response to a large number of mentally ill offenders in the criminal justice system, jail diversion programs have emerged as a viable solution to inappropriate criminal detention of individuals with mental illness. The number of jail with diversion

programs increased from about 52 jails in 1992 to more than 300 jails in 2005 nationally (Steadman & Naples 2005; Steadman, Barbera, & Dennis 1994). Studies have consistently found that jail diversion programs reduce the frequency of jail incarceration as well as fewer days in jail (Steadman & Naples 2005). A mental health court is another recent innovation that appears to reduce the involvement of persons with mental illness in the criminal justice system (Christy et al. 2005; Cosden et al. 2003; Trupin & Richards 2003). Approximately 125 mental health courts were in operation in 36 states in 2004, which was a huge increase from four mental health courts in 1997. Over 40 percent of adult mental health courts were located in four states including California, Ohio, Florida, and Washington (Bureau of Justice Assistance 2005). With the expansion of diversion programs and mental health courts, many offenders with severe mental illness are diverted away from arrests and jail incarceration toward treatment at any phases of the criminal justice process such as arrest, prosecution, pretrial, adjudication and sentencing, and release (Lamberti and Weisman, 2004). One implication of the nation-wide growth of the diversion efforts for mentally ill offenders is that we may not observe the same magnitude of the effect of a change in psychiatric bed availability on arrests or the size of jail population as it may have on crime, if any. For example, even if a decrease in psychiatric beds might increase crime and subsequent arrests and jail detentions, increased efforts and awareness of the diversion of mentally ill offenders may offset or reduce the effect that a decrease in psychiatric beds may have on arrests or jail detentions. Thus, whether changes in psychiatric hospital beds affected the number of arrests and jail inmates should be empirically investigated. Importantly, it is not for sure whether the decreases in psychiatric beds over the last several decades have been made up for by the advances of other alternative treatment options in the community. Considering only a small

proportion of persons with severe mental illness actually commit crime, the magnitude of the effect on arrests and jail detention should be explored empirically.

The effect of changes in available psychiatric beds on arrests and jail population likely varies by different hospital characteristics since different hospital types may be associated with different objective functions. Studies have reported that public psychiatric hospitals and non-traditional psychiatric facilities serve different patient clienteles. Compared with public psychiatric hospitals, non-traditional psychiatric facilities (such as private psychiatric hospitals and general hospitals) may provide less uncompensated care and avoid difficult patients (Mechanic 1999; Schlesinger and Gray 1999) particularly where the level of market competition is elevated (Schlesinger et al. 1997). Thus, an increase in non-traditional psychiatric facilities may lead to a larger number of persons with severe mental illness who may not obtain necessary psychiatric care and in turn raise their contacts with the criminal justice system. Because of the complexity of the interaction among hospitals of different characteristics and community mental health programs, the question of whether different characteristics of hospitals matter in terms of their effects on arrests and jail population should be empirically examined as well.

This paper does not seek to explore the channels through which the supply of psychiatric beds may affect the number of arrests and jail inmates; I examine a simple reduced form relationship between them.

3.4 Methods

3.4.1 Empirical specification

Building upon the conceptual model described above, the study questions of this research were explored using interstate variation in the supply of psychiatric beds and arrest

rates and the number of jail inmates over time. To isolate the effect of changes in psychiatric beds, the empirical equation takes the following form:

$$(Arrests, Jail\ Pop)_{st} = \beta \cdot Beds_{st} + \delta \cdot SMHA_{st} + \eta \cdot X_{st} + S_s + Y_t + S_s * T + \varepsilon_{st,} \quad (3)$$

where the dependent variables include the number of arrests per 100,000 persons ($Arrests$) and the average daily number of jail inmates per 100,000 persons ($Jail\ Pop$) in state S and in time t. *Arrests* includes measures of arrests for serious offenses such as (1) the total number of arrests for serious crimes in a relevant state which include both violent and property crimes, (2) the total number of arrests for violent crimes such as murder, rape, robbery, and aggravated assault, (3) the total number of arrests for property crimes such as burglary, larceny, motor vehicle theft, and arson, and (4) arrests for the eight individual categories of serious crime. It also includes measures of arrests for minor offenses such as (1) the total number of arrests for minor crimes such as simple assault, petty theft, or drug offenses and (2) the total number of arrests for drug offenses. Drug offenses are further divided into (1) drug selling and (2) drug possession. Since a natural log transformation is often done in the criminology literature, a logged transformation was tested for dependent variables that showed signs of skewness. R^2 from logged and unlogged models were compared to each other using a method proposed by Wooldridge (2003). For all dependent variables except murder and total minor offenses, the Wooldridge test favored the unlogged functional form.

Beds is the main independent variable of interest and corresponds to either the number or ratio of psychiatric beds. Several sets of variables were specified in *Beds* according to the specific study questions. First, to examine whether the total number of psychiatric beds was associated with the dependent variables, the total number

(contemporaneous) of psychiatric beds was included as our main independent variable. Then, to answer the question of whether the number of psychiatric beds of different hospital types affected the dependent variables differently, the total number of psychiatric beds was replaced with a set of variables including the number of psychiatric beds in public psychiatric hospitals, private psychiatric hospitals, public general hospitals, and private general hospitals. Finally, to address whether the dependent variables were determined by a relative market composition of psychiatric beds of each type, empirical models included a group of variables capturing the ratio of psychiatric beds of each type to public psychiatric hospital beds. Thus, the empirical models included a ratio of private to public psychiatric hospital beds, a ratio of psychiatric beds in private general hospitals to public psychiatric hospital beds, and a ratio of psychiatric beds in public general hospitals to public psychiatric hospital beds. The total number of psychiatric beds was also included to isolate the effect of the market share holding the total number of beds constant. In particular, a non-linear relationship between psychiatric beds and the number of jail inmates was explored by including a quadratic term of psychiatric beds because jail incarceration of persons with severe mental illness may be constrained by jail capacity and thus one can expect that psychiatric bed availability may have a diminishing effect on the size of jail population. Comparing adjusted R^2, a quadratic model was estimated for jail population.

State mental health agencies' expenditures on community mental health programs (*SMHA*) were included to explore the effect of the expansion of public community mental health treatment on the dependent variables as well as to mitigate a potential bias from state heterogeneity in the capacity of community mental health system. The sources of funds for SMHAs include states' general funds and special appropriations, Federal Mental Health

Block Grant funds, Medicaid, Medicare, other federal funds such as demonstration grants, state-required local government match, and various first-and third-party funds. The SMHA expenditure data excluded Medicaid expenditures and local community programs that are not directly administered by the SMHAs. In 1997, the data source included about 65 percent ($7.3 billion) of total expenditures ($11.2 billion) on community mental health programs. The percent of actual community mental health and substance abuse treatment expenditures that were not directly controlled by SMHA varied by states. In some states such as Delaware, Hawaii, Idaho, Montana, Nevada, and South Carolina, almost all community mental health expenditures are controlled by SMHAs. In other states such as Iowa, Indiana, Utah, Arkansas, and Nebraska, over 65 percent of the expenditures are not controlled by SMHA.

The vector *X* represents other state-specific characteristics that might be related to arrests or jail incarceration, such as policing policy, socio-economic, and demographic variables. Estimates would be biased if, for example, states that had a precipitous drop in psychiatric beds over time are also more likely to experience a continual increase in arrest rates or jail incarceration for that time period presumably due to an increase in police power. Thus, the total number of police per 100,000 residents was included and was once-lagged to minimize endogeneity between the number of police and our dependent variables (Donohue & Levitt 2001; Corman & Mocan 2000; Levitt 1997). State-level socioeconomic factors include the proportion of metropolitan residents, poverty rates, state unemployment rates, state per-capita income, the percent on Medicaid, and the percent on welfare (AFDC/TANF). Demographic controls such as the state compositions of race and age were included in the model because proportions of young adults and non-whites in a community are closely related to crime rates (Wilson & Herrnstein 1985). Race categories consist of the proportions

of blacks, and those considered neither white nor black. Age categories include the proportions of the state residents 19-29, 30-34, 35-44, 45-54, 55-64, and over 65. In addition to these covariates, the rated capacity of jails was specified in estimating the relationship between psychiatric beds and the number of jail inmates, which would otherwise confound the relationship.

Time invariant state effects (*S*) are included, as well as year effects (*Y*) that are common to all states. Thus, state fixed effects control for all unobserved state differences that do not change over time. Year dummies account for secular changes in the dependent variables over time, which are common to all states during year *Y*. Year dummies also control to some extent for advances of newer psychotropic medications. In addition to the extensive set of controls, remaining unobserved heterogeneity was further tested by including linear time trends *T* interacted with states which allows us to control for remaining differences from state specific trends in the dependent variables. F-tests for joint significance of the interaction terms were conducted. In addition, visual examination of whether the coefficient estimates of the main independent variables are substantially affected by the inclusion of the interaction terms was conducted because in this case an omitted variable bias is a concern. In addition, visual examination was also used to check whether other covariates are as expected with or without the interactions since an inclusion of the state-specific time trends may be highly correlated with one or more of the independent variables, which, in turn, may pick up too much variation and lead to weird results. Adjusted R^2 was used as additional criteria of a model choice. The models including the interaction terms are identified in the result tables.

3.4.2 Estimation issues

Unweighted estimates would produce heteroskedasticity because the magnitude of the error terms may be inversely correlated with the population size. For example, arrest rates may fluctuate more in the states with smaller population because small changes in the number of offenses yield larger changes in the ratio in the states with smaller population. Thus, the above empirical specification was estimated using weighted least squares with state populations as weights since the null hypothesis of homoskedasticy was rejected in all models.

In particular, this study addresses the following potential violations of ordinary least squares (OLS) standard assumptions in panel data: (1) panel heteroskedasticity, i.e. each state may have its own error variance; (2) contemporaneous correlation, i.e. the error variance for one state may be correlated with the errors for other states; and (3) serial correlation, i.e. the errors for a given state are correlated with the previous errors for that state. In the presence of the violation of any of the assumptions, OLS is not the best linear unbiased estimator (BLUE) and may produce incorrect inferences due to incorrect standard errors. Also, it should be noted that the data are distinguished from panel data usually found in health services research. While most common panel data have fairly large units of observations with small time periods, the data used in this study have a small number of observations (51 units of observations) with a relatively large number of time periods (17 years), which are often called time-series-cross-section (TSCS) data[6]. Although usual panel data techniques can be used for the TSCS data, simulations reported by Beck and Katz (2004, 1996 & 1995) indicate that the method of panel corrected standard errors (PCSE) developed by the authors has excellent statistical properties for the TSCS data especially when the number of time periods exceeds 15. The Beck-Katz method has recently received wide acceptance as a standard

[6] A good summary of difference between the two types of data is found in Beck (2001).

econometric technique by political scientists and social researchers (Plumper & Manow 2005; Worrall & Pratt 2004; Beck 2001). Although this technique is rarely employed in other disciplines, it addresses important issues related to correct inferences in the current analysis. Thus, using the PCSE method, I control for the remaining heteroskedasticity after weighting as well as for contemporaneous correlation across states.

A crucial assumption for the method of PCSE is that the errors are free of serial correlation because the OLS estimator is biased if the errors are serially correlated. A series of F-test for serial correlation (AR(1)) in panel data models developed by Wooldridge (2002) found some models which did not reject the null hypothesis of no serial correlation. These models are indicated in the result tables. For the models which are not described by an AR(1) process, I ran OLS with PCSEs. When there is evidence of AR(1), I eliminated serial correlation using the Prais-Winsten method, a variant of feasible generalized least squares (FGLS) (Prais & Winsten 1954). Thus, reported in the tables in the result section is either OLS estimates with PCSE or Prais-Winsten estimates with PCSE.

3.4.3 Data

This study utilized the state-level data from various sources over 17 years from 1982 to 1998 for all 50 states and the District of Columbia. Table 3.1 provides definitions, data sources, and summary statistics for the variables used in this study.

Data on the dependent variables came from the FBI's Uniform Crime Reporting (UCR) program from 1982 to 1998. The UCR provides the number of arrests for serious offenses (such as murders, forcible rapes, robberies, aggravated assault, burglary, larceny and motor vehicle theft) and minor offenses (such as simple assault, petty theft, drug violation, etc.). The UCR provides information only on offenses known to the police but remains the

only source of national time-series crime data that can be aggregated at the state level for all U.S. states and the District of Columbia. Data from UCR are widely used by researchers.

The annual number of psychiatric beds came from American Hospital Association's (AHA) Annual Survey of Hospitals data from 1982 to 1998. The AHA Annual Survey data contain hospital characteristics that are derived from hospital surveys and other proprietary sources. This survey has been conducted annually since 1946, and is widely regarded as the most authoritative and comprehensive source of individual hospital data available (AHA 1995). Psychiatric care facilities in the survey used to obtain the number of psychiatric beds include public and private mental hospitals and psychiatric units in general hospitals. Some observations have missing values for intervening years. These missing values were filled in by linear interpolation separately for each hospital. Observations were then collapsed at the state level.

Data on state mental health agencies (SMHAs)' expenditures on community-based mental health programs came from the National Association of State Mental Health Program Directors Research Institute (NRI). NRI has intermittently conducted the SMHA revenues and expenditures study in 1981, 1985, 1987, 1990, 1993, 1997 and 2001. The expenditures data for the intervening years were linearly interpolated. The data include SMHA-controlled expenditures on mental health including medications and drug and alcohol programs. Although the data are limited in that part of community mental health spending in a state was included and the difference with total community mental health expenditures varied across states, there is no other source of information on state expenditures on community mental health programs. Despite the limitation, consistency in the data collection methods across

states and over time renders a valid comparison across states and years (Lutterman and Hogan 2004).

Data on the number of jail inmates and jail capacity came from Census of Jails and Annual Survey of Jails, which are publicly available through National Archive of Criminal Justice Data of the Inter-university Consortium for Political and Social Research. The number of jail inmates is defined as average daily jail inmates each year. Jail capacity is defined as the rated jail capacity which is the maximum number of jail inmates set by State or local authorities. Census of Jails, which is a complete census of U.S. local jails was conducted in 1983, 1988, and 1993. During the intervening years, Annual Survey of Jails reports estimates of the number of inmates in the Nation's local jails. Both the Census and Survey provide detailed information on each facility, including average daily population, the number of inmates on June 30 of each year, and the rated jail capacity.

The data for the jail surveys were obtained by mailed questionnaires to sampled U.S. local jails. The response rate was 100 percent after follow-up phone call to nonresponding jails. The design is a stratified simple random sample of jurisdictions stratified by average daily population. The sampling unit is the county or city jurisdiction that administers one or more local jails. Jail jurisdictions were first stratified into two groups: multi-jurisdiction jails and single-jurisdiction jails. A multi-jurisdiction jail is one in which two or more jurisdictions have a formal agreement to operate the facility. All jails in multi-jurisdictions were selected with certainty. The remaining jurisdictions were then further stratified into two groups: jurisdictions with jail authorized to hold juveniles and jurisdictions with jails holding adults only. All jails that held juveniles and had an average daily population of 250 or more inmates or held only adults and had an average population of 500 or more inmates were

included in the surveys. The remaining jurisdictions were included based on stratified probability sampling procedures. When a jurisdiction was selected for inclusion in the sample, all local jails in the jurisdiction were included in the sample (Annual Survey of Jails, 1998). In 1985, about 30 percent of all U.S. local jails (893 jails out of 3,043) were surveyed (Annual Survey of Jails, 1985). It was approximately 28 percent in 1998 (Annual Survey of Jails, 1998). Sample weights were provided in the survey data sets and were used to produce jurisdiction-level estimates. The jurisdiction-level estimates were aggregated at the state level.

Information on the number of police came from the CJEE Extract file (The Expenditure and Employment Data for the Criminal Justice System [United States]: Extract File). Data on state-level socio-economic and demographic factors came from a variety of sources such as the US Census Bureau, the Bureau of Economic Analysis (BEA), and the Bureau of Labor Statistics (BLS). Data on state population came from the US Census Bureau.

3.5 Results

3.5.1 Relationship between the total number of psychiatric beds and arrests

Except robbery, there was no significant association between the total number of psychiatric beds and the aggregate arrest measures for either serious or minor crimes (Table 3.2). However, SMHAs' expenditures on community mental health programs were negatively associated with the number of arrests for any serious crimes, any violent crimes, aggravated assaults, and any minor crimes. For example, a $1 increase in SMHAs' community mental health expenditures per person (about 4-percent increase from the average) was associated with a decrease of approximately 2 arrests for serious crimes per 100,000 population. However, there was a positive association between SMHAs' expenditures and robbery.

Regarding the other control variables, the signs of the estimated coefficients were in general as expected. For example, there was a positive relationship between the total number of police and arrests for any serious crimes, any violent crimes, rapes, and aggravated assaults. Unemployment rates were positively associated with arrests for burglary and larceny. The percent of the black population and younger populations in general were positively associated with both serious and minor crime measures.

3.5.2 Relationship between psychiatric beds and arrests by different hospital type

The relationship between the number of psychiatric beds and arrests varied by hospital type. Although there was no significant association between the number of psychiatric beds of different hospital types and aggregate and individual measures of arrests for violent offenses (such as murder, aggravated assaults, rape, and robbery), the number of public psychiatric hospital beds was negatively associated with the aggregate measure of arrests for property crimes and motor vehicle theft (Table 3.3). A one-bed decrease in public psychiatric hospital beds per 100,000 persons was associated with an increase of approximately 3.2 arrests in one year for any property offenses per 100,000 population. We found no association between aggregate measure of arrests for minor crimes and psychiatric beds. However, interestingly, a one-bed decrease in public psychiatric hospital beds was associated with an increase of about the same number of arrests for drug possession while not related to arrests for total drug violations or drug sales.

The number of private psychiatric hospital beds was not associated with any of the composite measures of arrests for serious crimes. However, the individual measures of property crimes such as burglary, larceny, and arson were positively associated with the number of private psychiatric hospital beds while motor vehicle theft was negatively

associated and the size of the coefficient was larger than any of the other property crimes affected. There was no significant association for total minor crimes as well as drug violations.

The number of psychiatric beds in public general hospitals was positively associated with total arrests for robbery, but negatively associated with arrests for motor vehicle theft. Private general hospital beds were positively correlated with many of the crime categories such as total arrests for any serious crimes, murder, robbery, total arrests for property crimes, motor vehicle theft, and drug possession.

To summarize the relationship between the number of psychiatric beds and arrests by different hospital types, a decrease in public psychiatric hospital beds was related to an increase in arrests through motor vehicle theft and drug possession. The number of private psychiatric hospital beds was associated with arrests for property crimes, increasing or decreasing the number of arrests depending on types of crimes. There were strong positive relationship between private general hospital beds and arrests for both serious and minor crimes.

SMHAs' expenditures on community mental health programs showed significant and negative relationship with arrests for any violent crimes, aggravated assault, and any minor crimes, but were positively associated with robbery and motor vehicle theft.

The coefficient estimates of a ratio of private to public psychiatric hospital beds generally confirmed the results in Table 3.3 (Table 3.4). The results in general did not identify the relative proportion of beds in private psychiatric hospitals as a crime-affecting factor. An exception is its association with arrests for motor vehicle thefts with which a ratio of private to public psychiatric hospital beds was negatively correlated but was positively

associated with arsons. A ratio of private general hospital beds to public psychiatric hospital beds was also negatively related to motor vehicle thefts. In contrast, a ratio of public general hospital beds was positively correlated with motor vehicle thefts.

3.5.3 Relationship between psychiatric beds and the size of jail population.

As with arrests, the size of jail population was not associated with the total number of psychiatric beds (Model 1 in Table 3.5). When I allowed for a non-linear relationship between psychiatric beds and jail inmates (Model 2) by including the quadratic term of public psychiatric hospital beds, both the number of public psychiatric hospital beds and its quadratic term were significant. They were also jointly significant ($p<.001$). A positive, significant association was found between public general hospital beds and the number of jail inmates. The number of jail inmates was not associated with the ratio of private to public psychiatric hospital beds, but positively correlated with the market composition of public general hospital beds and negatively correlated with the market composition of private general hospital beds relative to public psychiatric hospital beds (Model 3).

There was a negative correlation between SMHAs' expenditures on community mental health programs and the size of jail population. A $3 increase in community mental health spending per person (about 10-percent increase from the mean) was associated with a decrease of about 2 persons in jail per 100,000 population. Also, an increase in jail capacity was a significant predictor of an increase in jail population. If rated jail capacity increased by ten, the average daily number of jail inmates increased by about nine.

3.6 Robustness Tests and Further Analyses

The robustness of our results was assessed in many ways. First, because the results of this study are from weighted-least-squares which places greater weights on states with larger

population, all regression models in Table 3.2 – Table 3.5 were re-estimated dropping observations from 5 largest states – California, Texas, New York, Florida, and Pennsylvania in descending order. The alternative models were estimated omitting one state at a time and then all five states together. Also, the sensitivity of the results was examined by removing the five states with the highest crime rates, one state at a time and then all five states together. These states included Wisconsin, Texas, Washington D.C., Florida, Arizona. The results from these models were quantitatively identical to those reported in this study.

Since legalized abortion and concealed-handgun regulations have been cited as important factors that affected changes in crime rates in the literature (Donohue and Levitt 2001; Lott and Mustard 1997) and in turn may affect arrest rates and the number of jail inmates, the robustness of the results of this research was tested by including two additional variables in estimation. Included were 15-year lagged variables indicating whether a state had the abortion law and dummy variables indicating the presence of concealed-handgun laws. No significant changes in our main results were found.

Finally, when there is evidence of serial correlation, this study used the Prais-Winsten correction; however, Beck and Katz (1996) suggest a different method. They suggest including the lagged dependent variable in the right-hand side variables to eliminate serial correlation of the errors. However, whether one can use the lagged dependent variable to control for serial correlation is somewhat controversial in the literature. Plumper and colleagues (2005) argue that Beck-Katz's method for dealing with an autocorrelation overestimates the serial correlation coefficient and results in an underestimation of the parameters. The results of the sensitivity analysis showed that this is generally true in our

data. However, I found no significant difference in our coefficients from the Beck-Katz and Prais-Winsten methods.

3.7 Conclusion

The changes in the total number of psychiatric beds were not associated with the increases in arrests and the size of jail population for the years 1982 to 1998. Nevertheless, the availability of psychiatric beds is still an important policy agenda because the relationship between changes in the supply of psychiatric beds and the number of arrests and jail inmates appears to vary by different hospital types. In particular, since the results indicate a significant inverse relationship between a decrease in public psychiatric hospital beds and the number of arrests and jail inmates holding other market factors (such as the number of non-traditional psychiatric beds and community mental health resources) constant, an increase in arrests and jail population may be expected for given reductions in public psychiatric hospital beds unless the reductions are accompanied or preceded by comparable changes in the psychiatric market which offset the negative impact on the criminal justice system. Thus, policymakers should be aware that on-going efforts for community integration of persons with severe mental illness may place a burden on the criminal justice system if a community is not adequately prepared for an increasing body of mental ill persons residing in the community.

The results suggest somewhat complex relationships between the availability of non-traditional psychiatric beds and the criminal justice outcomes. For example, the number of arrests for motor vehicle theft was found to be negatively associated with the number of psychiatric beds in private psychiatric hospitals and public general hospitals; in contrast, there was a positive relationship for private general hospital beds. In particular, potential

discrepancy in findings was identified between this study and Study 1 of this dissertation. For example, Study 1 found a positive association between the number of private psychiatric hospital beds and motor vehicle theft while the present study found an inverse relationship between private psychiatric hospital beds and arrests for motor vehicle theft. There are two plausible interpretations for this potential contradiction. First, there may be possible relevant factors behind this observed discrepancy. Beyond the classification scheme of non-traditional institutional psychiatric providers used in this study, other dynamic features of the mental health system, such as ownership status, market competition, and managed care, may operate behind the observed relationships and muddy the results for non-traditional psychiatric facilities. Second, the number of arrests may not be a function of crime rates especially for mentally ill persons. Not all crimes reported to the police end up with arrests. On the contrary, several offenders may engage in one criminal event. In particular, mentally ill persons could be arrested even without committing actual crimes due to the treatment of mental ill persons by law enforcement agencies (Lamberti and Weisman 2004; Lame and Weinberger 1998). Therefore, arrests may be distinguished from crime particularly for mentally ill persons. Similarly, the number of arrests may be affected by not only a change in crime rates but also the availability of psychiatric facilities to which mentally ill offenders (especially those committing petty offenses) could be diverted in lieu of arrests. Thus, with arrest data, an increased availability of non-traditional institutional psychiatric providers relative to public psychiatric hospitals could be found to reduce arrests even when increased non-traditional psychiatric beds in fact increase crime. This also implies that arrest data may be a misleading measure of criminal activities among persons with mental illness. Examination of these explanations in future research may help disentangle the somewhat complex implications of

the growth of non-traditional institutional psychiatric providers. Nonetheless, the interpretation of reduced public psychiatric hospital beds should not be affected.

Interestingly, the findings presented here suggest that increasing community mental health expenditures may decrease the rate of arrests. A potential pathway is through a direct decrease in crime. However, Study 1 of this dissertation found no association between community mental health expenditures and corresponding categories of serious crimes. Thus, a more plausible explanation is that increases in community mental health expenditures may lead to more effective diversions of mentally ill offenders due to a larger capacity of the community mental health system to treat mentally offenders rather than arrest and incarcerate them, especially those charged with minor offenses. Since changes in the number of psychiatric beds are mostly likely to affect persons with most debilitating symptoms, future studies should examine whether the capacity of the community mental health system affects arrests and jail incarceration of persons with severe mental illness differently depending on the severity of psychiatric symptoms.

Severely mentally ill offenders are more likely to be charged with minor offenses than serious offenses (Morrissey 2004; Torrey 1995; Valdiserri, Carroll, and Hartl, 1986; Lamb and Grant 1982; Sosowsky 1980; Steadman, Cocozza, and Melick 1978; Abramson 1972). Thus, it is reasonable to expect a larger effect of psychiatric beds on arrests for minor offenses than serious offenses. The results of this study, however, indicate that the availability of psychiatric beds does not increase total arrests for minor crimes. This is possibly because compared to serious crimes, minor crimes are less likely to end up with arrests (Lamb and Weinberger 1998). As much as mentally ill offenders charged with minor offenses are successfully diverted to the mental health system, an effect on arrest for minor

offenses would be less likely to be found. An alternative interpretation is a possible reporting bias in arrest data for minor offenses from the UCR. Since measurement error leads to attenuation bias, I may not found significant coefficients for arrests for minor crime. Nevertheless, I found a significant relationship for drug possession. This confirms that a significant proportion of mentally ill offenders are arrested for using illegal drugs. This also implies that substance abuse commorbidity among persons with severe mental illness may be one of the main methods of contact with the criminal justice system and its effect is large enough to offset the attenuation bias from the potential reporting error, if any.

The current study posits the structural mechanisms through which a decrease in psychiatric beds may affect criminal justice outcomes. However, the data used here do not allow us to examine the proposed channels. As much as a change in psychiatric bed supply affects mental health service utilization and subsequent mental health status and self-medicating among those with most debilitating psychiatric symptoms, the findings reported here would be supported. A subsequent study will address this issue, explicitly examining the pathways.

Another caveat is that this study was not able to explicitly control for a potentially important confounder, changes in *social capital*, which may determine criminal activities in a community and subsequently influence the number of arrests and jail inmates. Although the state-specific time trends could mitigate possible omitted variable bias if changes in social capital were linear during the study period, it could be argued that social capital changed non-linearly. Hence, it is unknown whether the results of this study may be influenced by the unobserved factor.

This study also has a limitation in causal interpretation of the results. The research design of this study was not to model timeframes to isolate the causal effect of a change in psychiatric bed supply on the number of arrests and jail inmates. Rather, this study exploited interstate variation in the number of psychiatric beds and the number of arrests and jail inmates over time. Given the strong contemporaneous relationship between psychiatric bed supply and the criminal justice outcomes, an exploration of temporal aspect of the relationship is an important area for future research.

This study contributes to the growing consensus in the literature that the supply of psychiatric beds in public psychiatric hospitals affects the criminal justice system. The current research also adds to the literature suggesting that changes in the supply of psychiatric beds would have different effect on the criminal justice system depending on hospital types. A next step for research is to examine the suggested mechanisms through which a change in the supply of psychiatric beds affect the criminal justice system, to identify sub-populations that are most likely to be affected by changes in the inpatient psychiatric hospital system, and to find effective ways of closing the "revolving door" between the mental health and criminal justice systems.

REFERENCES

Abramson, M.F. 1972. "The criminalization of mentally disordered behavior: possible side-effect of a new mental health law." *Hospital and Community Psychiatry* 23 (4):101-5.

American Hospital Association (AHA). 1995. "1994 Annual Survey of Hospitals Data Base Documentation Manual". Chicago, Ill: American Hospital Association.

American Hospital Association (AHA). AHA Annual Survey of Hospitals: 1982-1998. Chicago, Ill: American Hospital Association.

Axelson, G.L., and O.F. Wahl. 1992. "Psychotic vs. non-psychotic misdemeanants in a large county jail: An analysis of pre-trial treatment by the legal system." *International Journal of Law & Psychiatry* 15:379-386.

Beck, N., and J. Katz. "Time Series-Cross Section Issues: Dynamics, 2004." Working Paper, July 24, 2004.

Beck, N. 2001. "Time-Series Cross-Section Data: What Have We Learned in the Past Few Years?" *Annual Review of Political Science* 4:271-93.

Beck, N., and J. Katz. 1996. "Nuisance vs. Substance: Specifying and Estimating Time-Series—Cross-Section Models." *Political Analysis* 6:1-36.

Beck, N., and J. Katz. 1995. "What to Do (And Not Do) with Time-Series Cross-Section Data." *American Political Science Review* 89:634-47.

Becker, G.S., and C.B. Mulligan. 1997. "The Endogenous Determinatin of Time Preference." *The Quarterly Journal of Economics* 112(3):729-58.

Becker, G.S. and K.M. Murphy. 1988. "A Theory of Rational Addiction" *The Journal of Political Economy* 96(4):675-700.

Bureau of Justice Assistance. "Mental Health Courts: National Snapshot." Access on Mar. 03, 2007. Accessed at http://www.ojp.usdoj.gov/BJA/pdf/MHC_National_Snapshot.pdf.

Christy, A., N.G. Poythress, R.A. Boothroyd, J. Petrila, & S. Mehra. 2005. "Evaluating the efficiency and community safety goals of the Broward County Mental Health Court". *Behavioral Sciences and the Law* 23(2):227-243.

Corman, H. and H.N. Mocan. 2000. "A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City**"** *The American Economic Review* 90(3):584-604.

Cosden, M, J.K. Ellens, J.L. Schnell, & M.M. Welfe. 2003. "Evaluation of a Mental Health Treatment Court with Assertive Community Treatment." *International Journal of Law and Psychiatry* 21(4):415-27.

Ditton, P.M. 1999. "Mental Health Treatment of Inmates and Probationers." Washington DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics.

Domino, M.E., E.C. Norton, J.P. Morrissey, and N. Thakur. 2004. "Cost Shifting to Jails after a Change to Managed Mental Health Care." *Health Services Research* 39 (5):1379-1402.

Donohue, J.J., and S.D. Levitt. 2001. "The Impact of Legalized Abortion on Crime." *The Quarterly Journal of Economics* 116(2):379-420.

Fisher, W.H., I.K. Packer, L.J. Simon, and D. Smith. 2000. "Community Mental Health Services and the Prevalence of Severe Mental Illness in Local Jails: Are They Related." *Administration and Policy in Mental Health* 27 (6):371-82.

Frank, R.G., H.H. Goldman and M. Hogan. 2003. "Medicaid and Mental Health: Be Careful What You Ask For." Health Affairs 22(1):101-13.

Frank, R.G., and T.G. McGuire. 2000. "Economics and Mental Health" in The Handbook of Health Economics, Cuyler AJ and Newhouse JP, Eds. Amsterdam: Elsevier.

Fuchs, V.R. "Economic Aspects of Health." Chicago, University of Chicago Press, 1982.

Grob, G.N. 2001. "Mental Health Policy in the 20th-Century America." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Grob, G.N. 1994. "The Mad Among Us: A History Of The Care Of America's Mentally Ill." New York: Free Press.

Grossman, M. 1972. "On the Concept of Health Capital and the Demand for Health." *The Journal of Political Economy* 80(2):223-255.

Grunberg, F., B.I. Klinger, and B.R. Grument. 1997. "Homicide and the Deinstitutionalization of the Mentally Ill." *American Journal of Psychiatry* 134;685-7.

Harris, K.M., and M.J. Edlund. 2005. "Self-Medication of Mental Health Problems: New Evidence from a National Survey." *Health Services Research* 40 (1):117-34.

Koslowe, P.A., M.J. Rosenstein, L.J. Milazzo-Sayre, and R.W. Mandersheid. 1991. "Characteristics of Persons Served By Private Psychiatric Hospitals, United States: 1986." *Mental Health Statistical Note* 201:1-25.

Lamb, H.R., and R.W. Grant. 1982. "The Mentally Ill in an Urban County Jail." *Archives of General Psychiatry* 39:17-22.

Lamb, H.R., and L.E. Weinberger. 2005. "The Shift of Psychiatric Inpatient Care From Hospitals to Jails and Prisons." *J Am Acad Psychiatry Law* 33:529-34.

Lamb, H.R., and L.E. Weinberger. 1998. "Persons With Severe Mental Illness in Jails and Prisons: A Review." *Psychiatric Services* 49:483-92.

Lamb, H.R., L.E. Weinberger, and B.H. Gross. 2004. "Mentally Ill Persons in the Criminal Justice System: Some Perspectives." *Psychiatric Quarterly* 75 (2):107-26.

Lamberti, J.S., and R.L. Weisman. 2004. "Persons with severe mental disorders in the criminal justice system: challenges and opportunities." *Psychiatric Quarterly* 75:151–164.

Lott, J.R. and D.B. Mustard. 1997. "Crime, Deterrence, and Right-to-Carry Concealed Handguns." *Journal of Legal Studies*.

Lovell, D, G.J., Gagliardi, and P.D. Perterson. 2002. "Recidivism and Use of Services Among Persons With Mental Illness After Release From Prison." *Psychiatric Services* 53 (10):1290-6.

Lutterman, T. and M. Hogan. 2004. "State Mental Health Agency Controlled Expenditures and Revenues for Mental Health Services, FY 1981 to FY 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Mandersheid, R.W., J.E. Atay, A. Male, B. Blacklow, C. Forest, L. Lngram et al. 2004. "Highlights of Organized Mental Health Services in 2000 and Major National and State Trends." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2002*. Washington, D.C.: U.S. Government Printing Office.

Markowitz, F.E. 2006. "Psychiatric Hospital Capacity, Homelessness, and Crime and Arrest Rates." Criminology 44 (1) 45-72.

McNiel, D.E., R.L. Binder, and J.C. Robinson. 2005. "Incarceration Associated With Homeless, Mental Disorder, and Co-Occurring Substance Abuse." *Psychiatric Service* 56:840-6.

Mechanic, D. 1999. "Mental Health and Social Policy: The Emergence of Managed Care." Boston, MA: Allyn and Bacon.

Mechanic, D., and D.A. Rochefort. 1990. "Deinstitutionalization: An Appraisal of Reform. *Annu. Rev Sociol* 16:301-27

Milazzo-Sayre, L.J., M.J. Henderson, R.W. Manderscheid, M.C. Bokossa, C. Evans, A.A. Male. 2001. "Persons Treated in Specialty Mental Health Care Programs, United States, 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Morrissey, J.P. 1989. "The Changing Role of the Public Mental Hospital." in *Handbook on Mental Health Policy in the United States*, Ed. Rochefort, Westport, Conn.: Greenwood.

National Association of State Mental Health Program Directors Research Institute (NRI). 2004. "Closing and reorganizing state psychiatric hospitals:2003." NASMHPD Research Institute, Inc, Alexandria, VA.

New Freedom Commission on Mental Health. 2003. "Achieving the Promise: Transforming Mental Health Care in America: Final Report." DHHS Pub. No. SMA-03-3832. Rockville, MD.

Norton, E.C., J. Yoon, M.E. Domino, and J.P. Morrissey. 2006. "Transitions between the Public Mental Health System and Jail for Persons with Severe Mental Illness: A Markov Analysis." *Health Economics* 15(7):719-733.

Morrissey, J.P., H.J. Steadman, K.M. Dalton, A. Cullar, P. Stiles, and G.S. Cuddeback. 2006. "Medicaid Enrollment and Mental Health Use Following Release of Jail Detainees With Severe Mental Illness." *Psychiatric Services* 57:809-815.

Paldam, M. 2000. "Social Capital: One or Many? Definition and Measurement." *Journal of Economic Survey* 14(5):629-53.

Plumper T, V.E. Troeger, and P. Manow. 2005. "Panel Data Analysis in Comparative Politics: Linking Method to Theory." *European Journal of Political Research* 44:327-354.

Prais, S., and C. Winsten. 1954. "Trend Estimation and Serial Correlation." Cowles Commission Discussion Paper No. 383, Chicago.

Pristach, C.A., and C.M. Smith. 1996. "Self-Reported Effects of Alcohol Use on Symptoms of Schizophrenia." *Psychiatr Services* 47:421-3.

Raphael, S. 2000. "The Deinstitutionalization and the Mentally Ill and Growth in the U.S. Prison Population: 1971 to 1996." Unpublished manuscript. University of California, Berkely, CA.

Schlesinger, M. and B. Gray. 1999. "Institutional change and its consequences for the delivery of mental health services: Definitions and perspectives." In A. Horwitz & T. Scheid (Eds.), A handbook for the study of mental health: Social contexts, theories, and systems (pp. 427-448). Cambridge: Cambridge University Press.

Schlesinger, M., R. Dorwart, C. Hoover and S. Epstein. 1997. "The determinants of dumping: a national study of economically motivated transfer involving mental health care." *Health Services Research* 32 (5):561-76.

Silver, E. 2006. "Understanding the Relationship Between Mental Disorder and Violence: The Need for a Criminological Perspective." *Law and Human Behavior* 30(6):685-706.

Silver, E., E.P. Mulvey, and J.W. Swanson. 2002. "Neighborhood Structural Characteristics and Mental Disorder: Faris and Dunham Revisited." *Social Science & Medicine* 55:1457-70.

Silver, E., and B. Teasdale. 2005. "Mental Disorder and Violence: An Examination of Stressful Life Events and Impaired Social Support." *Social Problems* 52(1):62-78.

Sosowsky, L. 1980. "Explaining the Increased Arrest Rate Among Mental Patients: A Cautionary Note." *American Journal of Psychiatry* 137:1602-05.

Sosowsky, L. 1978. "Crime and Violence Among Mental Patients Reconsidered in View of the New Legal Relationship Between the State and the Mentally Ill." *American Journal of Psychiatry* 135:33-42.

State Mental Hospital Deinstitutionalization on United State Prison Populations, 1968-1978." *The Journal of Criminal Law and Criminology* 75 (2):474-90.

Steadman, H.J., S. Barbera, and D.L. Dennis. 1994. "A National Survey of Jail Diversion Programs for Mentally Ill Detainees. *Hospital and Community Psychiatry* 45:1109-13.

Steadman, H.J., J.J. Cocozza, and M.E. Melick. 1978. "Explaining the Increased Arrest Rate Among Mental Patients: The Changing Clientele of State Hospitals." *American Journal of Psychiatry* 135 (7):816-20.

Steadman, H.J., D.W. McCarty, and J.P. Morrissey. 1989. "The Mentally Ill in Jail: Planning for Essential Services." New York: Guildford Publications.

Steadman, H.J., J. Monahan, B. Duffee, E. Hartstone, and P.C. Robbins. 1984. "The Impact of

Steadman, H.J., and M. Naples. 2005. "Assessing the Effectiveness of Jail Diversion Programs for Persons with Serious Mental Illness and Co-Occurring Substance Use Disorders." *Behavioral Sciences and Law* 23(2):163-70.

Steadman, H.J., D. Vanderwyst, and S. Ribner, 1978. "Comparing Arrest Rates of Mental Patients and Criminal Offenders." *American Journal of Psychiatry* 135 (10):1218-20.

Swanson, J.W., M.S. Swartz, R. Borum, V.A. Hiday, H.R. Wagner, and B.J. Burns. 2000. "Involuntary Out-Patient Commitment and Reduction of Violent Behavior in Persons With Severe Mental Illness." *British Journal of Psychiatry* 176:324-31.

Teplin, L.A. 1990. "The prevalence of severe mental disorder among male urban jail detainees: comparison with the Epidemiologic Catchment Area Program." *American Journal of Public Health* 80(6):663-9.

Teplin, L.A. 1984. "Criminalizing Mental Disorder: The Comparative Arrest Rate of the Mentally Ill." *American Psychologist* 39:794-803.

Teplin, L.A. 1983. "The Criminalization of the Mentally Ill: Speculation in Search of Data." *Psychological Bulletin* 94:54-67.

Torrey, E.F. 1995. "Jails and Prisons – America's New Mental Hospitals." *American Journal of Public Health* 85:1611-3.

Trupin, E. & H. Richards. 2003. "Seattle's Mental Health Courts: Early Indicators of Effectiveness." *International Journal of Law and Psychiatry* 26(1):33-53.

US Dept. of Justice, Bureau of Justice Statistics. Annual Survey of Jails: Jurisdiction-Level Data, 1998 [Computer file]. Conducted by US Dept. of Commerce, Bureau of the Census. ICPSR ed. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [producer and distributor], 2001.

US Dept. of Justice, Federal Bureau of Investigation. Uniform Crime Reporting Program Data [United States]. County-Level Detailed Arrest and Offense Data, 1998 [Computer file]. 2nd ICPSR ed. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [producer and distributor], 2001.

Valdiserri, E.V., K.R. Carroll, and A.J. Hartl. 1986. "A Study of Offenses Committed by Psychotic Inmates in a County Jail." *Hospital and Community Psychiatry* 37 (2):163-6.

Whitmer, G.E. 1980. "From Hospitals to Jails: The Fate of California's Deinstitutionalized Mentally Ill." *American Journal of Orthopsychiatry* 50:65-75.

Wilson, J.Q. and Herrnstein R.J. 1985. "Crime and Human Nature: The Definitive Study of the Causes of Crime." The Free Press 1985.

Wooldridge, J.M. 2003. "Introductory Econometrics: A Modern Approach, second edition." Cincinnati, OH: South-Western College Publishing.

Wooldridge, J.M. 2002. "Econometric Analysis of Cross Section and Panel Data." Cambridge, MA: The MIT Press.

Worrel, J.L., and T.C. Pratt. 2004. “Estimation Issues Associated with Time-Series-Cross-Section Analysis in Criminology.” *Western Criminology Review* 5(1):35-49.

Table 3.1 Variable Definitions, Summary Statistics and Data Sources.

Variables	Definitions	Mean	Standard Deviation	Sources
Dependent Variables				
Arrests				
Total Serous Crime		1152	1854	
Violent Crime Total		197	120	
Murder		6.51	5.85	
Rape	The number of arrests for	13.18	6.26	
Robbery	total serious crime (UCR's	42.6	37.5	
Aggravated Assaults	Part I Crime total), total	134.8	84.8	
Property Crime Total	violent crime, total property	954	1847	
Burglary	crime, individual measures	145.1	64.7	
Larceny	of serious crime, total minor	592	314	UCR
Motor Vehicle Theft	crime (UCR's Part II Crime	208	1821	
Arson	total), drug violation total, drug sale, and drug	7.65	4.52	
Total Minor Crime	possession, per 100,000	4760	2979	
Drug total	persons.	366	255	
Drug sale		95	102	
Drug possession		252	177	
Jail Inmates	Annual average number of Jail inmates per 100,000 Persons	159	131	Census of Jails & Annual Survey of Jails
Main Independent Variables				
Psychiatric Beds per 100,000				
Total		66.2	40.1	
Public Psychiatric Hospital	The number of psychiatric	34.0	31.7	
Private Psychiatric Hospital	beds per 100,000 persons.	9.04	6.83	
Public General Hospital		7.82	6.03	
Private General Hospital		15.6	8.90	AHA
Proportion of psychiatric beds (%)	The ratio of the number of			
Private Psychiatric Hospital	psychiatric beds of each	42.6	58.4	
Public General Hospital	type to the number of public	32.1	30.6	
Private General Hospital	psychiatric hospital beds	65.5	62.1	
SMHA's Expenditures	Community-based outpatient mental health expenditures by state mental health agencies measured in millions of dollars per 100,000 persons	2.33	1.94	NRI
Covariates				
Jail Capacity	Maximum number of jail inmates set by State or local authorities	175	125	Census of Jails & Annual Survey of Jails
Police per 100,000	The number of the full- and	397	200	CJEE

(Once-lagged)	Part-time police with arrest power per 100,000 persons			Extracts
Per-Capita Income	State per-capita income	21703	4016	BEA
Unemployment	State unemployment-to-population ratio	0.063	0.022	BLS
Poverty	Proportion of the poor	0.146	0.042	
Metropolitan	Proportion of residents in metropolitan areas	0.66	0.22	
Medicaid	Proportion of Medicaid recipients	0.101	0.051	
Welfare (AFDC/TANF)	Proportion of AFDC/TANF recipients	0.040	0.017	
Racial Composition				
White	Proportion of residents of each race	0.85	0.14	Census Bureau
Black		0.11	0.12	
Non-White-Non-Black		0.044	0.089	
Age Structure				
Under 19	Proportion of residents within each category of age	0.296	0.027	
20-24		0.078	0.011	
25-34		0.164	0.018	
35-44		0.148	0.017	
45-54		0.106	0.014	
55-64		0.086	0.009	
65+		0.123	0.021	

Table 3.2 Effect of the Total Number of Psychiatric Beds on Arrest Rates Per 100,000 Persons.

	Total Serious Crime [a]	Violent Crime					Property Crime				
		Total [b]	ln(Murder) [b]	Rape	Robbery [b]	Agg. Assault [b]	*Total* [a, b]	Burglary [b]	Larceny [b]	Motor Vehicle Theft [a, b]	Arson [b]
Main Independent Variables											
Total Psychiatric beds	–1.19 (0.86)	0.33 (0.29)	0.0007 (0.0015)	0.015 (0.010)	0.134* (0.061)	0.14 (0.24)	1.17 (0.87)	0.11 (0.11)	0.59 (0.38)	0.06 (0.65)	0.0079 (0.0090)
CMHA's Expenditures	–19.47* (9.70)	–8.89** (2.83)	–0.009 (0.011)	0.10 (0.17)	1.87*** (0.44)	–10.91*** (2.79)	12.15 (13.40)	–1.91 (1.49)	–0.11 (5.30)	15.06 (8.82)	0.076 (0.084)
Covariates											
Police $_{t-1}$	0.43*** (0.10)	0.088* (0.037)	0.00019 (0.00025)	0.0037* (0.0016)	0.000 (0.010)	0.081* (0.032)	0.24 (0.19)	0.025 (0.020)	0.056 (0.064)	0.18 (0.16)	0.0010 (0.0014)
Socio–economic & demographic variables											
Per–capita Income	–0.032** (0.012)	–0.0021 (0.0031)	0.00001 (0.00002)	0.00036* (0.00015)	0.00002 (0.00087)	–0.0021 (0.0027)	–0.057** (0.020)	–0.0015 (0.0021)	–0.0068 (0.0064)	–0.048** (0.019)	–0.00006 (0.00019)
Poverty	–24.95*** (5.51)	–1.81 (0.93)	–0.0129* (0.0058)	–0.008 (0.056)	–0.50* (0.21)	–1.20 (0.71)	–36.75*** (3.72)	–0.41 (0.65)	–1.65 (2.02)	–32.94*** (2.50)	–0.051 (0.038)
Unemployment	–40.70*** (7.33)	1.86 (2.55)	0.012 (0.013)	–0.09 (0.11)	1.08* (0.50)	0.91 (2.13)	–26.87* (10.71)	4.33*** (1.14)	11.26** (4.21)	–43.03*** (8.53)	0.09 (0.11)
Metropolitan	–0.67 (5.65)	–2.37 (1.74)	–0.0040 (0.0090)	0.040 (0.068)	–0.49 (0.62)	–1.64 (1.07)	6.15 (9.09)	–0.67 (0.83)	–2.05 (3.91)	8.80 (8.72)	–0.01 (0.04)
Medicaid	–19 (301)	145 (131)	0.66 (0.62)	4.38 (5.90)	10.32 (34.21)	120.1 (94.7)	1025 (740)	18.7 (69.6)	340 (281)	637 (452)	–0.08 (5.17)
AFDC/TANF	1335 (1619)	266 (558)	3.30 (3.58)	54.09** (18.90)	16 138	223 476	2063 (1972)	–217 (303)	–1129 (910)	3578** (1357)	–13.1 (14.8)

Table 3.2 Continued.

Racial composition											
Black	3702 (2426)	4857** (1769)	12.54*** (2.82)	58.08* (28.67)	2384*** (285)	2367 (1526)	–9879*** (2825)	–759 (489)	3362* (1510)	–12408*** (2937)	–17.9 (45.7)
Non–white–non–Black	10565*** (1542)	5528*** (1164)	3.01 (7.03)	–86.13*** (14.01)	386 (301)	5109*** (1024)	18095*** (4666)	783 (711)	1064 (3060)	17544*** (2851)	162.1*** (27.4)
Age structure											
20–24	30029*** (3536)	2177** (836)	5.70 (4.93)	77.74 (46.09)	241 (241)	1768** (635)	49340*** (5478)	395 (465)	1581 (1700)	47868*** (4790)	37.4 (24.8)
25–34	11820*** (2023)	430 (669)	2.26 (5.45)	–17.92 (29.73)	–57 (198)	603 (567)	4896 (5272)	535 (299)	–237 (1184)	5142 (5107)	17.5 (41.2)
35–44	–23886*** (6219)	–1427 (776)	–2.00 (8.78)	169.10*** (41.79)	–885*** (172)	–608 (670)	12090*** (3663)	108 (478)	4881** (1746)	7980* (3402)	38.5 (43.1)
45–54	32648*** (5371)	–725 (1176)	1.82 (8.27)	134.71 (70.81)	49 (309)	–975 (1126)	500 (11574)	–787 (594)	1887 (2707)	–553 (9495)	–90.0 (67.6)
55–64	–37598*** (3542)	–1040 (1324)	0.94 (11.84)	87.90 (56.24)	–1094*** (298)	179 (1164)	–114900*** (8654)	–1522** (524)	–6791** (2214)	–104444*** (7025)	–115.8* (49.0)
Over 65	12946*** (2908)	–4688*** (1204)	–1.06 (6.78)	–37.51 (42.08)	–830* (326)	–3784*** (976)	–7065 (7096)	–1451* (623)	–4698 (2824)	681 (5148)	58.6 (84.4)
R−2	0.2387	0.9750	0.9598	0.9405	0.9772	0.9638	0.3134	0.9819	0.9764	0.2554	0.9177
N	791	791	790	791	791	791	791	791	791	791	791

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.2 Continued.

	ln(Total Minor Crime) [a,b]	Drug Violation		
		Total	Drug Sale	Drug Possession
Main Independent Variables				
Total psychiatric beds	0.00082 (0.00079)	–0.54 (0.53)	0.18 (0.26)	–0.55 (0.36)
CMHA's Expenditures	–0.0466*** (0.0080)	–10.56 (8.37)	–1.97 (3.00)	–5.02 (5.88)
Covariates				
Police $_{t-1}$	0.00021 (0.00016)	0.06 (0.11)	0.024 (0.037)	0.037 (0.070)
Socio–economic & demographic variables				
Per–capita Income	–0.00001 (0.00002)	0.0030 (0.0082)	–0.0052 (0.0038)	0.0074 (0.0066)
Poverty	–0.0071 (0.0039)	–1.49 (1.91)	–0.43 (1.34)	0.70 (1.44)
Unemployment	–0.002 (0.011)	–8.52 (5.47)	–5.38 (2.85)	–5.74 (4.26)
Metropolitan	–0.0073 (0.0063)	0.23 (1.94)	1.14 (0.68)	–0.96 (1.48)
Medicaid	0.40 (0.54)	–97 (160)	–115.2* (56.9)	–126 (137)
AFDC/TANF	–2.02 (1.79)	902 (1005)	–23 (714)	1142 (785)
Racial composition				
Black	–4.33* (1.94)	6332*** (1490)	3340*** (1030)	4798*** (729)
Non–white–Non–Black	7.92 (4.94)	1077 (2887)	1046 (544)	782 (2413)
Age structure				
20–24	11.13*** (2.77)	7558*** (1912)	2754*** (792)	5076*** (1450)
25–34	14.42*** (2.40)	5437*** (1395)	1521 (820)	4169*** (1204)
35–44	16.33*** (2.97)	1382 (2931)	–376 (1358)	523 (2528)
45–54	1.92 (4.09)	3727 (2721)	3520*** (962)	–523 (2384)
55–64	–13.70** (5.14)	1829 (3262)	–3735* (1503)	5648* (2777)
Over 65	–11.95** (4.10)	–4355 (2290)	–1927* (914)	–2342 (1897)
R−2	0.9474	0.9559	0.8361	0.9448
N	791	696	696	696

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.3 Effect of the Number of Psychiatric Beds of Different Hospital Type on Arrest Rates Per 100,000 Persons.

	Total Serious Crime [a, b]	Violent Crime					Property Crime				
		Total [b]	ln(Murder) [b]	Rape	Robbery [b]	Agg. Assaults [b]	*Total* [a, b]	Burglary [b]	Larceny [b]	Motor Vehicle Theft [a, b]	Arson [b]
Public psychiatric hospital beds	–3.00 (0.69)	0.18 (0.33)	–0.0010 (0.0020)	0.016 (0.011)	0.035 (0.045)	0.11 (0.31)	–3.18* (1.60)	–0.04 (0.12)	0.09 (0.43)	–3.49** (1.34)	0.003 (0.009)
Private psychiatric hospital beds	–0.15 (3.14)	0.57 (0.59)	–0.0001 (0.0023)	0.061 (0.036)	0.25 (0.17)	0.25 (0.43)	–0.96 (2.81)	0.61* (0.25)	2.71* (1.07)	–5.37* (2.32)	0.078*** (0.023)
Public general hospital beds	–9.23 (6.88)	0.39 (0.76)	0.0026 (0.0056)	–0.041 (0.051)	0.41* (0.20)	–0.07 (0.59)	–10.11 (6.53)	0.03 (0.43)	0.33 (1.28)	–11.23* (5.44)	0.026 (0.024)
Private general hospital beds	11.88* (5.81)	0.75 (0.52)	0.0106** (0.0039)	–0.002 (0.043)	0.25* (0.12)	0.37 (0.47)	11.55* (5.53)	0.53 (0.31)	0.94 (1.37)	10.45* (4.45)	–0.060 (0.038)
CMHA's Expenditures	18.56 (17.84)	–8.42** (2.81)	–0.003 (0.013)	0.12 (0.15)	1.95*** (0.45)	–10.57*** (2.72)	27.7 (16.9)	–1.29 (1.45)	1.51 (5.15)	28.8* (13.0)	0.057 (0.094)
R−2	0.3342	0.9751	0.9597	0.9410	0.9775	0.9640	0.3141	0.9821	0.9767	0.2554	0.9161
N	791	791	790	791	791	791	791	791	791	791	791

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.3 Continued.

	ln(Total Minor Crime) [a,b]	Drug Violation		
		Total	Drug Sale	Drug Possession
Public psychiatric hospital beds	0.00021	–1.02	–0.04	–0.98*
	(0.00082)	(0.64)	(0.32)	(0.44)
Private psychiatric hospital beds	0.0041	1.59	–0.26	1.26
	(0.0022)	(1.07)	(0.57)	(0.91)
Public general hospital beds	–0.0049	–1.46	–0.02	–1.91
	(0.0037)	(1.97)	(0.74)	(1.57)
Private general hospital beds	0.0065*	2.43	1.35	2.64*
	(0.0028)	(1.39)	(0.88)	(1.09)
CMHA's expenditures	–0.0383***	–10.14	–2.34	–4.43
	(0.0095)	(7.72)	(2.93)	(5.35)
R−2	0.9479	0.9572	0.8377	0.9483
N	791	696	696	696

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.4 Effect of the Composition of Psychiatric Beds of Each Hospital Type Relative to Public Psychiatric Hospital Beds on Arrest Rates Per 100,000 Persons.

	Total Serious Crime [a]	Violent Crime					Property Crime				
		Total [b]	ln(Murder) [b]	Rape	Robbery [b]	Agg. Assaults [b]	*Total* [a, b]	Burglary [b]	Larceny [b]	Motor Vehicle Theft [a, b]	Arson [b]
Private psychiatric hospital beds	–1.30 (0.28)	–0.008 (0.061)	0.00023 (0.00044)	0.0037 (0.0039)	–0.005 (0.020)	0.0001 (0.0449)	–1.32*** (0.24)	0.043 (0.035)	0.12 (0.12)	–1.53*** (0.24)	0.0039* (0.0019)
Public general hospital beds	3.81 (0.48)	0.14 (0.10)	0.00020 (0.00061)	–0.0049 (0.0086)	0.006 (0.019)	0.116 (0.079)	4.09*** (0.82)	0.032 (0.059)	0.26 (0.16)	3.65*** (0.87)	0.0022 (0.0029)
Private general hospital beds	–0.58 (0.16)	–0.048 (0.061)	0.00011 (0.00026)	0.0010 (0.0035)	0.014 (0.015)	–0.062 (0.056)	–0.92** (0.31)	–0.006 (0.033)	–0.081 (0.097)	–0.80*** (0.24)	–0.0002 (0.0017)
Total psychiatric Beds	–0.24 (1.04)	0.44 (0.32)	0.0008 (0.0014)	0.010 (0.012)	0.150 (0.066)	0.22 (0.26)	4.66*** (1.01)	0.13 (0.12)	0.78 (0.51)	3.25*** (0.69)	0.0064 (0.0079)
CMHA's Expenditures	–20.46 (11.00)	–8.82** (2.86)	–0.006 (0.011)	0.14 (0.18)	2.01 (0.41)	–11.07*** (2.78)	37.0*** (10.9)	–1.41 (1.49)	1.05 (5.35)	37.71*** (7.26)	0.093 (0.081)
R−2	0.2319	0.9754	0.9573	0.9413	0.9778	0.9650	0.3148	0.9817	0.9763	0.2665	0.9155
N	775	775	774	775	775	775	775	775	775	775	775

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.4 Continued.

	ln(Total Minor Crime) [a,b]	Drug Violation		
		Total	Drug Sale	Drug Possession
Private psychiatric hospital beds	0.00036 (0.00028)	0.14 (0.14)	0.027 (0.080)	0.153 (0.093)
Public general hospital beds	–0.00015 (0.00038)	–0.09 (0.19)	–0.016 (0.087)	–0.12 (0.15)
Private general hospital beds	–0.00010 (0.00017)	–0.02 (0.16)	–0.001 (0.074)	0.01 (0.11)
Total psychiatric beds	0.00053 (0.00083)	–0.66 (0.57)	0.15 (0.28)	–0.60 (0.37)
CMHA's expenditures	–0.0466*** (0.0080)	–10.56 (8.50)	–1.88 (3.10)	–4.73 (6.04)
R−2	1.0401	0.9580	0.8361	0.9454
N	775	680	680	680

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

Table 3.5 Effect of Psychiatric Beds on Annual Average Numbers of Jail Inmates Per 100,000 Persons.

	Model 1	Model 2	Model 3
Main Independent Variables			
Total Number of Psychiatric Beds			
Total Psychiatric beds	0.24 (0.16)	.	.
Number of psychiatric beds by different types			
Public psychiatric hospital beds	.	–0.64* (0.30)	.
Public psychiatric hospital beds ^{2}		0.0052*** (0.0016)	.
Private psychiatric hospital beds	.	1.03 (0.55)	.
Public general hospital beds	.	1.59** (0.60)	.
Private general hospital beds	.	–0.45 (0.37)	.
Ratio of Psychiatric Beds of each type to public Psychiatric hospital beds			
Private psychiatric hospital beds	.	.	0.160 (0.082)
Psychiatric beds in public general hospitals	.	.	0.194* (0.084)
Psychiatric beds in private general hospitals	.	.	–0.146** (0.046)
Total psychiatric beds	.	.	0.25 (0.15)
CMHA's expenditures	–6.27*** (1.95)	–6.33** (2.09)	–6.47*** (1.92)
Covariates			
Rated capacity of jail	0.866*** (0.038)	0.870*** (0.036)	0.861*** (0.036)
Police $_{t-1}$	–0.043 (0.025)	–0.050* (0.024)	–0.046 (0.025)
Socio–economic & demographic variables			
Per–capita income	–0.0079* (0.0035)	–0.0077* (0.0034)	–0.0063 (0.0034)
Poverty	0.27 (0.57)	0.14 (0.57)	0.32 (0.58)
Unemployment	–1.37 (1.67)	–0.54 (1.47)	–0.36 (1.59)
Metropolitan	1.60* (0.69)	1.17 (0.69)	1.46* (0.68)
Medicaid	–141 (133)	–158 (135)	–160 (140)
AFDC/TANF	38 (259)	–392 (257)	–211 (271)

Racial composition			
Black	–761	259	–366
	(778)	(886)	(770)
Non–white–non–black	–3099	–4386	–3391
	(2304)	(2526)	(2392)
Age structure			
20–24	1221	1103	1161
	(788)	(796)	(801)
25–34	1879*	1721*	1565
	(899)	(840)	(896)
35–44	1433	1390	833
	(1174)	(1143)	(1331)
45–54	–1057	–785	–1263
	(1023)	(1005)	(1109)
55–64	866	380	1987
	(2443)	(2489)	(2896)
Over 65	–4119**	–3522**	–3410*
	(1382)	(1337)	(1481)
R−2	0.9191	0.9216	0.9170
N	717	717	708

* p < .05 ** p<.01 *** p<.001. State and year dummies are included in all models.

[a] Models do not reject the null of no autocorrelation (based on Wooldridge's test for AR(1) autocorrelation in panel data) and therefore OLS estimates with PCSEs are reported. Otherwise, Praise-Winsten estimates with PCSEs are reported.

[b] State specific linear time trends are included.

CHAPTER IV

STUDY 3:
The Effect of Reductions in Psychiatric Beds on Jail Use by Persons with Severe Mental Illness

Abstract

This paper analyzes the impact of the supply of hospital psychiatric beds on jail detention among persons with mental illness. It also rigorously explores mechanisms by which reduced psychiatric bed availability would affect jail detention. The empirical analysis was based on unique longitudinal data that provide information on the utilization of mental health and substance abuse services and on stays in local jails in King County, Washington over the years 1993 – 1998. Based upon a simultaneous equations system which models a complex relationship between jail detentions, utilization of mental health services, and substance abuse, subpopulations of different severity of mental illness were examined. Fixed–effect linear probability models were first estimated to obtain the effect of the number of psychiatric beds on an individual's likelihood of jail detention, mental health service use, and substance abuse. Then, the instrumental variable two-step generalized method of moments estimation technique was employed to isolate the effect of mental health service use and substance abuse on jail detention. Findings indicate that a decrease in psychiatric beds increased the probability of jail detention among persons with severe mental illness mainly via an increase in minor offenses. This decrease was also found to have an effect on persons with non-severe mental illness. Further analyses revealed that psychiatric bed

reduction had the largest effect on black women with severe mental illness. Importantly, mental health service use and substance abuse were identified as the main channels through which psychiatric bed supply affected jail detention among persons with severe mental illness. Thus, in an era with continuing decrease in psychiatric beds, particular attention should be given to persons with severe mental illness, in particular black women, in terms of their use of mental health services, substance abuse, and subsequent contact with the criminal justice system.

4.1 Introduction

Does a decrease in the supply of hospital psychiatric beds increase jail detention? If so, what are the mechanisms through which the decreased capacity of inpatient mental health services may affect jail detention? Answers to these questions would yield enormous policy implications for both mental health and criminal justice systems. This study is relevant to both questions.

Since Penrose (1939) observed an inverse relationship between mental hospital census and the number of prisoners in European countries, whether decreased availability of hospital psychiatric beds affects correctional populations or not has been a topic of debate around the world for seven decades. In the U.S., recent literature presents a negative relationship between the capacity of public psychiatric hospitals and the size of incarcerated populations (Raphael 2000; Palermo, Smith, and Liska 1991). Yet, the prior studies are limited in that they examine only public mental hospitals and hence disregard a possible substitution effect of increased capacity of other institutional providers such as private psychiatric and psychiatric units in general hospitals as well as of the community mental

health system. Also, they focused on prison populations which are less interdependent with the mental health system than local jails. Importantly, mechanisms by which reduced psychiatric bed availability would affect jail detention have not been previously examined.

This study addresses the gaps in prior research using unique individual-level panel data from King County, Washington. The data included information on 42,511 persons about their receipt of mental health and substance abuse treatment as well as contacts with the criminal justice system from July 1993 through December 1998. It was posited that a decrease in mental hospital beds may affect a mentally ill individual's probability of jail detention through lack of mental health service use and subsequent development of substance abuse comorbidity. Based on a simultaneous equations system developed from the conceptual model of this study, fixed-effect linear probability models of jail detention were estimated to examine the *total* effect of a reduction in hospital psychiatric beds on the likelihood of jail detention for the entire sample and three subpopulations including persons with severe mental illness, non-severe mental illness, and no evidence of mental illness. To explore the pathways, this study first estimated fixed-effect linear probability models of mental health service use and substance abuse to isolate the effect of psychiatric bed supply on the likelihood of mental health service use and substance abuse. Using an instrumental variable two-step generalized method of moments (GMM) estimation technique (Baum, Schaffer & Stillman 2003), a structural equation of jail detention was estimated to examine the direct effect of mental health service use and substance abuse on the likelihood of jail detention. Identification of the models was achieved through exclusion restrictions. Results showed that a one-unit decrease in psychiatric beds per 100,000 persons increased the six-month probability of jail detention by 0.03 percentage points for persons with severe mental

illness. In addition, the adverse effect of decreased psychiatric beds was also found for the other subpopulations. Findings also indicate that the negative effect could be mitigated by increasing community mental health resources. Exploring the mechanisms in detail, the effect appears to occur due to an increase in substance abuse possibly due to lack of mental health treatment. Further analyses showed that among subpopulations of persons with severe mental illness, black women were the most likely to be negatively affected by reduced psychiatric bed supply.

4.2 Background

4.2.1 Nationwide trends in community mental health resources and hospital psychiatric beds

The U.S. mental health system has undergone significant changes in the delivery, organization, and financing of mental health services over the last several decades. Among the changes, *community mental health movements* is one of the most distinguished, on-going changes that have led to the shift of the location of treatment of persons with severe mental illness from public psychiatric hospitals to community mental health programs (Grob 1994). The changing landscape of the mental health system has been driven by several factors such as the patient rights movement, efforts to control the rising costs of care, changes in the availability of medication treatment and other therapies, and economic incentives created by social welfare programs such as Medicaid and Medicare (Grob 2001; Mechanic and Rochefort 1990; Morrissey 1989). As a result, community mental health treatments are now receiving substantially more funds than public inpatient psychiatric services. In 2004, community mental health programs accounted for 69 percent of state mental health agencies' expenditures, a 110 percent increase from 33 percent in 1981. Over the same period,

spending on state psychiatric hospital services experienced about a 56 percent decrease from 63 to 28 percent (NRI 2006).

The number of psychiatric facilities that provide outpatient-based treatments increased consistently from 2,156 to 4,386 between 1970 and 1998 (Manderscheid et al. 2004). The growing availability of mental health treatment in community outpatient settings has improved access to the mental health system for new patients who previously had no access to psychiatric treatment (Grob 2001; Morrissey 1989; Whitmer 1980). In addition, the increased emphasis on high-quality community treatment, such as intensive case management and assertive community treatment[1], and a variety of tools being used to improve adherence to psychiatric treatment in the community, such as involuntary outpatient commitment[2], have been shown to be effective in treating patients with severe mental illness in the community and important in reducing their involvement with the criminal justice system (Lamb and Weinberger 2005; Swanson et al. 2000). As a result, an increasing number of patients with severe mental illness have been treated in the community. The proportion of patients who used outpatient services has largely increased. In 1971, approximately 58 percent of 4.2 million users of mental health services in 1971 used psychiatric outpatient services. The proportion increased to 78 percent of 11 million mental health service users in 2000 (Manderscheid et al. 2004).

In contrast to the increased emphasis on community-based treatment of mental illness, the supply of inpatient psychiatric treatment beds has been significantly declining. In

[1] Assertive community treatment is a comprehensive and team-based treatment model of mental health service delivery for persons with severe mental illness. It provides highly customized services directly to consumers to help keep them out of psychiatric hospitals (Phillips et al. 2001; Stein and Test 1980).

[2] Involuntary outpatient commitment refers to community treatment orders as a legal intervention intended to improve treatment adherence among persons with serious mental illness (Swanson et al. 2000).

particular, the precipitous decrease in public psychiatric hospital beds has received interest from mental health professionals and policymakers because the declining capacity of public psychiatric hospitals may jeopardize treatment for the nation's most severely mentally ill and indigent patients, especially those in need of intensive and *structured* treatment but with no other alternatives in the community (Lamb and Weinberger 2005). Nationally, the total number of hospital psychiatric beds dropped substantially from 264 per 100,000 persons to 77 per 100,000 persons between 1970 and 2000. *Public* psychiatric hospitals experienced even more substantial decreases from 207.4 beds per 100,000 in 1970 to 21.2 per 100,000 in 2000 (Mandersheid et al. 2004). Although the size and trends in the number of hospital psychiatric beds varied across states (Mechanic and Rochefort 1990; Morrissey 1989), the number of public psychiatric hospital beds continues to decrease in most states. Survey data from the State Mental Health Agency (SMHA) Profile System show that 22 states decreased the number of state hospital beds between 2001 and 2006. In 2006, more than 7 states plan to close state psychiatric hospitals over the next two years. Downsizing of psychiatric beds may have influenced other aspects of the mental health system. For example, in 2006, 34 of 44 responding state agencies reported a shortage of acute care beds. A shortage of long-term care and forensic beds were also reported in 16 and 24 states, respectively. Furthermore, 23 states experienced increased waiting lists for public psychiatric hospital admissions and 11 states for non-public psychiatric beds (NRI 2006).

Compared to the decline in public psychiatric hospital beds, private psychiatric hospitals and separate psychiatric units in public and private general hospitals have gradually gained more importance in the treatment of mental illness. The number of treatment beds in private mental hospitals and psychiatric units of general hospitals exhibited substantial

growth from 1970 until the mid-1990's when it started to reduce slowly (Manderscheid et al. 2004). In 2000, private psychiatric and general hospitals accounted for 24 and 46 percent of all inpatient treatment episodes, respectively, compared to only 12 percent in state psychiatric hospitals (Manderscheid et al. 2004). Part of this shift has to do with the federal Medicaid regulations, which preclude payments for stays in public psychiatric hospitals for persons ages 21 – 64 (Frank, Goldman and Hogan 2003). Both public and non-public psychiatric facilities, however, operate at relatively full capacity. Psychiatric hospital occupancy rates, in general, have remained over 84 percent between 1975 and 2000[3]. The high rates of occupancy may indicate that hospitals' capacities to manage people with most debilitating psychiatric symptoms may be jeopardized.

4.2.2 Severely mentally ill offenders in jails

Over the period during which the mental health system has undergone the continuous decline in inpatient psychiatric beds, the criminal justice system has also experienced constant increases in both the number of inmates and the capacity of correctional facilities. In particular, local jails have been seen as being more likely interdependent with the mental health system than prisons (Steadman et al. 1984). National Data from Bureau of Justice Statistics (BJS) showed that the number of jail inmates per 100,000 persons had a steady increase from 108 per 100,000 in 1985 to 252 per 100,000 in 2005 (BJS 2007). The capacity of jails also grew constantly from 114 per 100,000 to 266 per 100,000 over the same period (BJS 1985 & 2005). Nevertheless, local jails are operating at almost 95 percent of their capacity.

[3] Authors' calculation using figures from Tables 2 and 5 in Manderscheid et al. (2004). The rates are calculated by taking the number of residents in psychiatric hospitals on Jan. 1 for each year and dividing by the number of psychiatric beds on Jan. 1 for that year.

There is an increasing concern that local jails are significantly overpopulated with severely mentally ill offenders. Approximately 6 to 16 percent of jail inmates have been reported to have severe mental illness (New Freedom Commission on Mental Health 2003; Fisher et al. 2000; Ditton 1999; Teplin 1990; Steadman, McCarty, and Morrissey 1989). Critics have often related the disproportionate presence of individuals with severe mental illness in correctional facilities to substantial reductions in the supply of psychiatric beds (Lamb, Weinberger, and Gross 2004; Lamb and Weinberger 1998; Torrey et al. 1995; Mechanic and Rochefort 1990; Teplin 1984; Telpin 1983; Lamb and Grant 1982; Abramson 1972). However, national research has not been able to completely substantiate this claim.

4.2.3 Prior studies on the relationship between inpatient psychiatric care capacity and correctional incarceration

Since the late 1970's in the U.S., an array of studies began examining the link between the inpatient mental health supply and the size of incarcerated populations. For example, using data from 3,897 randomly selected prisoners and 2,376 mental patients in 6 states, Steadman and colleagues (1984) examined whether persons with a history of psychiatric hospitalization were found in prisons more often than others with no records of prior hospital use. Based on a simple correlation of the percentage of male prisoners with prior hospitalization between 1968 and 1978, they observed significant increases in the percentage of prisoners with prior psychiatric hospitalization in three states (California, Texas, and Iowa) and comparatively small but statistically insignificant decreases in other states (New York, Arizona, and Massachusetts). However, the authors concluded that there is little evidence to support an inverse relationship between mental hospital and prison populations. Nevertheless, it was suggested that there was a large exchange of mental patients between mental hospitals and local jails. Later, a time series analysis using aggregate

national data from 1904 and 1987 showed an inverse correlation between mental hospital census and prison and jail populations for the United States as a whole (Palermo, Smith, and Liska 1991). In 2000, Raphael examined the relationship between public psychiatric hospital and state prison populations in the United States and found similar results. Using state-level panel data for the periods from 1971 to 1996, he found a strong negative association between hospitalization and prison incarceration rates.

While suggestive of the relationship between the capacity of psychiatric inpatient care and correctional populations, the prior studies focused on the capacity of only *public* psychiatric hospitals. Since possible confounders such as the capacity of inpatient care in other institutional providers as well as the growth of community mental health programs were omitted in estimation, the methodological weakness in these prior studies precludes causal inferences about the relationship between a reduction in psychiatric beds and correctional populations. For example, the decreased availability of public mental hospital beds may be supplemented to some extent by the increased capacity of non-public counterparts such as private psychiatric and general hospitals and of the community mental health system. In addition, a follow-up study of discharged patients inherently disregards persons who have never been identified as mentally ill just because they had not previously used mental hospitals. Furthermore, inferences from aggregate national time-series data may be misleading because potentially useful information is largely removed when it is aggregated at the national level. Instead, less-aggregated panel data, natural experiment, and individual-level data, may be a preferred source of data in particular for criminological research (Levitt 2001).

Addressing these limitations, Study 2 of this dissertation explored the association between the supply of psychiatric beds and the number of jail inmates, using state-level data for the years 1982 to 1998. It would found that a decrease in the total number of psychiatric beds including both public and non-public psychiatric beds were not associated with an increase in the size of jail population for the study period. However, this finding might be due to the fact that only a small percentage of the U.S. population suffers from severe mental illness, even smaller percentage of whom has symptoms that may lead to jail detention. Although the macro-level analysis did not find any significant association between the supply of psychiatric hospital beds and the number of jail inmates, it is still possible that a change in psychiatric hospital capacity affects an individual's likelihood of jail detention, in particular among persons with severe mental illness, since changes in the capacity of the inpatient mental health system is more likely to affect those with the most debilitating psychiatric symptoms. Nor did the study distinguish between the severities of charges for jail detention. Considering that severely mentally ill offenders are often charged with minor offenses (Morrissey 2004; Torrey 1995; Valdiserri, Carroll, and Hartl, 1986; Lamb and Grant 1982; Sosowsky 1980; Steadman, Cocozza, and Melick 1978; Abramson 1972), it is important to explore the effect of psychiatric hospital bed availability on jail detention separately for charges of different severity. In addition, for the prior findings to be more meaningful to policymakers, it is necessary to examine mechanisms by which reduced psychiatric bed availability may affect jail detention, particularly with individual-level data because an individual-level analysis is more convincing for a test of a theory formulated for individual behaviors (Levitt 2001).

4.3 Conceptual Framework

For a change in the number of psychiatric beds to affect jail incarceration, the effect should be through persons with mental illness –particularly those with severe mental illness– residing in the community, whose mental health relies on the effectiveness of the mental health system. Economic theories and empirical evidence suggest plausible channels through which the availability of psychiatric beds may affect criminal justice outcomes among persons with mental illness (see Figure 1). The starting point of this pathway is that changes in the availability of psychiatric beds may have an impact on the use of mental health services among persons with mental illness. For example, a decrease in the supply of psychiatric beds may lead to the lack of access to inpatient services for those who may need it because the supply of psychiatric beds may become less than the level of need in a community. Another possible implication of reduced psychiatric beds may be a long waiting list, and consequently patients may be prematurely discharged even before they have adequate discharge planning or their conditions are fully stabilized (Lamb and Weinberger 2005). On the other hand, reduced psychiatric bed supply may also result in a lack of outpatient treatment especially by persons with severe mental illness either (1) because the community mental health system may not be capable of serving the increasing number of patients with severe mental illness possibly due to the lack of community mental health resources (Lamb, Weinberger and Gross 2004) or (2) because difficult patients with the most debilitating mental health symptoms may not adjust well to community living and remain untreated (Lamb and Weinberger 2005). Although there is no supporting empirical evidence on these possible scenarios, the mechanisms are reasonable enough to link a reduction in psychiatric beds and mental health services use among persons with severe mental illness (*1*).

A direct consequence of the lack of mental health treatment, either inpatient or outpatient, is the worsening of mental health symptoms because one's mental health level may depend on the quantity of resources allocated to the production of mental health (Grossman 1972). Meanwhile, since the opportunity cost of treatment-seeking would be higher if a person is more present-oriented, a person with a higher rate of time preference is less likely to voluntarily seek mental health treatment in the community. Becker and Mulligan (1997) indicated that there exists *complementarity* between future utility and higher time preference; that is, anything that lowers future utility may lead to higher time preference. Thus, since the lack of mental health treatment among persons with severe mental illness would decrease their future utility or well-being, their time preference would subsequently increase (*2*). Importantly, since time preference varies across persons, some may have a very low level of time preference. In an extreme case, a person with severe mental illness may discount the future too excessively to justify any mental health investments and thus does not seek any mental health treatment at all in the community. This may explain why many persons with severe mental illness are not compliant with or do not voluntarily seek mental health treatment in the community.

For completeness of the discussion, consider a person with severe mental illness solving the following lifetime utility (U) maximization problem:

$$\max U = \sum_{t=0}^{T} \left(\frac{1}{1+\sigma} \right)^{t} \cdot U(C_t, f(MHS_t))$$

which is subject to an intertemporal budget constraint. C_t is consumption of composite market goods- either normal or addictive goods -in period t; MHS_t refers to mental health inputs such as mental health visits and medications; and the function f transforms mental

health investments into utility. σ is the rate of time preference and thus $\frac{1}{1+\sigma}$ refers to the discount function.

This behavioral model provides insights into two important mechanisms by which inadequate receipt of mental health treatment may affect the probability of jail detention among mentally ill persons: worsening of mental health and increase in the use of substances. In the above utility maximization framework, an inadequate level of mental health treatment (*MHS*) in the current period reduces mental health status and in turn decreases utility in the following period. Therefore, contemporaneous time preference would increase due to the complementarity between future utility and present higher time preference. Three consequences would emerge. First, persons with higher time preferences have larger opportunity costs of investing in mental health and thus are less likely to use mental health services because the utility derived from a normal consumption good *C* is immediate whereas the utility from mental health investments is obtained in future time periods (*3*). This would decrease utility in later time periods and further increase an individual's time preference (*2*). Second, the increase in time preference may raise criminal activities and subsequent jail detention (*4*) assuming that jail detention is a function of crime and subsequent arrests. This is because we can think of a key individual-level factor associated with *criminality* as the tendency to think in terms of short-term rather than long-term planning horizons (Wilson and Herrnstein, 1985), and the rewards from not committing *crime* almost always are in the future, while the rewards from committing it are almost always in the present. Thus, persons with higher time preference are more likely to make present-oriented decisions to commit crime because they are likely to discount future penalties of their current criminal behavior more heavily. Lastly, the increased time preference may lead the person with severe mental

illness to self-medicate their psychiatric symptoms with addictive substances (*5*) (Harris and Edlund 2005; Pristach and Smith 1996; Whitmer 1980) because persons with higher time preference would be more likely to seek current consumption of addictive goods (Becker and Murphy 1988). Suppose *C* is an addictive good. Then, an individual with higher time preference is more likely to consume *C*, which provides immediate gratification, rather than investing in mental health promotion from which he or she may benefit in the future.

The use of addictive substances may yield two consequences. It may increase the likelihood of jail detention because using illegal substance, such as illicit drugs, is a violation of the law (*6*). On the other hand, the use of addictive substances of any kind, such as alcohol and illicit drugs, increases the rate of time preference because of the complementarity between future utility and heavy future discounting (*7*). Subsequently, less investment into mental health promotion would occur (*3*).

Similar to inadequate mental health service receipt, *social capital* may also influence jail detention among persons with severe mental illness. Social capital can be defined as the amount of support that individuals could received in a community, which may include the level of trust and cooperation from family members and friends, social networking, employment, residential support, and neighborhood environment (Silver 2006; Paldam 2000). Mentally ill individuals who belong to a community with a higher level of social capital may receive more emotional and structural support which may help improve their behavior in the community. For example, a recent empirical study found a strong negative relationship between the level of perceived psychosocial support and both violence and drug use among mentally ill persons residing in the community (Silver and Teasdale 2005). Thus, either adequate mental health treatment or the level of social capital may determine successful

community living among persons with severe mental illness (8), which may have an effect on their probabilities of jail use.

Meanwhile, it is important to note that while some mentally ill individuals are booked in jails because they have committed actual crimes, others may enter jails just because they exhibit psychiatric symptoms in public without committing actual crimes (Lamberti and Weisman 2004). Some police officers may arrest and take mentally ill persons, who are symptomatic in public, in jails for psychiatric treatment or public safety reasons (Lamb and Weinberger 1998). Also, a study showed that only a small number of mentally ill offenders were sent to a hospital at the time of arrest while many were subsequently taken to jails (McFarland et al. 1989). Once severely mentally ill offenders are arrested, they are less likely to post bail and gain release, which results in increased jail days (Lamberti and Weisman 2004; Lovell, Gagliardi, and Peterson 2002). Persons arrested for serious offenses, no matter how mentally ill, would normally be sent to a jail (Lamb and Weinberger 1998). Thus, even when a decrease in psychiatric beds actually does not influence criminal behaviors among persons with severe mental illness, the treatment of mentally ill persons by law enforcement authorities could be another reason for a large number of jail inmates with severe mental illness. Also, since jail detention may increase the likelihood of receiving mental health and substance abuse treatment through referrals (9), this simultaneous relationship should be explicitly modeled.

4.4 Econometric Approaches

4.4.1 Empirical model specifications

The conceptual framework motivates the following empirical model. Specifically, a three-equation simultaneous structural model was posited to capture the complex

interrelationships among the supply of psychiatric beds, mental health care utilization, substance abuse, and jail detention. The general framework is specified as follows:

$$JAIL_{it} = f(MHS_{it}, SA_{it}, X_{it}, J\_S_t) \quad (1)$$

$$MHS_{it} = f(BED_t, JAIL_{it}, SA_{it}, X_{it}, MH\_S_t) \quad (2)$$

$$SA_{it} = f(MHS_{it}, JAIL_{it}, X_{it}, SA\_S_t) \quad (3)$$

where *JAIL* defines jail detention; *MHS* is inpatient or outpatient mental health service use; *SA* represents having a substance abuse disorder; *BED* refers to the number of psychiatric beds in the community; *X* is a vector of individual characteristics that determine jail detention, mental health service use, or substance abuse; *J_S, MH_S,* and *SA_S* include sets of system-level characteristics that determine jail incarceration, mental health service use and substance abuse, respectively. Our model identification strategy is to use the system-level factors as exclusion restrictions.

The empirical specification of the above three structural equations is as follows:

$$JAIL_{it} = \alpha_0 + \alpha_1 \cdot MHS_{it} + \alpha_2 \cdot SA_{it} + \alpha_3 \cdot AGE_{it} + \alpha_4 \cdot TREND_t + a_i + u_{it} \quad (4)$$

$$\begin{aligned} MHS_{it} = {} & \beta_0 + \beta_1 \cdot BED_t + \beta_2 \cdot CMH_t + \beta_3 \cdot MC_t + \beta_4 \cdot JAIL_{it} + \beta_5 \cdot SA_{it} \\ & + \beta_6 \cdot AGE_{it} + \beta_7 \cdot MEDICAID_{it} + \beta_8 \cdot TREND_t + b_i + \varepsilon_{it} \end{aligned} \quad (5)$$

$$\begin{aligned} SA_{it} = {} & \gamma_0 + \gamma_1 \cdot MHS_{it} + \gamma_2 \cdot JAIL_{it} + \gamma_3 \cdot SA\ EXPEND_t + \gamma_4 \cdot COCAINE_t \\ & + \gamma_5 \cdot METH_t + \gamma_6 \cdot AGE_{it} + \gamma_7 \cdot MEDICAID_{it} + \gamma_8 \cdot TREND_t + r_i + \nu_{it} \end{aligned} \quad (6)$$

where the subscripts *i* and *t* index an individual and a six-month period, respectively. a_i, b_i, and r_i refer to unobserved time-invariant individual heterogeneity. u_{it}, ε_{it}, and ν_{it} are idiosyncratic errors.

There are three endogenous variables in the simultaneous equations system: Jail detention (*JAIL*) consists of four binary dependent variables of charges for jail detention;

mental health service use (*MHS*) takes the value of 1 if a persons used at least one mental health services – either psychiatric hospitalization (including state mental hospitals) or public outpatient mental health services; *SA* is a binary indicator taking a value of one for substance abuse.

The individual-level exogenous variables in the system include time-varying age (*AGE*) and Medicaid enrollment status (*MEDICAID*). Medicaid is a dummy variable indicating whether an individual was on Medicaid, and was included because having mental health insurance coverage is expected to increase mental health and substance abuse treatment among persons with severe mental illness (Frank and McGuire 2000). However, *MEDICAID* would be endogenous if the use of mental health services leads individuals to gain the coverage or jail detention leads to termination of the coverage (Morrissey et al. 2006). To minimize the potential simultaneity bias, I follow Zuvekas (1999) and define *MEDICAID* as Medicaid enrollment status during the first month of a six-month period.

The system (county)–level exogenous variables for the mental health service equation include the number of psychiatric beds (*BED*), the total number of public outpatient mental health visits per 1,000 persons each period (*CMH*), and managed care (*MC*) for public outpatient mental health services. *BED*, which is a primary explanatory variable of interest, includes psychiatric beds in both state psychiatric hospital and other institutional care providers, such as private psychiatric hospitals and general hospitals. It is defined as the total number of psychiatric beds in King County per 100,000 persons. *CMH* was included because the availability of public outpatient mental health resources may increase an individual's likelihood of receiving outpatient mental health services and thus confound the effect of the psychiatric bed supply. *MC* was also included because a change in financing of outpatient

mental health services may influence treatment receipts among users of public outpatient mental health services and subsequent jail detention (Domino et al. 2004).

The substance abuse equation includes public expenditures on substance abuse treatment (*SA EXPEND*) and prices of two illicit drugs including cocaine (*COCAINE*) and methamphetamine (*METH*). *SA EXPEND* was included because substance abuse treatment receipt may be well driven by public funding support. Illicit drug prices were included because both theoretical and empirical research suggests that price changes account for behavioral changes in consumption of addictive substances (Becker and Murphy 1988; Becker, Grossman and Murphy 1991; Grossman and Chaloupka 1998; Grossman, Chaloupka and Sirtalan 1998; Frank and McGuire 2000; Grossman 2004). Time trends (*TREND*) were controlled for to capture unspecified temporal effects.

The main purpose of this paper is to examine whether a change in psychiatric bed supply increased an individual's likelihood of jail detention across three subpopulations: Persons with severe mental illness, non-severe mental illness, and no evidence of mental illness. Thus, I first derived a reduced form equation. Equations (4) through (6) were solved down to the following reduced-form equation (see Appendix for derivation).

$$\begin{aligned} JAIL_{it} = {} & \pi_0 + \pi_1 \cdot BED_t + \pi_2 \cdot CMH_t + \pi_3 \cdot MC_t \\ & + \pi_4 \cdot SA\ EXPEND_t + \pi_5 \cdot COCAINE_t + \pi_6 \cdot METH_t \\ & + \pi_7 \cdot AGE_{it} + \pi_8 \cdot MEDICAID_{it} + \pi_9 \cdot TREND_t + p_i + \upsilon_{it} \end{aligned} \qquad (7)$$

The second goal of this paper is to explore mental health service use and subsequent substance abuse as the main channels by which a change in hospital psychiatric bed supply affects jail detention. For an understanding of complex relationships between psychiatric bed supply, mental health service use, substance abuse, and jail detention, the structural equations, (4) – (6), could be jointly estimated using system estimation methods such as three-stage

least squares (3SLS) or full information maximum likelihood (FIML). However, this study chose a different estimation strategy for several reasons. First, the present study could not estimate the simultaneous equations jointly using 3SLS due to an identification problem. The 3SLS approach requires strong and valid instruments for identification. Despite thorough efforts to find valid instruments, however, valid or strong instruments were not found[4]. Second, the study also tried system estimation using FIML. Unfortunately, FIML failed to converge. In addition to these technical difficulties, an important caveat of system estimation approaches is that estimates are often difficult to interpret, and thus may not provide much insight on the mechanism questions under examination. In addition, the consistency of system estimation methods depends on the assumption that all equations are correctly specified. Thus, if one equation is misspecified, estimation results for the other equations are also contaminated.

This study used a combination of reduced-form and instrumental variable analyses, which is an indirect way of examining the mechanisms, but still accomplishes the goal of this research. Specifically, I solved Eqs. (4) – (6) to obtain two additional reduced-form equations similar to Eq. (7): one for the mental health service use (*MHS*) equation and the other for the substance abuse (*SA*) equation. The resulting reduced-form equations are shown below (see Appendix for derivation).

$$\begin{aligned} MHS_{it} = {} & \phi_0 + \phi_1 \cdot BED_t + \phi_2 \cdot CMH_t + \phi_3 \cdot MC_t \\ & + \phi_4 \cdot SA\ EXPEND_t + \phi_5 \cdot COCAINE_t + \phi_6 \cdot METH_t \\ & + \phi_7 \cdot AGE_{it} + \phi_8 \cdot MEDICAID_{it} + \phi_9 \cdot TREND_t + f_i + \mu_{it} \end{aligned} \tag{8}$$

[4] The prospective instruments included the number of police; measures of jail capacity such as the opening of a new jail early 1997 and annual rated jail capacity; measures of tough sentencing such as average jail days and annual averages of jail inmates; and annual clearance rates (a ratio of the number of arrests to the number of crime reported to the police).

$$SA_{it} = \tau_0 + \tau_1 \cdot BED_t + \tau_2 \cdot CMH_t + \tau_3 \cdot MC_t + \tau_4 \cdot SA\ EXPEND_t + \tau_5 \cdot COCAINE_t + \tau_6 \cdot METH_t + \tau_7 \cdot AGE_{it} + \tau_8 \cdot MEDICAID_{it} + \tau_9 \cdot TREND_t + t_i + \eta_{it} \quad (9)$$

The coefficient on *BED* of Eqs. (8) and (9) captures both direct and indirect effect of psychiatric bed supply on mental health service use and substance abuse, respectively. Estimating these two equations would answer the question of whether a decrease in psychiatric beds affected use of mental health services and substances. In addition to these reduced-form models, I estimated the *JAIL* equation (4) to explore a direct effect of mental health services use and substance abuse on an individual's likelihood of jail detention. One weakness of our approach is that we cannot examine the relationship between mental health service use and substance abuse. Nonetheless, compared with joint estimation, this approach provides a straight-forward interpretation of results. Eqs. (4), (8), and (9) are referred to as the *mechanism equations* in the remainder of the paper.

4.4.2 Estimation issues

The empirical analysis was performed in two steps. First, the reduced–form equation (7) was estimated using ordinary least squares (OLS) controlling for individual unobserved heterogeneity. Thus, this study estimated individual fixed-effect linear probability models (LPM). Although it is well known that OLS provides consistent estimates when using a discrete dependent variable (Maddala 1983), the fact that the predicted probabilities can lie outside the unit range and heteroskedasticity is present, can be a concern. For data used here, the predicted values ranged between -0.04 and 1.03. Approximately 90 percent of the predicted values were bounded within the unit interval in all models although there was slight difference across the models. Standard errors were adjusted for heteroskedasticity and arbitrary forms of clustering. Thus, concern over the deficiencies of OLS estimation of LPMs

should be relatively minor in our application. In fact, there are many empirical advantages of using ordinary least squares on a linear probability model over non-linear models, which include ease of interpretation of marginal effects and no perfect prediction problem associated with non-linear models, particularly when panel data are used.

This study first estimated the main reduced-form equation on the entire sample. The effect of a change in psychiatric bed availability on persons with severe mental illness is expected to be larger than the effect on persons with non-severe mental illness who may not have chronic psychiatric symptoms. Also, since the availability of psychiatric beds might not have an effect on persons who did not use mental health services during our study period, three different populations were examined: persons with severe mental illness; persons who used mental health services but did not have severe mental illness (non-severe mental illness); and persons with no records of mental health service use.

The second step of the analysis was to provide a coherent explanation of the mechanisms through which the effect of psychiatric bed supply on jail detention works. First, the reduced-form mechanism equations, (8) and (9), were estimated using fixed effect LPM separately for the subpopulations, controlling for unobserved individual heterogeneity and adjusting standard errors for intra-cluster correlations. Predicted values for both equations were bounded within the unit interval.

Then, the structural mechanism equation (5) was estimated. Compared with the reduced-form mechanism equations, Eq. (5) includes two endogenous variables, *MHS* and *SA*, on the right-hand side of the equation. Estimating the structural equation using OLS may may bias the estimated coefficients on these endogenous varibles as well as other variables in the estimated equation. Thus, the structural *JAIL* equation was estimated using two-stage

least squares (2SLS). Specifically, in the first stage, using the estimated reduced-form parameters of the reduced-form mechanism equations, mental health service use (*MHS*) and substance abuse (*SA*) equations, the fitted values of each dependent variable were calculated. Then, the structural parameters in the *JAIL* equation were estimated by replacing the fitted values for the actual observations on the corresponding endogenous variables that appeared in the right-hand side of the equations. The 2SLS estimation process controlled for individual time-invariant unobserved heterogeneity. Although 2SLS estimators are consistent, an important pitfall is that they may be inefficient. Particularly in the presence of heteroskedasticity and clustering, the 2SLS procedure may prevent valid inference. To address this concern, standard errors were corrected for heteroskedasticity and unknown form of intra-cluster correlation.

In addition, the instrumental variable two-step generalized method of moments (IV-GMM) was employed to estimate the *JAIL* equation. The IV-GMM method uses two-step procedures (Baum, Schaffer & Stillman 2003). The first step of the two-step IV-GMM estimation is to obtain consistent residuals using the conventional instrumental variable approach, and then using the residual estimate an *optimal* weighting matrix. Using the estimated weighting matrix, the second step is to calculate consistent and *efficient* GMM estimators that asymptotically minimize the variance of GMM estimators. If the estimated equation is exactly identified, the two-step IV-GMM estimators coincide with instrumental variable estimators. However, the two-step IV-GMM estimators are more efficient if the equation is over-identified. In our application, *BED, CMH* and *MC* serve as prospective instruments in the mental health service use (*MHS*) equation and *SA EXPEND, COCAINE* and *METH* serve as prospective instruments in the substance abuse (*SA*) equation. Thus,

since the prospective instruments in the *JAIL* equation are of greater number than the endogenous variable, the two-step IV-GMM method may result in more efficient estimators than the conventional instrumental variable approach.

Since the prospective instruments can be flawed in two ways – either invalid or weak correlation with the endogenous variables, rigorous specification checks were conducted to test the strength and validity of our instruments. First, although *MHS* and *SA* are endogenous by definition, the study tested the null hypothesis that the variables *MHS* and *SA* are exogenous in the *JAIL* equation using the Durbin-Wu-Hausman (DWH) test (Durbin 1954; Wu 1973; Hausman 1978). The null was rejected in all models at the 1 percent level of significance. The *p*-values are reported in the result tables.

Second, a set of tests for the strength of the instruments in the first-stage estimation were employed. First, the individual *t*-statistic of each instrument for *MHS* and *SA* was examined. The instruments were significant at the 0.01 level except that psychiatric beds in the *MHS* equation for persons with non-severe mental illness and public substance abuse expenditures in the *SA* equation for persons with severe mental illness were significant at the 0.05 significance level (See the second and third columns in Table 7). The *weak* instrument problem may arise even when a *t*-statistic is significant at the conventional levels of significance. Following Staiger and Stock (1997), this study consider instrumental variables with the first-stage *F*-statistic less than ten as having little explanatory power. The *F*-statistic was well above ten in all models. Next, the joint significance of the instruments were checked using *F*-tests. In all models, the instruments were jointly significant. The smallest *F*-statistic of the joint significance was 20.96. Using the adjusted R^2, I tested the explanatory power of the first-stage estimation. The adjusted R^2 ranged between 0.3805 and 0.8381.

Finally, to test the null hypothesis of *weak* identification, the Anderson canonical correlations likelihood-ratio (LR) statistic was used. The LR statistic was significant at the 0.05 level for the severe-mental-illness group and at the 0.01 level for the no-evidence-of-mental-illness group. However, the LR statistic failed to reject the null hypothesis of weak identification for the non-severe-mental-illness group. Taken together, a series of tests confirm the strength of the instruments. *p*-values for the LR statistic are reported in the result tables.

Lastly, Hansen *J* test (Hansen 1982) was used for the overidentifying restrictions to evaluate the joint null hypothesis that instruments are uncorrelated with the error and thus are validly excluded from the estimated equation. This statistic is robust to heteroskedasticity and arbitrary intra-cluster correlation, and is numerically identical to the *robustified* Sargan's statistic for overidentifying restrictions in the instrumental variable estimation with heteroskedasticity-clustering robust standard errors (Baum, Schaffer & Stillman 2003). The resulting *J* statistic did not reject the overidentifying restrictions at the 1 percent level in all models. The *p*-values are shown in the result tables. The results of the first-stage regressions are reported in Tables 7.

4.4.3 Timing of the effect of a change in psychiatric beds on the likelihood of jail detention

In the simultaneous equations system, Eqs. (4) – (6), I modeled a contemporaneous relationship between psychiatric bed supply, mental health service use, substance abuse, and jail detention. However, we cannot rule out the possibility that mental health service in the current period may affect substance abuse in the subsequent period. To address this concern about a lagged effect of psychiatric bed supply on jail detention, I re-wrote Eqs. (4) through (6) and obtained the following partially-reduced-form equation, which is equivalent to Eq. (7) for contemporaneous relationships (see Appendix for derivation).

$$
\begin{aligned}
JAIL_{it} = {} & \pi_0 + \pi_1 \cdot JAIL_{it-1} + \pi_2 \cdot BED_{t-1} + \pi_3 \cdot CMH_{t-1} + \pi_4 \cdot MC_t \\
& + \pi_5 \cdot SA_{it-1} + \pi_6 \cdot SA\ EXPEND_t + \pi_7 \cdot SA\ EXPEND_{t-1} \\
& + \pi_8 \cdot COCAINE_t + \pi_9 \cdot COCAINE_{t-1} + \pi_{10} \cdot METH_t + \pi_{11} \cdot METH_{t-1} \\
& + \pi_{12} \cdot AGE_{it} + \pi_{13} \cdot AGE_{it-1} + \pi_{14} \cdot MEDICAID_{it} + \pi_{15} \cdot MEDICAID_{it-1} \\
& + \pi_{16} \cdot TREND_t + p_i + \upsilon_{it}
\end{aligned}
\qquad (10)
$$

Except the once-lagged *JAIL*, all right-hand-side variables are exogenous or predetermined. The above equation is subject to two concerns. One is that since a majority of the right-hand-side variables include both contemporaneous and once-lagged values of exogenous variables, multicollinearity may lead to large standard errors. Nevertheless, pairwise correlation coefficients between the once-lagged psychiatric beds and other right-hand-side variables ranged from 0.0028 to 0.6713. Also, first differencing, which was employed in estimation of Eq. (10), is expected to reduce the multicollinearity problem. Another, more important, aspect of Eq. (10) is that the presence of the lagged dependent variable on the right-hand side may render a biased and inconsistent OLS estimate of psychiatric beds. One way to deal with this concern is to use twice and longer lags of the dependent variables as instruments for the lagged *JAIL* variable after removing unobserved heterogeneity (p_i) using first differencing (Anderson and Hsiao 1981 & 1982). Building upon this idea, Arellano and Bond (1991) proposed more efficient GMM estimators, which is often called Arellano-Bond dynamic panel-data estimators or *difference* GMM estimators. The basic idea of the difference GMM estimation is to estimate a dynamic equation in the GMM framework using lagged levels of a dependent variable as instruments removing unobserved heterogeneity with first differences. Later, Blundell and Bond (1998) suggested more efficient *system* GMM estimation, where variables in levels are instrumented with suitable lags of their own first differences. Eq. (10) was estimated using this system GMM method to

obtain a more efficient and consistent coefficient estimate of the psychiatric bed variable[5]. Standard errors were adjusted for both heteroskedasticity and clustering.

The second through forth lags of the dependent variable were used as instruments. Since the consistency of system GMM estimators depends on whether the lagged values are valid instruments in the *JAIL* regression, two specification tests were conducted. The overall validity of the instrument was tested using the standard Sargan-Hansen test of overidentifying restrictions The Sargan-Hansen test of overidentifying restrictions did not indicate a serious problem with the validity of the instruments in all models. Also specification checks tested for first-order and second-order serial correlation in the first-differenced residuals. If the disturbances are not serially correlated in the first-differenced residuals, which is the important assumption of the system GMM method, there should be evidence of a significant negative first-order serial correlation and no evidence of second-order serial correlation. The results provided further support to the model. The estimates of psychiatric beds show that there was no lagged effect of psychiatric bed supply on jail detention for any subpopulations.

4.5 Data

4.5.1 Sample

The study population consists of individuals aged between 19 and 64 from King County, WA. The sample includes persons who ever used any of the three systems in King County for the years of 1994 to 1998: the King County jail system, the King County public mental health system, and the Washington State Medicaid program. The sample was drawn using the choice-based sampling; users of certain system combinations (e.g., jail and county

[5] Stata 9.2 was used for all computations. The GMM estimation was implemented using – xtabond2 – written by Roodman (2005).

mental health or jail and Medicaid) were oversampled (Morrissey et al. 2003). Using the combined data set, 11 half-yearly observations per person were created. We provide the reason below. The entire analytic sample included 433,423 observations on 41,236 persons. To obtain consistent estimates for the choice-based sample, Manski-Lermen weights were calculated and used in estimation to weight up to the county population level. The creation of the weights is described elsewhere (Norton et al. 2006; Domino et al. 2004).

Severe mental illness was identified using information from five data sources (see Table 4.1). The validity of a time-varying measure of severe mental illness depends on the accuracy of diagnosis by providers and recording in administrative data. In addition, a significant proportion of persons with severe mental illness may not obtain treatment in the community and thus would not be detected as having severe mental illness at any given time. To mitigate the problem, a time-invariant measure of severe mental illness was constructed. Using this information on severe mental illness and mental health service utilization records, the entire sample was separated into the three groups as described previously. The analytic sample of persons with severe mental illness included 73,360 observations on 6,829 individuals, compared to 137,272 observations on 19,192 persons with non-severe mental illness and 255,797 observations on 26,695 persons with no evidence of mental illness from these sectors.

4.5.2 Jail detention

The dependent variables of jail detention include four binary indicators of charges for jail detention such as (1) any offenses, (2) any serious offenses, (3) any minor offenses, and (4) drug violations. According to the FBI's Uniform Crime Reporting System (UCR) classification scheme, serious offenses include such legal charges as murder, rape, serious

assaults, robbery, burglary, forgery, felony theft, and felony charge of stolen property possession. Minor offenses included simple assaults, failure to appear in court, court order violations, driving violations, parole and probation violations, and drug violations. Unweighted descriptive statistics for the entire study period are provided in Table 4.2. On average, 10 percent of the observations of the entire sample had a jail detention in each six-month period. Minor offenses were the most common charges (8 percent).

4.5.3 Mental health service use and substance abuse

To examine the pathways through which a change in psychiatric beds may affect jail detention, valid outcome measures are needed for each mechanism. The study constructed binary indicators of any mental health service use in a given six-month period. Therefore, the outcome measure of mental health service use was coded as 1 if a person used at least one mental health services –either inpatient or outpatient– in a given period and 0 if not. Data on psychiatric hospital utilization came from two sources: Two Washington State psychiatric hospitals for adults (Western State Hospital and Eastern State Hospital) and Washington State hospital discharge data known as Comprehensive Hospital Abstract Reporting System (CHARS). Western State Hospital is one of two state psychiatric hospitals for adults and provides inpatient treatment for persons with severe mental illness referred through the county mental health system. The hospital serves 19 western Washington counties. Eastern State Hospital is the regional state psychiatric hospital for 22 eastern Washington counties. The CHARS data record all hospital inpatient discharge information including diagnosis and procedures in state-licensed acute care facilities. Data on publicly-funded outpatient mental health treatment were obtained from the King County community mental health system. On

average, 18 percent of the sample used either inpatient or outpatient mental health services in a six-month period.

Substance abuse was constructed as a binary time-varying measure (see Table 4.1 for definition and data sources). As with severe mental illness, information from administrative data may not be sufficient to identify substance abuse because if a person does not appear in the substance abuse treatment system during a given six-month period, the person would be considered as having no substance abuse problems even when he or she actually does. Since substance abuse is a chronic condition, the study identified the first date when an individual received substance abuse treatment and regarded the individual as having persistent substance abuse problems for the rest of the study period. Thus, the substance abuse variable is coded as 1 after the first treatment. Data from four systems were used to create the substance abuse variable: the Western State Hospital discharge data, the CHARS data, the King County outpatient mental health system, and the Treatment and Assessment Report Generation Tool (TARGET) data. The TARGET is the statewide substance abuse treatment database system and provides information on all users of substance abuse services in facilities that accept public funding. About 15 percent of the sample was identified as having substance abuse problems (see Table 4.2).

4.5.4 Psychiatric beds and other covariates

The main independent variable of interest is the number of psychiatric beds in King County per 100,000 county residents. The Census data were used to obtain estimates of the King County population at the beginning of each six-month period. The information on psychiatric beds was available from American Hospital Association (AHA)'s Annual Survey of Hospitals. The AHA Annual Survey data contain hospital characteristics that are derived

from hospital surveys and other proprietary sources. This survey has been conducted annually since 1946, and has been also widely used by researchers. Psychiatric care facilities in the survey which were used to obtain the number of psychiatric beds included public and private psychiatric hospitals and psychiatric units in general hospitals. Psychiatric and general hospitals exclusively for children were excluded. Table 4.2 shows that an average of 137 psychiatric beds per 100,000 was available in King County over the study period. The total number of psychiatric beds (including the state mental hospitals) generally decreased from 145 to 126 per 100,000 persons between 1993 and 1998 with interrupted increases in 1994 and 1997.

Since the number of psychiatric beds is available only annually, this study could create five annual observations per person. Doing so, however, would result in only four degrees of freedom for county-level variables. This means that one could include only up to four county-level variables in the right-hand side of an equation, and thus could not include a full set of controls in estimation including our prospective instruments. Therefore, up to 11 half-yearly observations per person were created assuming that the number of psychiatric beds was constant in a given year. The Result section explores possible measurement error bias which may occur by assuming constant psychiatric bed availability in a given year.

Table 4.2 also reports summary statistics for other county-level control variables. A six-month average of total public outpatient mental health visits was 673 per 100,000 persons ranging between 604 and 750. Public expenditures on substance abuse treatment were obtained using the TARGET data. Only publicly-funded services were included because the substance abuse expenditures variable would not be exogenous if services paid by private sources drove an increase in total expenditures on substance abuse treatments. A six-month

average of public expenditures on substance abuse treatment for King County residents was $508,000.

King County started public outpatient managed mental health care on 1 April 1995. The implementation of managed care may change utilization patterns of outpatient mental health services among county outpatient mental health service users (Domino et al. 2004). So, county-level covariates for the mental health service equation includes the dummy variable *MC* which takes the value of 1 for the period during which King County outpatient managed mental health care was implemented.

Heroine and methamphetamine prices came from published data (Abt Associates 2001). In the report to the Office of National Drug Policy, Abt Associates estimated retail prices of illicit drugs per pure gram from 1981 through 2000 based on the System to Retrieve Information from Drug Evidence (STRIDE) data maintained by the Drug Enforcement Administration of the U.S. Department of Justice. Retail prices varied across regions and purity, but the trend in price changes were similar from region to region during our study period. Since retail prices varied by purity, I selected prices of lowest-quality drugs (100 pure grams), which can be obtained at the lowest prices. This study uses annual retail prices in the pacific region which includes King County. The average prices for cocaine and methephatemine were $31 and $34, respectively.

Finally, summary statistics for sample individuals show that 62 percent of the sample was on Medicaid at a give time period, the average age was 35, and 48 percent were women. The majority of the sample was white, followed by blacks and Asians.

4.6 Results

4.6.1 Fixed-effect LPM for the main equation: Total effect of psychiatric bed supply on the likelihood of jail detention

The reduced-form estimation results in Tables 4.3 and 4.4 provide evidence of the relevance between the availability of psychiatric beds and jail detention. Specifically, the findings show a strong, significant, negative relationship between the number of psychiatric beds and an individual's likelihood of jail detention for all subpopulations (see Table 4.3). For example, a one-bed decrease in psychiatric beds per 100,000 persons was associated with about 0.01 percentage point increase in the likelihood of jail detention for the entire population during a six-month period. The magnitude of the effect was largest for persons with severe mental illness (0.03 percentage points). Jail detention of persons with non-severe mental illness was also affected by a decrease in psychiatric beds (0.01 percentage point). Interestingly, although the effect was relatively small compared with the other subpopulations, jail detention of persons with no evidence of mental illness was also found to be adversely affected by a decreased availability of psychiatric beds (0.008 percentage points).

A comparison across different charges for jail detention shows that a decrease in psychiatric beds did not affect an individual likelihood of jail detention for serious charges for any subpopulations (see Table 4.4). The effect was via only an increase in minor offenses. The likelihood of jail detention for drug violations was negatively associated with the number of psychiatric beds only for persons with severe mental illness.

Results on other covariates are of interest as well. The total number of public outpatient mental health visits had a negative and significant effect on an individual's likelihood of jail detention for persons with severe mental illness (see Table 4.3). The estimate indicates that if the public mental health system increases the number of outpatient visits by a thousand per 100,000 persons during a six-month period (approximately 7%

increase), a six-month likelihood of jail detention would decrease by about 5 percentage points among persons with severe mental illness. However, there was no effect of public mental health visits for the other subsamples. Public managed care was found to increase the likelihood of jail detention for all subpopulations, consistent with results reported elsewhere (Domino et al., 2004). As with psychiatric bed supply, it had no effect on the probability of jail detention for serious offenses, but the effect on jail detention for minor offenses was large. For example, public managed care was associated with about 0.6 percentage point increase in the likelihood of jail detention for any charges among persons with severe mental illness. It also affected jail detention for drug violations among persons with either severe or non-severe mental illness (results are available upon request). There was an inverse relationship between retail prices of illicit drugs and the likelihood of jail detention. The effect of age varied across severity of mental illness. It was positively correlated with jail detention probability for persons with severe mental illness, but was negatively correlated for persons with non-severe mental illness. Holding other things fixed, having Medicaid coverage was not associated with the likelihood of jail detention.

4.6.2 Further analyses of the main equation

Due to the limitation that the number of psychiatric beds was available only annually, I assumed that the supply of psychiatric beds was fixed in a given fiscal year. Thus, there is the possibility that the number of psychiatric beds was measured with error. It is well-known that classical measurement errors always attenuate estimates toward zero. Particularly in fixed-effects models, the attenuation bias due to measurement error is further exacerbated because including fixed effects may decrease the variation in psychiatric beds and the attenuation is greater the less variation in psychiatric beds is used in estimation. To address

this concern, the models in Table 4.3 were re-estimated using OLS on pooled data (see Table 4.5). Estimates of pooled OLS may be less subject to measurement error, but are more likely to suffer from omitted variable bias than fixed-effect OLS estimates. Nevertheless, the estimate of psychiatric beds, which is a system-level variable, should not be substantially affected by individual unobserved heterogeneity. Results from pooled OLS were consistent with the main results, but the magnitude of the effect of psychiatric beds reduced by approximately a half. Measurement error in psychiatric beds was further explored using annual data, which had up to five observations per person between 1994 and 1998. Since an estimation can control for at most four county-level variables, only four county-level variables were included which were significant in our main results – the number of psychiatric beds, the total number of public outpatient mental health visits, public managed care, and the linear time trend. For a comparison with annual data estimates, the main models were re-estimated controlling for the same covariates as the annual data analysis. Estimates of these two regressions may be biased. However, comparing signs and significance of estimates between theses two models can be served as a proxy for the severity of measurement error. The estimates of psychiatric beds from the annual data analysis were not significant for any of the subpopulations. Compared to the estimates from annual data, estimates of the models, which used half-year data but controlled for the same covariates as the annual data, were significant only for persons with severe mental illness at the 0.05 level and were smaller in magnitude. In addition, the AHA data show that the changes in psychiatric beds in King County were mostly due to closure or opening of psychiatric beds. Taken together, it is supported that the main estimates of psychiatric beds do not suffer from measurement error bias seriously.

In addition, a linear functional form may not be a correct assumption. This concern was addressed by comparing probit estimates on pooled data with the main results. Although probit estimates do not control for unobserved heterogeneity and thus may suffer from omitted variable bias, the estimate of psychiatric beds, by the same argument for pooled OLS, should not substantially affected by individual heterogeneity. The results were qualitatively the same between fixed-effects OLS and pooled probit in terms of the sign, significance, and magnitude of the estimates of psychiatric beds and other covariates. This result reassures that potential measurement error and specification error due to the assumption of a linear functional form should not be a major concern in our application.

Two additional analyses were conducted to test a possible model misspecification of the reduced-form equations. Length of stay in psychiatric hospitals has sometimes been suggested as a factor affecting continuity of care and subsequent mental health among persons with severe mental illness (Lieberman et al. 1998). Thus, as with psychiatric bed supply, a decrease in length of hospital stay might affect jail detention among persons with severe mental illness. When the main reduced-form equations were re-estimated controlling for average hospital days in each period, a similar result for persons with severe mental illness was found. The estimate of psychiatric beds for persons with non-severe mental illness was also similar to our main result but was insignificant. The length of stay variable was insignificant in all models. Since substance abuse has often been suggested as a strong predictor of jail detention among persons with severe mental illness, the main equations were re-estimated including substance abuse as a covariate. Since substance abuse is endogenous, the IV-GMM estimation technique was employed using public substance abuse expenditures and retail prices of cocaine and methamphetamine as instruments. In all models, the

Anderson canonical correlations likelihood-ratio (LR) statistic was significant at the 0.01 levels, and Hansen *J* statistic was insignificant ranging from 0.1430 to 0.6934. The estimates are almost the same as the main estimates. In sum, the estimates from the main equations are fairly robust to different specification.

Finally, since persons with severe mental illness were most likely to be affected, the study also examined six sub-groups of persons with severe mental illness (see Table 4.6). The results identify black women with severe mental illness as the most vulnerable groups of persons in terms of jail detention at the time of decrease in psychiatric bed availability. The estimates show that a one-bed decrease per 100,000 persons would increase the six-month probability of jail detention by 0.1 percentage point for black women. Interestingly, increased outpatient visits served by the public mental health system reduce jail detention probability only for whites.

4.6.3 Mechanism equations: Effect of psychiatric bed supply on mental health service and substance abuse & effect of mental health service use and substance abuse on jail detention

We now turn to estimations from the pathway models. Our reduced-form results in Table 4.7 indicate that a decrease in psychiatric beds increased the likelihood of mental health service use among persons with either severe or non-severe mental illness. There was a larger effect for those with severe mental illness. A one-bed decrease was associated with a 0.06 percentage point increase in mental health services use for persons with severe mental illness. However, there was strong, negative relationship between psychiatric bed supply and substance abuse treatment receipt for all subpopulations. Importantly, the effect on substance abuse was larger than the effect on the increase in mental health service use. A one-bed

decrease was found to increase substance abuse by about 0.16 percentage points for persons with severe mental illness.

An increase in total outpatient visits served by the public mental health system did not change mental health service use and substance abuse. However, public managed care was found to increase mental health service use and substance abuse for all subpopulations. Interestingly, public expenditures on substance abuse treatment were negatively associated with substance abuse for the subpopulations. The largest effect was found for persons with severe mental illness. There was negative relationship between illicit drug prices and substance abuse. Having Medicaid coverage was found to decrease substance abuse for persons with severe mental illness and those with no evidence of mental illness.

Table 4.8 reports estimates of 2SLS and IV-GMM for the structural *JAIL* equation. The two different estimation techniques yielded almost identical results. Mental health service use had no direct effect on jail detention. In contrast, substance abuse directly affected the likelihood of jail detention for all subpopulations, and the magnitude of the effect was quantitatively large. Substance abuse had the largest effect on jail detention for persons with severe mental illness. Both 2SLS and IV-GMM estimates show that having substance abuse problems increased the likelihood of jail detention by 17 percentage points for persons with severe mental illness. A relatively small but still larger effect was found for the other subsamples. Being on Medicaid was positively associated with jail detention for persons with severe mental illness or no evidence of mental illness. For persons with non-severe mental illness, having Medicaid was negatively correlated with the likelihood of jail detention.

4.6.4 Further analyses of the mechanism equations

Since patterns of mental health service use are expected to be different depending on severity of mental illness, this study further analyzed the effect of psychiatric bed supply on mental health service use separately for inpatient and outpatient mental health services between persons with severe mental illness and non-severe mental illness. The results show that a decrease in psychiatric beds did not affect the likelihood of inpatient service receipt, but increased the use of public outpatient mental health system (see Table 4.9). Persons with severe mental illness were more likely to use the outpatient mental health services than persons with non-severe mental illness due to decreased psychiatric bed supply.

In addition, the reduced-form mechanism equations were estimated separately for each subgroup of persons with severe mental illness (see Table 4.10). A decrease in psychiatric beds increased mental health services only among whites. There was a negative effect of psychiatric beds on substance abuse in all subgroups. This inverse relationship between psychiatric bed supply and substance abuse was the largest for black women with severe mental illness.

Finally, this study tested whether the main results are robust to a different definition of substance abuse. In this paper, a person is considered as having a persistent substance abuse disorder once after the person received substance abuse treatment. However, this definition of substance abuse may overstate the prevalence of substance abuse in the population. Thus, this study tested the robustness of the definition by considering a person as having substance abuse only for periods when the person used substance abuse services. The coefficient estimates of psychiatric beds were slightly smaller, but did not change the implication of our main results ($p < .01$) (results are available upon request).

4.7 Conclusion

This study provides evidence about the effect of the supply of psychiatric beds on a severely mentally ill individual's likelihood of jail detention as well as on the mechanisms that link the supply of psychiatric beds at the system level and the likelihood of jail detention at the individual level. The results suggest that as posited, persons with severe mental illness are the most likely to be influenced by a change in psychiatric bed availability. This research estimated that a one-bed decrease per 100,000 persons would increase the probability of jail detention by 0.03 percentage points for a six-month period among persons with severe mental illness.

The findings also suggest that decreased availability of psychiatric beds would increase jail detention among persons with non-severe mental illness although the effect was smaller than the effect for persons with severe mental illness. Even those with no evidence of mental illness were found to be adversely affected, which might cast some suspicion on our findings in general. However, the finding for persons with no evidence of mental illness is reasonable because as researchers have observed, many persons with severe mental illness may not receive adequate levels of treatment or remain untreated or diagnosed in the community when public mental health resources are insufficient (Lamb, Weinberger and Gross 2004). In addition, although I found that the adverse effect of psychiatric bed supply was relatively small for persons with no evidence of mental illness, the overall negative effect might be substantially larger than the other subpopulations because it is expected that persons with severe mental illness comprises only a small proportion of persons who do not use any mental health services. Unfortunately, an examination of the effect on those who have severe mental illness but remain untreated in the community is beyond the scope of the present study. Considering its implication for policy, future research should explore this issue.

The results from the mechanism equations suggest that the adverse effects of reduced psychiatric beds occurred because a decrease in psychiatric bed supply increased substance abuse possibly via insufficient community mental health resources. It appears that a decrease in psychiatric beds increased mental health service use among persons with mental illness. Nonetheless, the results indicate that a change in psychiatric bed supply had a significantly larger effect on substance abuse than on an increase in mental health treatment. A reasonable interpretation is that although community mental health service use increased as a result of decreased psychiatric bed supply, community mental health resources might be insufficient to meet treatment need of an increased volume of persons with mental illness in the community. This is because as much as the public outpatient mental health system meets treatment need of mentally ill persons in the community, I should not find an increase in substance abuse and subsequent jail detention. In addition, the data used for this study show that among persons with severe mental illness in King County, the total number of non-public psychiatric hospital admissions constantly decreased from about 79 in 1994 to 57 per 100,000 persons in 1998. During the same period, the annual total visits served by the county mental health system also decreased from 30,424 to 29,842 per 100,000 persons. A reasonable interpretation of these trends is that the increased likelihood of jail detention was due to insufficient public outpatient mental health resources relative to the increasing pool of persons suffering from adverse psychiatric symptoms in the community.

Black women with severe mental illness were identified as a group of persons who would be the most likely to be adversely affected by a decreased supply of inpatient mental health services. A plausible explanation of this result is that black women with severe mental illness are underserved by the public mental health system. Subsequently, lack of mental

health service use may lead to substance abuse and jail detention. The findings of this study provide evidence to support this interpretation. First, the availability of the public outpatient mental health resources was found to reduce the likelihood of jail detention among persons with severe mental illness, but only among whites with severe mental illness. Second, reduced psychiatric bed supply was found to increase the use of the public outpatient mental health system among mentally ill persons in the community, but again only among whites with mental illness. Third, consistent with national research that has shown racial differences in the use of mental health services (Wang et al. 2005; Kessler et al. 1994; Leaf et al. 1988), the data used for this study indicate that black women with severe mental illness are less likely than white women with severe mental illness to use the public mental health system. The administrative data for this research revealed that a rate of diagnosis by the data systems considered here was approximately 8.6 percent for black women with severe mental illness, slightly larger than 7.5 percent for white women with severe mental illness. However, over the study period, overall about 55 percent of black women with severe mental illness used the public mental health system in a six-month period, compared with about 58 percent for white women with severe mental illness. This finding on disproportionate use of mental health services between blacks and whites could be explained by a recent study which explored racial differences in attitudes toward seeking psychiatric treatment. Using the National Comorbidity Survey, Diala and colleagues (2000) found that African American's attitudes toward seeking mental health services were comparable to those of whites prior to their actual use of services. African Americans sometimes displayed more positive attitudes than did whites toward seeking psychiatric treatment. However, negative attitudes were found to be more common among African Americans once after they use mental health services.

Subsequently, African Americans who received psychiatric services were less likely to seek psychiatric treatment than whites with comparable needs.

The data for this study also reveal that in contrast to the difference in mental health service use between the two racial groups, black women with severe mental illness were more likely than white women with severe mental illness to have comorbid substance abuse problems and use jail. A six-month prevalence of substance abuse was approximately 9 percent for black women with severe mental illness, higher than white women with severe mental illness by 2 percentage points. A six-month probability of jail detention was 3 percent for black women with severe mental illness, compared with only 1 percent for white women with severe mental illness. Taken together, the findings listed above call for special attention to black women with severe mental illness.

Interestingly, the estimates of this study suggest that if the number of outpatient visits served by the public mental health system increases by 1,000 per 100,000 persons, an individual's likelihood of jail detention would decrease by 5 percentage point in a six-month period among persons with severe mental illness. This finding implies that other things unchanged, a growth in community mental health programs may offset an adverse effect that a decrease in psychiatric beds would have on jail detention for persons with severe mental illness. This result is consistent with Study 2 of this dissertation which found a negative relationship between public expenditures on community mental health programs and the number of jail inmates using data from 50 states and Washington, D.C. for the years 1982 – 1998. However, a 2000 study from Massachusetts contradicts this finding. Fisher and colleagues (2000) compared the prevalence of severe mental illness between western and central Massachusetts jails in 1996. These two areas are contrasted to each other. Western

Massachusetts (Hampton County) closed a state hospital in 1993 and developed a comprehensive array of community programs such as community-based outpatient mental health services, case management, emergency respite, and mobile crisis. In contrast, central Massachusetts (Worcester County) has experienced a slow growth of community services. Based on descriptive data on the prevalence of severe mental illness in local jails in the two areas, they concluded that even nation's highest level of community mental health services did not decrease the proportion of severely mentally ill offenders in jail. However, their findings may be flawed because they failed to consider other factors such as the availability of inpatient psychiatric services that may confound the relationship between the amount of community mental health resources and jail detention by persons with severe mental illness. It is also possible that the closure of the state psychiatric hospital in western Massachusetts had a larger impact on that area than on central Massachusetts. Therefore, based on the present and earlier findings, an expansion of public outpatient mental health programs may offset the effects of the lower level of institutional care.

There is continuing enthusiasm for community treatment of persons with severe mental illness. The Supreme Court's 1999 Olmstead decision ruled that it is a violation of the American with Disabilities Act to treat persons with cognitive impairment in institutional settings when they could be served equally or more effectively in community-based settings. The Olmstead decision may result in a further increase in the number of persons with severe mental illness in the community. Although this research found that increased community outpatient mental health resources would decrease a contact with the criminal justice system by persons with severe mental illness, I do not know to what extent inpatient and outpatient mental health services could substitute each other, in particular for a subgroup of difficult

persons who may need highly-structured care. Some have argued that community-based treatment may not inherently address their need in the absence of some level of structure (Lamb and Weinberger 2006), and thus the development of community-based and alternative inpatient settings is needed to meet the need of the subgroup (Fisher et al. 1996). Thus, to increase opportunities for successful community integration of persons with severe mental illness, future research should explore a balance between inpatient and outpatient service provisions.

In addition to our main results, this study also found evidence that a change in financing of public outpatient mental health services would have impacts on mental health service use, substance abuse, and jail detention. In particular, the finding on the negative relationship between public managed care and jail detention among persons with severe mental illness is consistent with results from a prior study that used the same data (Domino et al. 2004). The results on substance abuse indicate that substance abuse significantly increases the likelihood of jail detention. In particular, comorbid mental health and substance abuse would have a substantial effect on jail detention. However, since an increase in public expenditures on substance abuse treatment was found to decrease substance abuse in the population, efforts to increase public funding for substance abuse treatment may be an effective means by which to reduce jail detention among persons with mental illness. Finally, as theories and previous empirical evidence suggest, substance abusers were found to be responsive to price changes of illicit drugs. In sum, these additional findings emphasize the within- and cross-system impacts of both financing and delivery of mental health services. Also, our findings indicate that effective community integration of persons with severe mental illness entails close collaboration among different sub-systems of a community

including the inpatient mental health system, the outpatient mental health system, the substance abuse treatment system, and the criminal justice system.

In interpreting the findings of this research, several limitations deserve comments. First, this study could not explore whether different hospital types have different effects. The first two studies of this dissertation have emphasized the importance of hospital characteristics as a factor that affects criminal justice outcomes. For example, using 17-year state-level longitudinal data, these studies found that the supply of *public* psychiatric hospital beds was negatively associated with crime, arrests, and jail detention in the community. In contrast, an increase in *private* psychiatric hospital beds was suggested to increase the criminal justice outcomes. Unfortunately, in King County, there was one state mental hospital and one private psychiatric hospital during our study period, and there was no much variation in the number of psychiatric beds in these facilities over time.

Second, this study could not examine one important mechanism: the link between mental health service use and use of substances. Nevertheless, this does not influence the implications of the findings reported here since this study was able in an alternative way to explore the impact of psychiatric bed supply on mental health service use, substance abuse, and jail detention as well as the direct effect of mental health service use and substance abuse on jail detention. The gap in this study could be addressed by prior studies which found an inverse relationship between lack of mental health treatment and subsequent use of substances (Harris and Edlund 2005).

Third, this study used data from administrative databases, and therefore suffers from inherent limitations in observational studies; for example, the data used in this study could not observe persons with severe mental illness who did not received any mental health

treatment or used mental health services outside of the systems used to identify severe mental illness in this study. Thus, the validity of our measure of severe mental illness is not known. However, the data for this study provide only source of information that could explore the study questions raised in the present paper. In addition, this study addressed the limitation in several creative ways such as the creation of time-invariant measure of severe mental illness and the inclusion of persons with no evidence of mental illness in analyses.

Fourth, the data for this study do not have any direct measures of *social capital*. This limitation was partly addressed by including social resources such as the availability of public outpatient mental health resources and public funding support for substance abuse treatment as well as the linear time trends. As long as social capital in King County gradually (linearly) decreased or increased over the study period, the linear time trends are expected to explain unobserved changes in social capital. However, the linear time trends may not be sufficient to explain changes in social capital, in particular non-linear changes in an individual's perceived level of social support. Future studies should seek out more detailed examination of interactions among the supply of psychiatric beds, social capital, and the likelihood of contacts with the criminal justice system among persons with severe mental illness.

Finally, the results of this study may pertain only to the study site, King County, Washington. Situations vary across different regions. For example, a decrease in psychiatric beds may have a different implication between an area with relatively abundant public mental health and community support resources and another area with relatively scarce resources. An availability of more mental health resources, such as assertive community

treatment, may increase the number of persons who have a favorable outcome in the community. Therefore, the findings presented here should be generalized with caution.

REFERENCES

Abramson, M.F. 1972. "The criminalization of mentally disordered behavior: possible side-effect of a new mental health law." *Hospital and Community Psychiatry* 23 (4):101-5.

Abt Associates. 2001. "The Price of Illicit Drugs: 1981 through the Second Quarter of 2000." Office of National Drug Control Policy. NJC 190636.

American Hospital Association (AHA). 1995. "1994 Annual Survey of Hospitals Data Base Documentation Manual". Chicago, Ill: American Hospital Association.

American Hospital Association (AHA). AHA Annual Survey of Hospitals: 1982-1998. Chicago, Ill: American Hospital Association.

Anderson, T.W., and C. Hsiao. 1981. "Estimation of Dynamic Models with Error Components." *Journal of the American Statistical Association* 76:598-606.

Anderson, T.W., and C. Hsiao. 1982. "Formulation and Estimation of Dynamic Models Using Panel Data." *Journal of Econometrics* 18:47-82.

Arellano, M., and S. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies* 58:277-97.

Axelson, G.L., and O.F. Wahl. 1992. "Psychotic vs. non-psychotic misdemeanants in a large county jail: An analysis of pre-trial treatment by the legal system." *International Journal of Law & Psychiatry* 15:379-386.

Baum, C.F., M.E. Schaffer, and S. Stillman. 2003. "Instrumental Variables and GMM: Estimation and Testing." *Stata Journal* 3(1):1-31.

Becker, G.S., M. Grossman, and K.M. Murphy. 1991. "Rational Addiction and the Effect of Price on Consumption." *American Economic Review* 81(2):237-41.

Becker, G.S., and C.B. Mulligan. 1997. "The Endogenous Determinatin of Time Preference." *The Quarterly Journal of Economics* 112(3):729-58.

Becker, G.S. and K.M. Murphy. 1988. "A Theory of Rational Addiction" *The Journal of Political Economy* 96(4):675-700.

Blundell, R.W., and S.R. Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87:115-43.

Bollen, K.A., D.K. Guilkey, and T.A. Mroz. 1995. "Binary Outcomes and Endogenous Explanatory Variables: Tests and Solutions With an Application to the Demand for Contraceptive Use in Tunisia." *Demography* 1995:32(1):111-131.

Bureau of Justice Assistance. "Mental Health Courts: National Snapshot." Access on Mar. 03, 2007. Accessed at http://www.ojp.usdoj.gov/BJA/pdf/MHC_National_Snapshot.pdf.

Bureau of Justice Statistics (BJS). 2005. "Jail Statistics." Access at http://www.ojp.usdoj.gov/bjs/jails.htm. Accessed on May 05, 2007.

Bureau of Justice Statistics (BJS). 2007. "Key Facts at a Glance: Correctional Populations." Access at http://www.ojp.usdoj.gov/bjs/glance/tables/corr2tab.htm. Accessed on March 05, 2007.

Diala, C., C. Muntaner, C. Walrath, K.J. Nickerson, T.A. LaVeist, and P.J. Leaf. 2000. "Racial Differences in Attitudes Toward Professional Mental Health Care and in the Use of Services." *American Journal of Orthopsychiatry* 70(4):455-64.

Ditton, P.M. 1999. "Mental Health Treatment of Inmates and Probationers." Washington DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics.

Domino, M.E., E.C. Norton, J.P. Morrissey, and N. Thakur. 2004. "Cost Shifting to Jails after a Change to Managed Mental Health Care." *Health Services Research* 39 (5):1379-1402.

Durbin, J. 1954. "Errors in Variables." *Review of the International Statistical Institute* 22:23-32.

Fisher, W.H., I.K. Packer, L.J. Simon, and D. Smith. 2000. "Community Mental Health Services and the Prevalence of Severe Mental Illness in Local Jails: Are They Related." *Administration and Policy in Mental Health* 27 (6):371-82.

Fisher, W.H., L. Simon, J.L. Geller, et al. 1996. "Case Mix in the Downsizing State Hospital." *Psychiatric Services* 42:255-62.

Frank, R.G., H.H. Goldman and M. Hogan. 2003. "Medicaid and Mental Health: Be Careful What You Ask For." Health Affairs 22(1):101-13.

Frank, R.G., and T.G. McGuire. 2000. "Economics and Mental Health." In Culyer, A.J. and Newhouse, J.P. (eds.), *Handbook of Health Economics*, Vol. 1B. Elsevier, Amsterdam.

Guilkey, D.K., T.A. Mroz, and L. Taylor. 1992. "Estimation and Testing in Simultaneous Equations Models with Discrete Outcomes Using Cross Section Data." Working Paper, The University of North Carolina at Chapel Hill.

Grob, G.N. 1994. "The Mad Among Us: A History Of The Care Of America's Mentally Ill." New York: Free Press.

Grossman, M. 1972. "On the Concept of Health Capital and the Demand for Health." *The Journal of Political Economy* 80(2):223-255.

Grossman, M. 2004. "Individual Behaviors and Substance Use: The Role of Price." NBER, Working Paper 10948.

Grossman, M. and F.J. Chaloupka. 1998. "The Demand for Cocaine by Young Adults: A Rational Addiction Approach." *Journal of Health Economics* 17(4):427-74.

Grossman, M., F.J. Chaloupka, and I. Sirtalan. 1998. "An Empirical Analysis of Alcohol Addiction: Results from the Monitoring the Future Panels." *Economic Inquiry* 36(1):39-48.

Harris, K.M., and M.J. Edlund. 2005. "Self-Medication of Mental Health Problems: New Evidence from a National Survey." *Health Services Research* 40 (1):117-34.

Hausman, J. 1978. "Specification Tests in Econometrics." *Econometrica* 46(3)1251-71.

Hayashi, F. 2000. "Econometrics." 1st ed. Princeton, NJ: Princeton University Press.

Hansen, L. 1982. "Large Sample Properties of Generalized Method of moments Estimators." *Econometrica* 50(3):1029-54.

Kessler, R., K.A. McGonagle, S. Zhao, C. Nelson, M. Hughes, S. Eshleman, H.U. Wittchen, and K.S. Kendler. 1994. "Lifetime and 12-Month Prevalence of DSM-III-R Psychiatric Disorders in the US: Results from the National Comorbidity Survey." *Archives of General Psychiatry* 51:8-19.

Lamb, H.R., and R.W. Grant. 1982. "The Mentally Ill in an Urban County Jail." *Archives of General Psychiatry* 39:17-22.

Lamb, H.R., and L.E. Weinberger. 2005. "The Shift of Psychiatric Inpatient Care From Hospitals to Jails and Prisons." *J Am Acad Psychiatry Law* 33:529-34.

Lamb, H.R., and L.E. Weinberger. 1998. "Persons With Severe Mental Illness in Jails and Prisons: A Review." *Psychiatric Services* 49:483-92.

Lamb, H.R., L.E. Weinberger, and B.H. Gross. 2004. "Mentally Ill Persons in the Criminal Justice System: Some Perspectives." *Psychiatric Quarterly* 75 (2):107-26.

Lamberti, J.S., and R.L. Weisman. 2004. "Persons with severe mental disorders in the criminal justice system: challenges and opportunities." *Psychiatric Quarterly* 75:151–164.

Leaf, P.J., M.L. Bruce, G.L. Tischler, D.H. Freeman, M.M. Weissman, and J.K. Myers. 1988. "Factors Affecting the Utilization of Specialty and General Medical Mental Health Services." *Medical Care* 26:9-26.

Levitt, S. 2001. "Alternative Strategies for Identifying the Link Between Unemployment and Crime." *Journal of Quantitative Criminology* 17(4):377-90.

Lieberman, P.B., S.A. Wiitala, B. Elliott, S. McCormick, S.B. and Coyette. 1998. "Decreasing Length of Stay: Are There Effects on Outcomes of Psychiatric Hospitalization?" *American Journal of Psychiatry* 155:905-9.

Lovell, D, G.J., Gagliardi, and P.D. Perterson. 2002. "Recidivism and Use of Services Among Persons With Mental Illness After Release From Prison." *Psychiatric Services* 53 (10):1290-6.

Lutterman, T. and M. Hogan. 2004. "State Mental Health Agency Controlled Expenditures and Revenues for Mental Health Services, FY 1981 to FY 1997." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Maddala, G.S. 1983. "Limited Dependent and Qualitative Variables in Econometrics." New York: Cambridge University Press.

Mandersheid, R.W., J.E. Atay, A. Male, B. Blacklow, C. Forest, L. Lngram et al. 2004. "Highlights of Organized Mental Health Services in 2000 and Major National and State Trends." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2002*. Washington, D.C.: U.S. Government Printing Office.

Markowitz, F.E. 2006. "Psychiatric Hospital Capacity, Homelessness, and Crime and Arrest Rates." Criminology 44 (1) 45-72.

McFarland B.H., L.R. Faulkner, J.D. Bloom, R. Hallaux, and J.D. Bray. 1989. "Chronic Mental Illness and the Criminal Justice System." *Hospital and Community Psychiatry* 40 (7):718-23.

McNiel, D.E., R.L. Binder, and J.C. Robinson. 2005. "Incarceration Associated With Homeless, Mental Disorder, and Co-Occurring Substance Abuse." *Psychiatric Service* 56:840-6.

Mechanic, D., and D.A. Rochefort. 1990. "Deinstitutionalization: An Appraisal of Reform. *Annu. Rev Sociol* 16:301-27

Morrissey, J.P. 1989. "The Changing Role of the Public Mental Hospital." in *Handbook on Mental Health Policy in the United States*, Ed. Rochefort, Westport, Conn.: Greenwood.

Morrissey, J.P., N. Thakur, H.J. Steadman, and J. Preisser. 2003. "The Impact of Managed Care on the Use of Jails, Mental Health Services, and Medicaid: A Population-Based Perspective." Working Paper, UNC – Chapel Hill.

Morrissey, J.P., H.J. Steadman, M.D. Kathleen, A. Cuellar, P. Stiles, and G.S. Cuddeback. 2004. "Medicaid Enrollment and Mental Health Service Use Following Release of Jail Detainees With Severe Mental Illness." *Psychiatric Services* 57:809-15.

National Association of State Mental Health Program Directors Research Institute, Inc (NRI). 2006. "State psychiatric hospitals:2006." NASMHPD Research Institute, Inc, Alexandria, VA. Pub. No. 06-4.

National Association of State Mental Health Program Directors Research Institute, Inc (NRI). 2006. "State Profile Highlights: FY 2004 Revenue and Expenditure Study Results." NASMHPD Research Institute, Inc, Alexandria, VA. Pub. No. 06-01.

New Freedom Commission on Mental Health. 2003. "Achieving the Promise: Transforming Mental Health Care in America: Final Report." DHHS Pub. No. SMA-03-3832. Rockville, MD.

Norton, E.C., J. Yoon, M.E. Domino, and J.P. Morrissey. 2006. "Transitions between the Public Mental Health System and Jail for Persons with Severe Mental Illness: A Markov Analysis." *Health Economics* 15(7):719-733.

Paldam, M. 2000. "Social Capital: One or Many? Definition and Measurement." *Journal of Economic Survey* 14(5):629-53.

Palermo, G.B., M.B. Smith, and F.J. Liska. 1991. "Jails Versus Mental Hospitals: A Social Dilemma." International Journal of Offender Therapy and Comparative Criminology 35:97-106.

Penrose, L.S. 1939. "Mental Disease and Crime: Outline of a Comparative Study of European Statistics." *British Journal of Medical Psychology* 18:1-15.

Phillips, S.D., B.J. Burns, E.R. Edgar, et al. 2001. "Moving Assertive Community Treatment into Standard Practice." *Psychiatric Services* 52:771-9.

Pristach, C.A., and C.M. Smith. 1996. "Self-Reported Effects of Alcohol Use on Symptoms of Schizophrenia." *Psychiatr Services* 47:421-3.

Raphael, S. 2000. "The Deinstitutionalization and the Mentally Ill and Growth in the U.S. Prison Population: 1971 to 1996." Unpublished manuscript. University of California, Berkely, CA.

Roodman, D. 2005. "xtabond2: Stata Module to Extend xtabond Dynamic Panel Data Estimator." Center for Global Development, Washington D.C., http://exonpapers.repec.org/software/bocbocode/s435901.htm.

Sargan, J. 1958. "The Estimation of Econometric Relationships Using Instrumental Variables." *Econometrica* 26(3):393-415.

Silver, E. 2006. "Understanding the Relationship Between Mental Disorder and Violence: The Need for a Criminological Perspective." *Law and Human Behavior* 30(6):685-706.

Silver, E., E.P. Mulvey, and J.W. Swanson. 2002. "Neighborhood Structural Characteristics and Mental Disorder: Faris and Dunham Revisited." *Social Science & Medicine* 55:1457-70.

Silver, E., and B. Teasdale. 2005. "Mental Disorder and Violence: An Examination of Stressful Life Events and Impaired Social Support." *Social Problems* 52(1):62-78.

Sosowsky, L. 1980. "Explaining the Increased Arrest Rate Among Mental Patients: A Cautionary Note." *American Journal of Psychiatry* 137:1602-05.

Staiger, D., and J.H. Stock. 1997. "Instrumental Variables Regression With Weak Instruments." *Econometrica* 65(3):557-86.

Steadman, H.J., D.W. McCarty, and J.P. Morrissey. 1989. "The Mentally Ill in Jail: Planning for Essential Services." New York: Guildford Publications.

Steadman, H.J., J. Monahan, B. Duffee, E. Hartstone, and P.C. Robbins. 1984. "The Impact of State Mental Hospital Deinstitutionalization on United State Prison Populations, 1968-1978." *The Journal of Criminal Law and Criminology* 75 (2):474-90.

Steadman, H.J., D. Vanderwyst, and S. Ribner, 1978. "Comparing Arrest Rates of Mental Patients and Criminal Offenders." *American Journal of Psychiatry* 135 (10):1218-20.

Stein, L.I., and M.A. Test. 1980. "An Alternative to Mental Health Treatment: A Conceptual Model." *Archives of General Psychiatry* 37:392-7.

Swanson, J.W., M.S. Swartz, R. Borum, V.A. Hiday, H.R. Wagner, and B.J. Burns. 2000. "Involuntary Out-Patient Commitment and Reduction of Violent Behavior in Persons With Severe Mental Illness." *British Journal of Psychiatry* 176:324-31.

Teplin, L.A. 1990. "The prevalence of severe mental disorder among male urban jail detainees: comparison with the Epidemiologic Catchment Area Program." *American Journal of Public Health* 80(6):663-9.

Teplin, L.A. 1984. "Criminalizing Mental Disorder: The Comparative Arrest Rate of the Mentally Ill." *American Psychologist* 39:794-803.

Teplin, L.A. 1983. "The Criminalization of the Mentally Ill: Speculation in Search of Data." *Psychological Bulletin* 94:54-67.

Torrey, E.F. 1995. "Jails and Prisons – America's New Mental Hospitals." *American Journal of Public Health* 85:1611-3.

U.S. Dept. of Justice, Bureau of Justice Statistics (BJS). 1985. "Annual Survey of Jails, Jurisdiction-Level and Jail-Level Data, 1985 [Computer File]. ICPSR version. "Washington, DC: U.S. Department of Commerce, Bureau of the Census [Producer], 1986. Ann Arbor, MI: Inter-University Consortium for Political and Social Research [Distributor], 2001.

Valdiserri, E.V., K.R. Carroll, and A.J. Hartl. 1986. "A Study of Offenses Committed by Psychotic Inmates in a County Jail." *Hospital and Community Psychiatry* 37 (2):163-6.

Wang, P.S., M. Lane, M. Olfson, H.A. Pincus, K.B. Wells, and R.C. Kessler. 2005. "Twelve-Month Use of Mental Health Services in the United States." *Arch Gen Psychiatry* 62:629-40.

Whitmer, G.E. 1980. "From Hospitals to Jails: The Fate of California's Deinstitutionalized Mentally Ill." *American Journal of Orthopsychiatry* 50:65-75.

Wilson, J.Q. and Herrnstein R.J. 1985. "Crime and Human Nature: The Definitive Study of the Causes of Crime." The Free Press 1985.

Windmeijer, R. 2005. "A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators." *Journal of Econometrics* 126:25-51.

Wu, D.-M. 1973. "Alternative Tests of Independence Between Stochastic Regressors and Disturbances." *Econometrica* 41(4):733-50.

Figure 4.1 Mechanisms Through Which the Supply of Psychiatric Beds Affects Jail Detention.

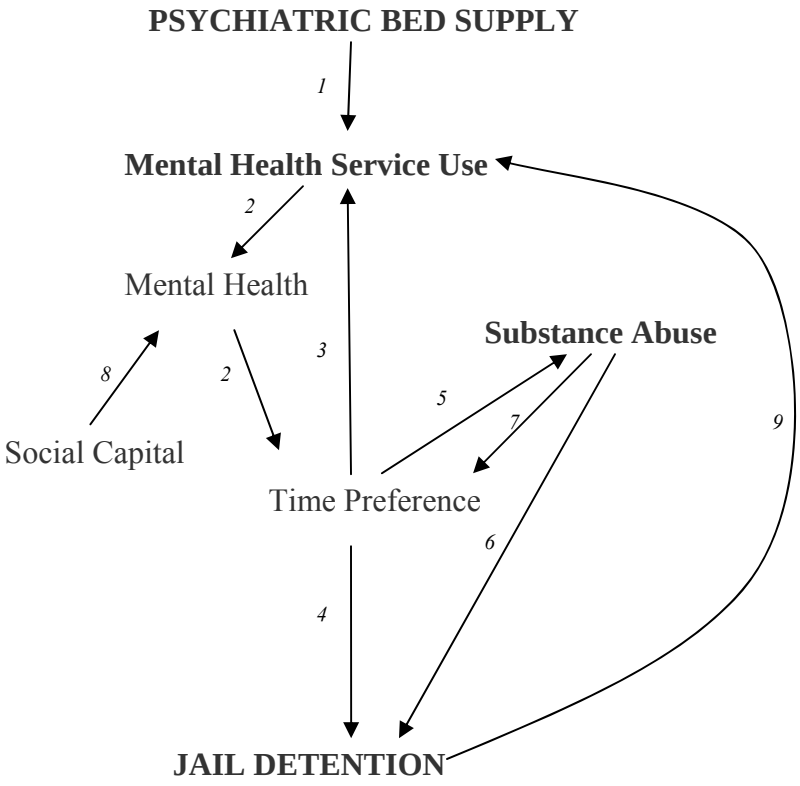

Table 4.1 ICD-9 and DRG Codes and Data Sources for Severe Mental Illness and Substance Abuse.

	ICD-9 & DRG codes	Data sources
Severe mental illness	295.*xx* (schizophrenic disorder) 296.*xx* (affective disorders – except borderline personal disorder, 295.2) 297.*xx* (paranoid states and delusional disorders) 298.*xx* (non-organic psychosis) DRG 424 – 432	• Western State Hospital • King County mental health system • King County jail system • Public substance abuse treatment program (TARGET) • Hospital discharge data (CHARS)
Substance abuse	291.*xx* (alcohol psychosis) 292.*xx* (drug psychosis) 303.*xx* (alcohol dependence) 304.*xx* (drug dependence) 305.0 (alcohol abuse) 305.2 – 305.9*x* (other drug abuse) 648.4*x* (drug dependence disorders complicating childbirth) DRG 433 – 437	• Western State Hospital • King County mental health system • King County jail system • Public substance abuse treatment program (TARGET) • Hospital discharge data (CHARS)

Note: Both ICD-9 and DRG codes were used for the CHARS data.

Table 4.2 Summary Statistics on the Entire Sample (Unweighted): 1993 – 1998.

	Description	*Mean*	*S.D.*	*Min*	*Max*
Endogenous variables					
Jail detention	= 1 for any charges of jail detention; 0 otherwise.	0.100		0	1
Serious	= 1 if a person was incarcerated in jail for such serious legal charges as murder, rape, serious assaults, robbery, burglary, forgery, felony theft, and felony charge of stolen property possession; 0 otherwise.	0.016		0	1
Minor	= 1 if a person used jail for minor offenses such as simple assaults, failure to appear in court, court order violations, driving violations, parole and probation violations; 0 otherwise.	0.081		0	1
Drug	= 1 if a person used jail for any drug violation; 0 otherwise.	0.010		0	1
Mental health service use	= 1 if a person used either inpatient or outpatient mental health services; 0 otherwise.	0.184		0	1
Substance abuse	= 1 for the period after a person received substance abuse treatment for the first time during the entire study period; 0 otherwise.	0.149		0	1
Exogenous variables					
System (county)-level characteristics					
Psychiatric beds	Total number of hospital psychiatric beds per 100,000 persons	136.5	8.5	126	151
Total public outpatient visits	Total number of visits served by King County's public outpatient mental health system (measured in 1,000 visits per 100,000 persons)	0.673	0.046	0.604	0.750
Public substance abuse treatment expenditures	Total public expenditures on substance abuse treatment (measured in thousands of dollars)	508.1	103.8	367.3	685.3
Cocaine price	Actual cocaine retail price (100 pure gram)	31.47	2.40	28.45	37.7
Methephat-amine price	Actual methephatamine retail price (100 pure gram)	34.11	12.61	21.77	56.1
Individual-level characteristics					
Severe mental illness	= 1 if a person had ever been diagnosed as having severe mental illness over the study period; 0 otherwise	0.169		0	1

Non-severe mental illness	= 1 if a person had ever received any mental health service but had not been diagnosed as having severe mental illness; 0 otherwise	0.317		0	1
No evidence of mental illness	= 1 if a person had never used the mental health system; 0 otherwise.	0.590		0	1
Medicaid	1 if a person was on Medicaid for the first month of each period	0.616		0	1
Age	Actual age at the beginning of each period	35.2	10.7	18	64
Female	1 for female; 0 otherwise	0.481		0	1
Race					
White	= 1 for each race; 0 otherwise.	0.670		0	1
Black		0.176		0	1
Asian		0.050		0	1
Hispanic		0.017		0	1
Native		0.027		0	1
Others		0.058		0	1

Note: Means are six-month averages.

Table 4.3 Fixed-Effect LPM: The Total Effect of Psychiatric Beds on the Likelihood of Jail Detention for Any Charges.

	Entire sample	*Severe mental illness*	*Non-severe mental illness*	*No evidence of mental illness*
Psychiatric beds	0.000103*** (0.000022)	0.000321*** (0.000088)	0.000141*** (0.000044)	0.000077** (0.000027)
Total public outpatient visits	0.022 (0.062)	0.051* (0.024)	0.017 (0.012)	0.058 (0.073)
Public managed care	0.00325*** (0.00058)	0.0063** (0.0023)	0.0045*** (0.0011)	0.00279*** (0.00069)
Public substance abuse treatment expenditures	0.0033 (0.0046)	0.003 (0.017)	0.0066 (0.0093)	0.004 (0.055)
Cocaine price	0.000248*** (0.000060)	0.00026 (0.00021)	0.00031** (0.00012)	0.000243*** (0.000072)
Methaphetamine price	0.000087*** (0.000017)	0.000251*** (0.000066)	0.000161*** (0.000035)	0.000067*** (0.000020)
Age	0.00033* (0.00038)	0.0032* (0.0014)	0.00171* (0.00078)	0.00043 (0.00044)
Medicaid	0.00020 (0.00079)	0.0017 (0.0014)	0.0098 (0.0051)	0.00106 (0.00069)
Time	0.00073** (0.00023)	0.00252*** (0.00092)	0.00012 (0.00049)	0.00068* (0.00029)
R^2	0.1138	0.1544	0.1411	0.1077
N	433,423	73,360	132,272	255,797

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations. All regressions included individual fixed effects.

Table 4.4 Fixed-Effect LPM: The Effect of Psychiatric Beds and Total Public Outpatient Mental Health Visits on the Likelihood of Jail Detention.

	Serious offense	*Minor offense*	*Drug violation*
Entire sample			
Psychiatric beds	9.54e-06 (7.85e-06)	0.000094*** (0.000020)	6.96e-06 (6.26e-06)
Total public outpatient visits	0.0007 (0.0022)	0.0035 (0.0056)	0.0030 (0.0017)
Severe mental illness			
Psychiatric beds	0.000036 (0.000029)	0.000275*** (0.000080)	0.000054* (0.000024)
Total public outpatient visits	0.0168 (0.0088)	0.030 (0.021)	0.0112 (0.0069)
Non-severe mental illness			
Psychiatric beds	0.000027 (0.000017)	0.000108** (0.000040)	0.000015 (0.000012)
Total public outpatient visits	0.0009 (0.0046)	0.017 (0.011)	0.0057 (0.0034)
No evidence of mental illness			
Psychiatric beds	9.80e-07 (9.08e-06)	0.000080*** (0.000024)	6.50e-08 (7.49e-06)
Total public outpatient visits	0.0005 (0.0026)	0.0068 (0.0066)	0.0014 (0.0020)

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations. Other covariates included managed care, public substance abuse treatment expenditures, prices of cocaine and methephatamine, age, Medicaid, the linear time trend, and individual fixed effects. Estimates of these covariates are not reported to save the space, but interpretations of the covariates across subpopulations are the same as the main results in Table 3.

Table 4.5 Estimates from Different Specifications: Jail Detention for Any Charges.

		Severe mental illness	*Non-severe mental illness*	*No evidence of mental illness*
Main results from Table 3	Psychiatric beds	0.000321*** (0.000088)	0.000141** (0.000044)	0.000077** (0.000027)
Pooled OLS	Psychiatric beds	0.000182** (0.000064)	0.000077* (0.000034)	0.000043* (0.000021)
Annual data[2]	Psychiatric beds	0.00058 (0.00052)	0.00021 (0.00050)	0.00017 (0.00018)
Half-yearly data[2]	Psychiatric beds	0.000162* (0.000076)	0.000054 (0.000037)	0.000038 (0.000022)
Probit on pooled data	Psychiatric beds	0.0042*** (0.013)	0.00157* (0.00880)	0.00112* (0.00054)
	Marginal effect[3]	0.000216*** (0.000068)	0.000072* (0.000036)	0.000036* (0.000017)
Including length of stay	Psychiatric beds	0.00044** (0.00014)	0.000125 (0.000070)	.
	Length of stay	1.64 (1.48)	0.23 (0.73)	.
Including substance abuse	Psychiatric bed	0.000311*** (0.000088)	0.00132*** (0.000044)	0.000076** (0.000027)
	Substance abuse	0.0063 (0.0037)	0.0096*** (0.0021)	0.0040* (0.0016)
Including both length of stay and substance abuse	Psychiatric beds	0.00043** (0.00014)	0.000111*** (0.000070)	0.000076** (0.000027)
	Length of stay	1.58 (1.48)	0.29 (0.73)	.
	Substance abuse	0.0063 (0.0037)	0.0096*** (0.0021)	.

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations. [1] Unweighted estimates. The estimates of psychiatric beds in Table 3 were slightly larger when I re-ran the main models without Manski-Lerman weights but the interpretation were the same. [2] Covariates include public expenditures on community mental health, managed care, age, and time trend. [3] Marginal effects were calculated for black women on Medicaid in the post managed care period. Mean values were used for other covariates.

Table 4.6 Fixed-Effect LPM: The Total Effect of Psychiatric Beds on Jail Detention for Any Charges for Persons with Severe Mental Illness by Sex and Race.

	Black		*White*		*Other race*	
	Women	Men	Women	Men	Women	Men
Psychiatric beds	0.00097*	0.00002	0.00039**	0.00021	0.00024	0.00065*
	(0.00040)	(0.00037)	(0.00012)	(0.00014)	(0.00016)	(0.00033)
Total public outpatient visits	0.06	0.09	0.013*	0.104**	0.028	0.042
	(0.11)	(0.11)	(0.031)	(0.037)	(0.041)	(0.083)
R^2	0.1487	0.1571	0.1579	0.1359	0.2456	0.1914
N	5,455	8,982	18,911	31,069	4,634	4,319

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations. Unreported covariates include managed care, public substance abuse treatment expenditures, prices of cocaine and methephatamine, age, Medicaid, the linear time trend, and individual fixed effects. Estimates are not reported to save the space, but interpretations of the covariates across subpopulations are the same as the main results in Table 3.

Table 4.7 Fixed-Effect LPM: The Effect of Psychiatric Beds on Mental Health Services and Substance Abuse.

	Severe mental illness		*Non-Severe Mental Illness*		*No-MH*
	MHS	*SA*	*MHS*	*SA*	*SA*
Psychiatric beds	0.00061***	0.00157***	0.000217*	0.00098***	0.000415***
	(0.00017)	(0.00022)	(0.000090)	(0.00012)	(0.000056)
Total public outpatient visits	0.051	0.013	0.032	0.017	0.003
	(0.048)	(0.044)	(0.026)	(0.024)	(0.012)
Public managed care	0.0311***	0.0420***	0.0099***	0.0267***	0.0133***
	(0.0048)	(0.0048)	(0.0024)	(0.0028)	(0.0013)
Public substance abuse treatment expenditures	0.0005	0.069*	0.024	0.057**	0.0294**
	(0.031)	(0.035)	(0.018)	(0.020)	(0.0094)
Cocaine price	0.00201***	0.00402***	0.00044	0.00236***	0.00169***
	(0.00039)	(0.00055)	(0.00022)	(0.00032)	(0.00016)
Methaphetamine price	0.00094***	0.00172***	0.000214**	0.000980***	0.000614***
	(0.00014)	(0.00017)	(0.000068)	(0.000097)	(0.000046)
Age	0.0017	0.0018	0.0024	0.0013	0.00018
	(0.0029)	(0.0025)	(0.0015)	(0.0013)	(0.00065)
Medicaid	0.005	0.0300***	0.0080	0.015	0.0082***
	(0.010)	(0.0061)	(0.0070)	(0.022)	(0.0016)
Time	0.0016	0.0178***	0.00076	0.01681***	0.011854***
	(0.0019)	(0.0018)	(0.00098)	(0.00093)	(0.000046)
R^2	0.3805	0.8381	0.4623	0.8089	0.8000

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations.

Table 4.8 Fixed-Effect 2SLS and Fixed-Effect IV-GMM Estimation for the *JAIL* Equation.

	Severe mental illness		Non-severe mental illness		No evidence of mental illness	
	2SLS	IV-GMM	2SLS	IV-GMM	2SLS	IV-GMM
Mental health service use	0.55 (0.30)	0.56 (0.30)	0.13 (0.23)	0.39 (0.36)	.	.
Substance abuse	0.35* (0.14)	0.35** (0.14)	0.122* (0.060)	0.204* (0.085)	0.096*** (0.030)	0.095** (0.030)
Age	0.0017 (0.0023)	0.0017 (0.0023)	0.00155 (0.00098)	0.0029* (0.0014)	0.00044 (0.00045)	0.00043 (0.00045)
Medicaid	0.0103 (0.0068)	0.0104 (0.0068)	0.0128* (0.0052)	0.0096 (0.0069)	0.00178* (0.00073)	0.00176* (0.00073)
Time	0.0082** (0.0025)	0.0082** (0.0025)	0.00209* (0.00091)	0.0028* (0.0012)	0.00149*** (0.00049)	0.00140*** (0.00043)
p Value for DWH test	< 0.0000		< 0.0000		0.0021	
p Value for LR test	0.0340		0.5149		< 0.0000	
p Value for Hansen J test	0.9906		0.2661		0.2661	

* $p < .05$; ** $p < .01$; *** $p < .001$. Two-step heteroskedasticity-clustering robust standard errors are in parentheses. Individual fixed-effects were included in all models. *p*-Value for DWH Statistic is to test the null hypothesis that the *JAIL* variable exogenous in the estimated equation. *p*-Value of the LR statistic is for Anderson canonical correlations likelihood-ratio test of null hypothesis that equation is underidentified. Hansen J Statistic tests the joint null hypothesis that instruments are uncorrelated with the error in the estimated equation and correctly excluded from the estimated equation.

Table 4.9 Fixed-Effect LPM: The Effect of Psychiatric Beds on Mental Health Services and Substance Abuse.

	Severe mental illness		*Non-Severe Mental Illness*	
	Inpatient	*Outpatient*	*Inpatient*	*Outpatient*
Psychiatric beds	0.00031 (0.00017)	0.000298*** (0.000037)	0.000147 (0.000089)	0.000068*** (0.000011)
Total public outpatient visits	0.019 (0.048)	0.0352*** (0.0086)	0.018 (0.025)	0.0144*** (0.0026)
Public managed care	0.0165*** (0.0047)	0.0149*** (0.0010)	0.0071** (0.0024)	0.00278*** (0.00030)
Public substance abuse treatment expenditures	2.28e-06 (0.000031)	3.23e-06 (5.95e-06)	0.000027 (0.000018)	2.61e-06 (1.84e-06)
Cocaine price	0.00114** (0.00038)	0.00089*** (0.00010)	0.00026 (0.00022)	0.000175*** (0.000029)
Methaphetamine price	0.00039** (0.00013)	0.000559*** (0.000034)	0.000107 (0.000068)	0.000107*** (0.000009)
Age	0.0015 (0.0028)	0.00025 (0.00051)	0.0022 (0.0015)	0.00028 (0.00015)
Medicaid	0.0058* (0.0027)	0.002 (0.010)	0.0080 (0.0067)	0.0001 (0.0032)
Time	0.0016 (0.0019)	0.0178*** (0.0018)	0.00073 (0.00097)	7.60e-06 (0.000010)
R^2	0.2793	0.4620	0.4684	0.4425

* $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses are corrected for heteroskedasticity and intra-cluster correlations. Individual fixed effects were included in all models.

Table 4.10 Fixed-Effect LPM: Estimates of Psychiatric Beds Among Persons with Severe Mental Illness by Sex and Race.

	Black		*White*		*Other race*	
	Women	Men	Women	Men	Women	Men
MHS equation	0.00010	0.00010	0.00076*	0.00059*	0.00040	0.00232**
	(0.00043)	(0.00040)	(0.00032)	(0.00030)	(0.00042)	(0.00083)
SA equation	0.00110*	0.00182**	0.00198***	0.00175***	0.00005	0.00040
	(0.00054)	(0.00062)	(0.00040)	(0.00036)	(0.00063)	(0.00066)

* $p < .05$; ** $p < .01$; *** $p < .001$.

Note: The numbers are estimated coefficients on psychiatric beds. Cluster-robust standard errors are reported in parentheses. All models were estimated controlling for the full set of covariates and individual fixed effects.

CHAPTER V

CONCLUSION

The broad goal of this dissertation was to examine whether a reduction of hospital psychiatric beds affects the criminal justice system in terms of crime, arrests, and jail detention. Three studies were conducted to explore the questions raised in this research. In specific, Study 1 and Study 2 examined whether a reduction in psychiatric hospital beds increase crime, arrests, and the size of jail populations at the state level. Study 3 explored the question of whether a reduction in hospital psychiatric beds increases the likelihood of jail detention at the individual level across the groups of persons of different severity and demographic characteristics. Study 3 also explored mechanisms through which a reduction in psychiatric bed supply may affect jail detention of persons with severe mental illness.

This chapter synthesizes the findings of the three individual manuscripts. It concludes the dissertation providing directions for future research and several important timely suggestions for policy.

5.1 Summary of Findings

5.1.1 The effect of the supply of psychiatric beds on crime, arrests, and jail detention

This section summarizes findings from both state-level and individual-level analyses, making comparisons when necessary.

First, there was no evidence of the relationship between the total number of psychiatric beds and criminal justice outcomes related to serious crime. This result is consistent between the state-level and individual-level analyses. However, regarding minor crime, while the state-level data show no evidence of a relationship between the availability of psychiatric beds and the number of arrests for minor offenses, the King County data indicates that a decrease in psychiatric bed supply increases an individual's likelihood of jail detention. A competent explanation for this discrepancy is that the estimates of the state-level data are likely to suffer attenuation bias due to measurement error. The use of the Uniform Crime Reports data on arrests for minor offenses was previously avoided by others due to possible reporting bias (Markowitz 2006) although the magnitude of measurement error is unknown. Nevertheless, for drug law violations, both the number of arrests at the state level and the likelihood of jail detention at the individual level were found to increase with decreased psychiatric bed supply.

Both Study 1 and Study 2 found that the effect of psychiatric bed supply varies depending on types of psychiatric facilities. Study 1 revealed that other conditions being unchanged, a decrease in the number of *public psychiatric hospital* beds would have a sizable negative effect on crime rates for both violent and property crimes. For example, in a given year, a one-unit decrease in public psychiatric hospital beds per 100,000 persons was found to be associated with an increase in murder by 0.027 unit per 100,000 persons and approximately 6 more property crimes. In contrast, if the number of *private psychiatric hospital* beds increases by one bed per 100,000 persons, the total number of property crimes would increase by 25. The supplies of psychiatric beds in public general hospitals and private general hospitals were associated with an increase and decrease in aggravated assaults,

respectively, but the same magnitude of the association implies that the effects offset each other.

Study 1 also estimated social costs of crime associated with reductions in psychiatric beds, and found that costs to society from reduced public psychiatric hospital beds were large. The decrease in public psychiatric hospital beds and the increase in private psychiatric hospital beds between 1982 and 1998 were estimated to yield social costs of about $174.5 million per 100,000 largely due to costs from violent crimes.

The findings on arrests in Study 2 estimate that a one-bed decrease in public psychiatric hospital beds would lead to 3 more arrests for property crimes. The supply of private psychiatric hospital beds was associated with an increase in arrests for burglary, larceny, and arson, but was negatively associated with arrests for motor vehicle theft. Interestingly, the magnitude of the effect of psychiatric bed supply on arrests was far smaller than the effect on crime. This finding is consistent with the notion that the clearance rate on average is less than the unity. Interestingly, a decrease in public psychiatric beds was found to increase arrests for drug possession.

Study 2 also indicates that as with crime and arrests, although the number of jail inmates may not affected by a change in the total number of psychiatric beds, a decrease in public psychiatric hospital beds would increase the number of jail inmates. This study found that the magnitude of the effect was quantitatively large. A 10-bed decrease in public psychiatric hospitals was associated with 6 more jail inmates.

Even if the availability of psychiatric beds does not change in a community – e.g., the decrease in the number of public psychiatric beds is accompanied by an increase in the same number of non-public hospital psychiatric beds, a change in the market composition of

psychiatric facilities of different hospital types may affect the criminal justice outcomes. For example, Study 1 found that a one-percentage point increase in the ratio of private to public psychiatric hospital beds holding the total number of psychiatric beds constant, was associated with an increase in about three serious crimes per 100,000 persons. The size of the effect was larger for property crimes. However, compared to the absolute number of psychiatric beds, the effect of the market composition of different hospital types was much smaller. In contrast, the number of arrests was found to be reduced by an increased market share of private psychiatric hospital beds relative to public psychiatric hospital beds. The relative market share of private psychiatric hospital beds was not associated with the number of jail inmates.

Finally, compared with Study 2 which did not find any relationship between the total number of psychiatric beds and the size of jail inmates, the individual-level analysis of Study 3 found a significant negative relationship between the supply of psychiatric beds and the likelihood of jail detention. Specifically, a decrease in psychiatric beds increased the probability of jail detention among persons with severe mental illness mainly via an increase in minor offenses. This adverse effect was also found to have an effect on persons without severe mental illness. Importantly, psychiatric bed reduction had the most considerable effect on black women with severe mental illness. One possible interpretation of the contradictory findings between the state-level and individual-level analyses is that since length of jail stay is usually brief, an increase in the probability of jail detention at the individual level may not lead to a significantly larger number of jail inmates enough to influence annual averages at the state level. Another competing explanation would be that the effect on psychiatric beds on jail detention is more likely to be observed at lower system levels such as a local county

and thus the use of state-level data, which are more aggregate, may lose important information available at local levels (i.e., have less variation in the criminal justice outcomes and the supply of psychiatric beds) and thus be less likely to isolate the relationship between the supply of psychiatric beds and the criminal justice outcomes.

5.1.2 The effect of the availability of community mental health resources on crime, arrests, and jail detention.

Study 1 and Study 2 used state mental health agencies' expenditures on mental health and substance abuse treatment as a measure of public outpatient mental health resources. Little evidence was found to relate the availability of community mental health resources to crime. However, public expenditures on community mental health programs were found to decrease arrests for both serious and minor crimes. Specifically, a $1 million increase in state mental health agencies' community mental health expenditures was associated with approximately 20 less arrests for serious crimes in a given year. A negative correlation between the expenditures on community mental health programs and the size of jail population was also found. A $1-million increase in community mental health spending was associated with a decrease of 6-7 persons detained in jail in a given year.

A consistent result was also found in Study 3. In Study 3, the total number of outpatient visits served by the public mental health system was used as a measure of public outpatient mental health resources. There was a negative and significant relationship between the total number of public outpatient mental health visits and an individual's likelihood of jail use. Study 3 also suggests that black women with severe mental illness are more likely to be underserved by the public outpatient mental health system.

Taken as a whole, the results on the relationship between the availability of community mental health resources and the criminal justice outcomes imply that increased

community mental health resources would lead to more effective diversions of mentally ill offenders due to the improved availability of community mental health resources, especially those charged with minor offenses.

5.1.3 The mechanisms by which the supply of psychiatric beds affects the criminal justice outcomes.

The dissertation has developed a theoretical framework that models the mechanisms linking a change in the supply of psychiatric beds and the criminal justice outcomes. These mechanisms were tested using individual-level panel data from King County in Study 3. As postulated, mental health service use and substance abuse were identified as main channels through which psychiatric bed supply affected jail detention in particular among persons with severe mental illness.

The results suggest that although a decrease in psychiatric beds may increase mental health service use among mentally ill persons, significantly larger adverse effect on substance abuse could be found as much as community mental health resources are not sufficient to meet treatment need of an increased volume of persons with mental illness in the community. This adverse effect was found to be the most substantial among persons with severe mental illness – in particular black women.

The state-level analysis also provides support for the pathways. A one-bed decrease in public psychiatric hospital beds was associated with a similar increase of arrests for drug possession. However, the study found no evidence of the relationship between psychiatric bed supply and arrests for any drug violations and drug sales.

5.2 Limitations and Directions for Future Research

This section summarizes the limitations of this study and provides directions for future research.

First, although the number of persons on probation has been consistently increasing, probationers with severe mental illness were disregarded in this research mainly due to a paucity of data, as in prior research (Lurigio and Swartz 2000). Annual Probation Surveys show that the estimated number of the nation's probationers at the end of a year has been increasing over time from 3.1 million in 1995 to 4.2 million in 2005 (Glaze and Bonczar 2006). The surveys also show that probationers accounted 53 percent of the growth of the correctional populations between 1990 and 2005; nearly 76 percent of all probationers entered probation without incarceration in 2005; the proportion of probationers convicted of misdemeanors increased from 44 percent in 1995 to 49 percent in 2005. Meanwhile, co-occurring mental illness and substance use disorders are at least as prevalent among probationers as among jail detainees (Lurigio et al. 2002). Taken together, there is evidence that a significant proportion of mentally ill offenders enter probation in lieu of incarceration. Thus, it is an open question whether on-going increases in the number of persons on probation are attributed to reductions in psychiatric beds. For comprehensive understanding of the relevance between psychiatric bed supply and criminal justice outcomes, future research should produce reliable data on mentally ill persons on probation and explore implication of changes of mental health policies and laws on this population.

Second, this research also overlooked other dynamic features of the mental health system, such as hospital ownership, market competition and managed care, which are also worth of exploration as a possible extension of this research. For example, profit status of psychiatric hospitals may affect hospitals' treatment patterns due to different incentives. In

general medical markets, theoretical models often predict that not-for-profit hospitals derive part of their utility from patient well-being while for-profit counterparts are more inclined to maximize profits and thus may avoid indigent or high-cost patients (Sloan 2000). Although empirical evidence on different behaviors between for-profit and not-for-profit hospitals in terms of uncompensated care and quality is mixed (Sloan 2000), hospitals in markets with a higher market share of for-profit hospitals may be less likely to provide uncompensated care and admit uninsured patients (Schlesinger, Dorwart and Hoover 1997; Frank, Salkever and Mullann 1990). This market failure may be exacerbated in particular for psychiatric care because persons with mental illness are often lack of insurance coverage and thus for-profit hospitals may engage in *cream-skimming* of more profitable patients especially under increased market competition (Schlesinger et al. 1997). In addition, since asymmetric information between providers and consumers – i.e., providers know much more than patients about the patients' conditions – is more likely to be present in psychiatric care than in general medical care (Ettner and Hermann 2001), quality of psychiatric care may differ by the profit status and degree of market competition and managed care penetration. Therefore, increased for-profit market share of psychiatric beds may impact treatment patterns of psychiatric care for individuals with severe mental illness and subsequent criminal justice outcomes.

Third, the state-level analysis of crime in Study 1 examined only serious crime due to the unavailability of data on minor crime. Considering severely mentally ill offenders are often charged with minor crime (Morrissey, 2004; Torrey, 1995; Valdiserri, Carroll, & Hartl, 1986; Lamb & Grant 1982; Sosowsky 1980; Steadman, Cocozza, & Melick 1978; Abramson 1972), the effect of a decrease in psychiatric beds may occur largely though an increase in

minor crimes. For example, despite a possible reporting bias in arrests for minor offenses which may leads to attenuation bias, a significant negative relationship was found between psychiatric bed availability and arrests for drug possession. In addition, the individual-level analysis of Study 3 found that a significant, large increase in the likelihood of jail detention for minor offenses was associated with reductions in psychiatric beds among persons with severe mental illness. Clearly, an examination of the relationship between psychiatric bed supply, minor crime, and arrests for minor offenses should be explored by future research.

Fourth, a majority of persons with severe mental illness can be successfully treated in the community with a wide range of community support such as sufficient transitional facilities, adequate aftercare, employment opportunities, housing, and social supports (Grob 2001). Nonetheless, both existing literature (Lamb and Weinberger 2003; Rock 2001) and the findings of this research suggest that there exist a subgroup of persons who are difficult to manage in the community. Although this research found that increased community outpatient mental health resources would decrease a contact with the criminal justice system among persons with severe mental illness, this research is limited in that it could not examine to what extent inpatient and outpatient mental health services could substitute each other. Since there may exist a subgroup of persons who are highly resistant to treatment in the community and thus would be best served by highly-structured care, future research should identify persons who need to be served in a highly-structured setting and explore an optimal public mental health resource allocation between inpatient and outpatient service provisions.

Fifth, the conceptual framework of this dissertation posits *social capital* as another important factor which may affect contacts with the criminal justice system among persons with severe mental illness. However, due to the unavailability of data, the present research

could not explicitly control for this potential confounders. Future studies should explore the implications of interactions among the supply of psychiatric beds, social capital, and the criminal justice outcomes for more comprehensive understanding of the issues raised in this research.

Finally, the individual-level analysis used data from one local county. Given a great deal of variation in public mental health and substance abuse treatment resources across different geographical areas, future studies should explore the research questions examined here in other regional settings.

5.3 Policy Implications

Community integration of persons with severe mental illness remains an on-going process. Consequently, persons with severe mental illness who present difficult problems in treatment and management continue to be placed in the community. This section concludes the dissertation research by summarizing several important implications that will lead to more effective and efficient mental health policy, particularly in a current era with increasing emphasis on downsizing of inpatient psychiatric care with increased emphasis on community treatment of persons with severe mental illness.

The findings presented here suggest that retaining the capacity of public psychiatric hospital beds may prevent a possible increase in the contacts with the criminal justice system among persons with mental illness especially if other things are unchanged – i.e., no expansion of the public outpatient mental health system. Clearly, this finding should not be seen as supporting the notion of investing on a state hospital-based mental health system. Not only would the idea of a hospital-centered system be unrealistic in today's political and organizational environments, but it is inconsistent with research showing that relative to

hospital-based care, community treatment alternatives improve function and quality of life for persons with severe mental illness and are cost-effective (Rothbard 1997; Mechanic and Rochefort 1990). Rather, the present challenge of community integration of the severely mentally ill is to ensure the availability of adequate mental health and community support resources. Thus, the findings of this research support the idea that increased community mental health resources should be preceded by a reduction in public psychiatric hospital beds.

The state-level analyses suggest that the market composition of inpatient psychiatric facilities of different hospital types should be closely monitored and be reflected in policy decision making. In particular, since an increase in private psychiatric hospital beds was found to lead to more crimes, arrests, and jail inmates, a special attention should be given to the market composition of this type of psychiatric facilities.

The results of Study 2 and Study 3 suggest that increased community mental health expenditures would lead to more effective diversions of mentally ill offenders, especially those charged with minor offenses. In contrast, Study 1 found that community mental health programs are not successful in preventing crime. Clearly, there exist a group of mentally ill persons who cannot be successfully managed in today's community-oriented treatment environments. Thus, a process of community integration of persons with severe mental illness needs to be accompanied by a through examination of the community mental health system about its capability to serve those who are at the greatest risk of committing serious violent crimes.

Even though community mental health resources increase, some subgroups of the population are found not to benefit from it. Special attention should be given to black women with severe mental illness since this population was identified as the most underserved group

of persons with mental illness under the on-going emphasis on community-based treatment of severe mental illness. More effective use of scarce community mental health resources is to target those with lower probability of mental health service use and subsequent higher probability of criminal involvement. In addition, as suggested by several studies, for the use of mental health services to be more effective, other community support, such as housing, employment and rehabilitation, should be also provided (Lamb, Weinberger and Gross 2004; Lurigio and Swartz 2000).

Persons with the most debilitating symptoms, especially those with a criminal history, are less likely to seek or comply with treatment in the community, and thus are more likely to experience the contact with the criminal justice system (Lamb, Weinberger and Gross 2004; Lamb and Weinberger 1998). Effective community treatment for this group of individuals requires not only increased budgets for community mental health programs but also the availability of high-quality community treatment modalities and legal interventions. For example, a comprehensive team-based treatment model such as assertive community treatment (ACT) and a tool being used to improve treatment compliance in the community such as involuntary outpatient commitment (OPC) have been shown to be effective in treating patients with severe mental illness in the community and important in reducing their involvement with the criminal justice system (Lamb and Weinberger 2005; Phillips et al. 2001; Swanson et al. 2000; Swartz et al. 1998; Stein and Test 1980). However, ACT is expensive and OPC has a legal limitation due to the legislative concern about patient rights. Nevertheless, ACT has been viewed as a cost-effective alternative to long psychiatric hospitalization (Latimer 1999) and OPC has been considered the most promising method of a legal intervention against patient rights for the sake of public safety and patients' own

benefits (Monahan, Swartz and Bonni 2003). Thus, the most effective use of the available high-quality community treatment options is to target those who are most likely to benefit from these available community treatment leverages (Cuddeback, Morrissey and Piper 2006; Wysoker et al. 2004). Combined with the implications of the current research, it is suggested that community mental health programs should outreach black women with severe mental illness. Specifically, focus should be put mentally ill persons in the community who have a history of serious violent acts which may put harms on others or themselves but do not seek treatment voluntarily. Comprehensive treatment should be provided to this population and if necessary, involuntarily.

It should be aware that when community mental health resources are insufficient, an adverse effect of psychiatric bed supply on the criminal justice outcomes could be also found among persons with non-severe mental illness. It also should be noted that persons who have severe mental illness but do not receive mental health treatment may be the group of persons who are the most likely to be adversely affected by a change in psychiatric bed supply.

This research identifies substance abuse as an important channel through which persons with severe mental illness are adversely affected by decreased availability of inpatient psychiatric services. Co-occurring substance abuse disorders are often related to elevated criminal activities among persons with severe mental illness for both violent and non-violent crimes (Hiday et al. 1999; Swartz et al. 1998; Borum et al. 1997). While efforts should continue to address mental health and substance abuse comorbidities, this research found that increasing public expenditures on substance abuse treatment would prevent further development of substance abuse disorders among persons with severe mental illness and in turn decrease their contacts with the criminal justice system. On the other hand, increased

access to mental health services would reduce the prevalence of dually diagnosed individuals and subsequently reduce the probability of involvement with the criminal justice system by persons with severe mental illness.

In conclusion, the results presented in this research reassure the importance of a suggestion that has been previously touched upon by many critics in this field. Effective community integration of persons with severe mental illness should entail close, continuous communication and collaboration within and across different sub-systems of a community including the inpatient mental health system, the outpatient mental health system, the substance abuse treatment system, and the criminal justice system (Rock 2001; Lurigio and Lewis 2000).

APPENDIX

Derivation of Reduced-Form Equations.

This appendix provides our derivation of the reduce-form equations (7) – (10) using the following simultaneous equations on page 9:

$$JAIL_{it} = \alpha_0 + \alpha_1 \cdot MHS_{it} + \alpha_2 \cdot SA_{it} + \alpha_3 \cdot AGE_{it} + \alpha_4 \cdot TREND_t + a_i + u_{it} \tag{4}$$

$$\begin{aligned} MHS_{it} = {} & \beta_0 + \beta_1 \cdot BED_t + \beta_2 \cdot CMH_t + \beta_3 \cdot MC_t + \beta_4 \cdot JAIL_{it} + \beta_5 \cdot SA_{it} \\ & + \beta_6 \cdot AGE_{it} + \beta_7 \cdot MEDICAID_{it} + \beta_8 \cdot TREND_t + b_i + \varepsilon_{it} \end{aligned} \tag{5}$$

$$\begin{aligned} SA_{it} = {} & \gamma_0 + \gamma_1 \cdot MHS_{it} + \gamma_2 \cdot JAIL_{it} + \gamma_3 \cdot SA\ EXPEND_t + \gamma_4 \cdot COCAINE_t \\ & + \gamma_5 \cdot METH_t + \gamma_6 \cdot AGE_{it} + \gamma_7 \cdot MEDICAID_{it} + \gamma_8 \cdot TREND_t + r_i + \nu_{it} \end{aligned} \tag{6}$$

- *Derivation of Equation (7)*

First, substitute (5) into (6):

$$\begin{aligned} SA_{it} = {} & \left(\frac{\gamma_0 + \gamma_1\beta_0}{1 - \gamma_1\beta_5} \right) + \left(\frac{\gamma_1\beta_1}{1 - \gamma_1\beta_5} \right) \cdot BED_t + \left(\frac{\gamma_1\beta_2}{1 - \gamma_1\beta_5} \right) \cdot CMH_t + \ldots \\ & + \left(\frac{\gamma_1\beta_4 + \gamma_2}{1 - \gamma_1\beta_5} \right) \cdot JAIL_{it} + \ldots \end{aligned} \tag{6a}$$

Substitute (5) into (4):

$$(1 - \alpha_1\beta_4) JAIL_{it} = \alpha_0 + \alpha_1\beta_1 \cdot BED_t + (\alpha_1\beta_5 + \alpha_2) \cdot SA_{it} + \ldots \tag{4a}$$

Substitute (6a) into (4a):

$$(1 - \alpha_1\beta_4) JAIL_{it} = \left(\alpha_1\beta_1 + \frac{(\alpha_1\beta_5 + \alpha_2)\beta_1\gamma_1}{1 - \beta_5\gamma_1} \right) \cdot BED_t + \left(\frac{(\alpha_1\beta_5 + \alpha_2)(\beta_4\gamma_1 + \gamma_2)}{1 - \beta_5\gamma_1} \right) \cdot JAIL_{it} + \ldots$$

Finally, re-arranging the terms, we obtain the reduced-form equation (7).

$$JAIL_{it} = \frac{\beta_1\alpha_1 + \beta_1\gamma_1\alpha_2}{1 - \beta_5\gamma_1 - \alpha_1\beta_4 - \beta_5\alpha_1\gamma_2 - \beta_4\gamma_1\alpha_2 - \gamma_2\alpha_2} \cdot BED_t + \ldots \tag{7}$$

In the numerator, the first term $\beta_1\alpha_1$ reflects the pathway that psychiatric bed supply affects mental health service use (β_1), which has a direct effect on jail detention (α_1). The second term $\beta_1\gamma_1\alpha_2$ reflects the other pathway that the supply of psychiatric beds affects substance abuse due to changes in mental health service use ($\beta_1\gamma_1$) and substance abuse directly affect jail detention (α_2). The denominator captures complex relationships between psychiatric beds, mental health service use, substance abuse, and jail detention. For example, the $\beta_5\alpha_1\gamma_2$ term reflects the path that substance abuse affects mental health service use (β_5) and subsequent jail detention (α_1), which affects substance abuse simultaneously (γ_2).

- *Derivation of Equation (8)*

First, substitute Eq. (4) into Eq. (6)

$$SA_{it} = \frac{\gamma_0 + \gamma_2\alpha_0}{1-\gamma_2\alpha_2} + \frac{\gamma_0 + \gamma_2\alpha_0}{1-\gamma_2\alpha_2} \cdot MHS_{it} + ... \quad (6b)$$

Substitute Eq. (4) into Eq. (5)

$$(1-\beta_4\alpha_1)MHS_{it} = (\beta_0 + \beta_4\alpha_0) + \beta_1 \cdot BED_t + \beta_4\alpha_2 \cdot SA_{it} + ... \quad (5a)$$

Substitute Eq. (6b) into Eq. (5a)

$$(1-\beta_4\alpha_1)MHS_{it} = (\beta_0 + \beta_4\alpha_0) + \beta_1 \cdot BED_t + \frac{\beta_4\alpha_2(\gamma_1 + \gamma_2\alpha_2)}{1-\gamma_2\alpha_2} \cdot MHS_{it} + ...$$

Finally, rearrange the terms:

$$MHS_{it} = \beta_1 \cdot \left(\frac{1-\gamma_2\alpha_2}{1-\gamma_2\alpha_2 - \beta_4\alpha_1 - \alpha_2\beta_4\alpha_1)} \right) BED_t + ... \quad (8)$$

- *Derivation of Equation (9)*

First, rewrite Eq. (5a):

$$MHS_{it} = \frac{\beta_0 + \beta_4\alpha_0}{1-\beta_4\alpha_1} + \frac{\beta_1}{1-\beta_4\alpha_1} \cdot BED_t + \frac{\beta_4\alpha_2}{1-\beta_4\alpha_1} \cdot SA_{it} + \ldots \quad (5b)$$

Substitute Eq. (5b) into Eq. (6b):

$$SA_{it} = \frac{\beta_1}{1-\beta_4\alpha_1} \cdot \frac{\gamma_0 + \gamma_2\alpha_0}{1-\gamma_2\alpha_2} \cdot BED_t + \frac{\beta_4\alpha_2}{1-\beta_4\alpha_1} \cdot \frac{\gamma_0 + \gamma_2\alpha_0}{1-\gamma_2\alpha_2} \cdot SA_{it} + \ldots$$

Rearranging the terms:

$$SA_{it} = \frac{\beta_1\gamma_1 + \beta_1\alpha_1\gamma_2}{1-\beta_4\alpha_1 - \gamma_2\alpha_2 - \beta_4\alpha_2\gamma_1} \cdot BED_t + \ldots \quad (9)$$

- *Derivation of Equation (10)*

In the following, we show a simplified version of the derivation for Eq. (10).

First, re-write Eqs. (4) – (6).

$$JAIL_{it} = f(MHS_{i,t-1}, SA_{it}, AGE_{it}, MEDICAID_{it}, TREND_t) \quad (4b)$$

$$MHS_{i,t-1} = f(BED_{t-1}, CMH_{t-1}, MC_t, JAIL_{i,t-1}, SA_{i,t-1}, AGE_{i,t-1}, MEDICAID_{i,t-1}, TREND_t) \quad (5c)$$

$$SA_{it} = f(MHS_{i,t-1}, JAIL_{it}, SA\ EXPEND_t, COCAINE_t, METH_t, AGE_{it}, MEDICAID_{it}, TREND_t) \quad (6c)$$

Substitute Eq. (5c) into Eq. (6c):

$$SA_{it} = f(BED_{t-1}, CMH_{t-1}, MC_t, JAIL_{it}, JAIL_{i,t-1}, SA\ EXPEND_t, COCAINE_t, METH_t, AGE_{it}, MEDICAID_{it}, AGE_{i,t-1}, MEDICAID_{i,t-1}, TREND_t) \quad (6d)$$

Substitute Eqs. (5c) and (6d) into Eq. (4b):

$$\begin{aligned} JAIL_{it} = {} & \pi_0 + \pi_1 \cdot JAIL_{it-1} + \pi_2 \cdot BED_{t-1} + \pi_3 \cdot CMH_{t-1} + \pi_4 \cdot MC_t \\ & + \pi_5 \cdot SA_{it-1} + \pi_6 \cdot SA\ EXPEND_t + \pi_7 \cdot SA\ EXPEND_{t-1} \\ & + \pi_8 \cdot COCAINE_t + \pi_9 \cdot COCAINE_{t-1} + \pi_{10} \cdot METH_t + \pi_{11} \cdot METH_{t-1} \\ & + \pi_{12} \cdot AGE_{it} + \pi_{13} \cdot AGE_{it-1} + \pi_{14} \cdot MEDICAID_{it} + \pi_{15} \cdot MEDICAID_{it-1} \\ & + \pi_{16} \cdot TREND_t + p_i + \upsilon_{it} \end{aligned} \quad (10)$$

where SA_{t-1} is assumed to be predetermined.

REFERENCES

Abramson, M.F. 1972. "The criminalization of mentally disordered behavior: possible side-effect of a new mental health law." *Hospital and Community Psychiatry* 23 (4):101-5.

Borum, R., J.W. Swanson, M.S. Swartz, and V.A. Hiday. 1997. "Substance Abuse, Violent Behavior, and Police Encounters among Persons with Severe Mental Disorder." *Journal of Contemporary Criminal Justice 13*(3):236-50.

Cuddeback, G.S., J.P. Morrissey, and P.S. Meyer. 2006. "How Many Assertive Community Treatment Teams Do We Need?" Psychiatric Services 57(12):1803-6.

Ettner, S.L., and R.C. Hermann. 2001. "The Role of Profit Status Under Imperfect Information: Evidence From the Treatment Patterns of Elderly Medicare Beneficiaries Hospitalized for Psychiatric Diagnoses." *Journal of Health Economics* 20(1):23-49.

Frank, R.G., D.S. Salkever, and F. Mullann. 1990. "Hospital Ownership and the Care of Uninsured and Medicaid Patients: Findings from the National Hospital Discharge Survey 1979-1984." *Health Policy* 14(1):1-11.

Glaze, L.E. and T.P. Bonczar. 2006. "Probation and Parole in the United States." Bureau of Justice Statistics, NCJ 215091. Washington, D.C.

Grob, G.N. 2001. "Mental Health Policy in the 20th-Century America." In Mandersheid RW and MJ Henderson (Eds.), *Mental Health, United States, 2000*. Washington, D.C.: U.S. Government Printing Office.

Hiday, V.A., Swartz MS, Swanson JW, et al. 1999. "Criminal victimization of persons with severe mental illness." *Psychiatric Services* 50:62-68.

Lamb, H.R., and R.W. Grant. 1982. "The Mentally Ill in an Urban County Jail." *Archives of General Psychiatry* 39:17-22.

Lamb, H.R., and L.E. Weinberger. 2003. "One-Year Follow-Up of Persons Discharged From a Locked Intermediate Care Facility." *Psychiatric Services* 56(2):198-201.

Lamb, H.R., and L.E. Weinberger. 2005. "The Shift of Psychiatric Inpatient Care From Hospitals to Jails and Prisons." *Journal of American Academic Psychiatry and Law* 33:529-34.

Lamb, H.R., and L.E. Weinberger. 1998. "Persons With Severe Mental Illness in Jails and Prisons: A Review." *Psychiatric Services* 49:483-92.

Lamb, H.R., L.E. Weinberger, and B.H. Gross. 2004. "Mentally Ill Persons in the Criminal Justice System: Some Perspectives." *Psychiatric Quarterly* 75 (2):107-26.

Latimer, E.A. 1999. "Economic Impacts of Assertive Community Treatment: A Review of the Literature." *Canadian Journal of Psychiatry* 44:443-55.

Lurigio, A.J., and J.A. Swartz. 2000. "Changing the Contours of the Criminal Justice System to Meet the Needs of Persons with Serious Mental Illness." In W. Reed & L. Winterfield (eds.), *Criminal Justice, Volume 3. Policies, Processes, and Decisions of the Criminal Justice System*. Washington, D.C.: U.S Department of Justice, Office of Justice Programs.

Lurigio AJ, Cho YI, Swartz JA, et al. 2002. "Standardized Assessment of Substance-Related, Other Psychiatric, and Comorbid Disorders Among Probationers." *International Journal of Offender Therapy and Comparative Criminology* 47:630–52.

Markowitz, F.E. 2006. "Psychiatric Hospital Capacity, Homelessness, and Crime and Arrest Rates." *Criminology* 44 (1) 45-72.

Mechanic, D., and D.A. Rochefort. 1990. "Deinstitutionalization: An Appraisal of Reform. *Annual Review of Sociology* 16:301-27

Monahan, J., M.S. Swartz, and R. Bonnie. 2003. "Mandated Treatment in the Community for People with Mental Disorders." *Health Affairs* 22:28-38.

Morrissey, J.P., H.J. Steadman, M.D. Kathleen, A. Cuellar, P. Stiles, and G.S. Cuddeback. 2004. "Medicaid Enrollment and Mental Health Service Use Following Release of Jail Detainees With Severe Mental Illness." *Psychiatric Services* 57:809-15.

Phillips, S., Burns, B., Edgar, E., et al. 2001. "Moving Assertive Community Treatment into Standard Practice." *Psychiatric Services* 52(6):771-9.

Rock, M. 2001. "Emerging Issues with Mentally Ill Offenders: Causes and Social Consequences." *Administration and Policy in Mental Health* 28(3):165-80.

Rothbard, A.B., E. Kuno, A.P. Schinnar, T.R. Hadley, and R. Turk. 1999. "Service Utilization and Cost of Community Care for Discharged State Hospital Patients: A 3-Year Follow-Up Study." *American Journal of Psychiatry* 156 (6):920-7.

Schlesinger, M., R. Dorwart, C. Hoover and S. Epstein. 1997. "The determinants of dumping: a national study of economically motivated transfer involving mental health care." *Health Services Research* 32(5):561-76.

Schlesinger, M., R. Dorwart, and C. Hoover. 1997. "Competition, Ownership, and Access to Hospital Services: Evidence from Psychiatric Hospitals." *Medical Care* 35(9):974-92.

Sloan, F.A. 2000. "Not-for-profit ownership and hospital behavior." In: Newhouse, J.P., Culyer, A.J. (eds.). *Handbook of Health Economics*. North-Holland, Amsterdam.

Sosowsky, L. 1978. "Crime and Violence Among Mental Patients Reconsidered in View of the New Legal Relationship Between the State and the Mentally Ill." *American Journal of Psychiatry* 135:33-42.

Steadman, H.J., J.J. Cocozza, and M.E. Melick. 1978. "Explaining the Increased Arrest Rate Among Mental Patients: The Changing Clientele of State Hospitals." *American Journal of Psychiatry* 135 (7):816-20.

Stein, L.I., and Test, M.A. 1980. "An Alternative to Mental Hospital Treatment: I. Conceptual Model, Treatment Program, and Clinical Evaluation." *Archives of General Psychiatry* 37:392-9.

Swanson, J.W., M.S. Swartz, H.R. Wagner, B.J. burns, R. Borum and V.A. Hiday. 2000. "Involuntary Out-Patient Commitment and Reduction of Violent Behavior in Persons with Severe Mental Illness." *British Journal of Psychiatry* 176(4): 324 - 31.

Swartz, M.S, J.W. Swanson, V.A. Hiday, R.B. Borum, H.R. Wagner, and B.J. Burns. 1998. "Violence and Severe Mental Illness: The Effects of Substance Abuse and Nonadherence to Medication." *American Journal of Psychiatry* 155:226-31.

Torrey, E.F. 1995. "Jails and Prisons – America's New Mental Hospitals." *American Journal of Public Health* 85:1611-3.

Valdiserri, E.V., K.R. Carroll, and A.J. Hartl. 1986. "A Study of Offenses Committed by Psychotic Inmates in a County Jail." *Hospital and Community Psychiatry* 37 (2):163-6.

Wysoker, A., G. Agrati, J. Collins, P. Marcus, and B. Thelander. 2004. "Mandatory Outpatient Treatment." Journal of the American Psychiatric Nurses Association 10(5):247-50.