

Mental Health and Substance Abuse Treatment and Juvenile Crime

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Abstract

Background and Study Aims: There is a large body of literature examining the determinants of juvenile crime, which highlights economic, family, peer, and educational factors associated with delinquency and recidivism, and the important roles of social service and educational systems. Two factors, substance abuse and mental illness are also potentially important. The observed high correlations between crime, substance abuse and poor mental health suggests that factors which reduce substance abuse and improve mental health may also be effective in reducing criminal activities. The purpose of this paper is to examine the effectiveness of mental health and substance abuse treatment in reducing crimes committed by juveniles.

Methods: This paper uses detention data in conjunction with substance abuse and mental health treatment data for youth enrolled in the Colorado state foster care program over a three year period. Duration models are used to examine the structural determinants of detention. We analyze the impact of treatment in delaying or preventing this group of at-risk youth from engaging in criminal behavior. Violent crimes are analyzed separately. We also include the price of beer in all models to gauge the effectiveness of higher beer prices in reducing crime, holding treatment constant.

Results: The analysis finds that individuals who receive treatment have lower probabilities of being detained for any offence. Accounting for the unobserved heterogeneity makes the magnitude of these effects larger. Also consistent with our theory, higher beer prices lower the detention hazard.

Conclusion: Results of this study suggest that expansion of health services targeted at these youth may be effective at reducing crime. For violent crime, where the literature shows that substance abuse plays a significant role, stricter alcohol-regulatory policies may also be highly effective.

Received 21 November 2003; accepted 2 April 2004

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Source of Funding: Partial support was provided by NIMH (K01 MH067086-01, Cuellar, PI), the Institute for Child and Family Policy, Columbia University (Cuellar, PI), the Cornwall Center for Metropolitan Studies Faculty Award for Scholarly Research at Rutgers University, Newark (Sara Markowitz, PI), and by a W.T. Grant Foundation Faculty Scholars Award (Libby, PI).

Introduction and Study Aims

Criminal behaviors are highly prevalent among adolescents. In 2000, youth ages 10-20 accounted for 16 percent of the population, but 32.1 percent of all arrests, 29.8 percent of arrests for violent crime and 48.3 percent of arrests for property crime.¹ There is a large body of literature examining the determinants of juvenile crime, which highlights economic, family, peer, and educational factors associated with delinquency and recidivism, and the important roles of social service and educational systems.^{2,3} While these factors are extremely important, two other factors, substance abuse and mental illness are potentially as important, and may be influenced through public policy and the public health system. This paper examines the effectiveness of mental health and substance abuse treatment in reducing crimes committed by juveniles.

A number of studies have shown that youth with substance abuse or mental health disorders consistently have higher offending rates than those without disorders.⁴⁻⁶ For example, Vander Stoep *et al.*⁷ show that youth enrolled in a public mental health system had three times as many police referrals to the juvenile justice system as those in the general child population. Others have shown higher rates of violence and aggression among youth with mental health problems.^{8,9} Some evidence suggests that mental illness contributes in part to youths' illegal behavior.^{10,11}

Similarly, a number of studies have shown that children in the juvenile justice system experience substantially higher rates of mental health and substance abuse disorders than youth in the general population.¹²⁻¹⁶ For example, Wasserman *et al.*¹⁶ studied past-month mental health diagnoses among a group of male youth in secure placement facilities and found expectably high rates of disruptive diagnoses (33 percent), but also high rates of substance abuse diagnoses (50 percent), anxiety disorders (20 percent) and mood disorders (10 percent). By comparison, estimates for youth ages 18 and under from the nationally representative National Comorbidity Survey show a much lower past year prevalence of substance abuse disorders (11 percent), but similar rates of anxiety disorders (25 percent) and mood disorders (13 percent). The use of different instruments and survey time frames across studies makes comparisons

difficult, but a review of impairment studies among general population youth reported the median rate of any disorder to be 15 percent.¹⁷

Studies of substance abuse and crime, whether violent or nonviolent, show a strong positive relationship (Miczek *et al.*,¹⁸ and Forrest and Gordon¹⁹ provide reviews of the literature). Regarding violent crime, the Bureau of Justice Statistics²⁰ states that a higher proportion of violent male inmates in local jails report drinking at the time of the offense than property crime inmates. Among all state prisoners under the influence of alcohol at the time of the offense (about 33% of prisoners), the average blood alcohol content (BAC) is 0.27, which is almost 3 times that of the legal limit for driving under the influence. In comparison, the average BAC for intoxicated drivers involved in fatal accidents is about 0.17.²⁰ Other studies comparing violent and non-violent criminals also find high rates of alcohol use among violent offenders.²¹⁻²³

In considering violence by youths, Rossow *et al.*²⁴ and Bernburg and Thorlindsson²⁵ show that when violence is measured as a specific act, such as beating or threatening to beat someone or having been in a fight with a weapon, frequent intoxication will lead to increased violence, as will the use of marijuana or other drugs. Salts *et al.*²⁶ find that alcohol and marijuana use are highly correlated with increased violent behaviors in both black and white adolescent males. Similar findings hold for teens of both genders when examining drug use and violence in school.²⁷

It is important to note that the studies showing the high correlation between mental illness, substance use, aggression, and crime do not establish causality. There could exist unobserved individual, familial, or situational confounders driving these relationships (see Fagan²⁸ for a review of the theories on intoxication and aggression). However, if having a mental illness or substance abuse disorder contributes to crime, for example, due to aggression or lack of impulse control, then targeting the disorder through health care treatment may reduce the likelihood of subsequent offense and contact with the juvenile justice system. As a result, increased availability of mental health and substance use treatment programs may be an effective means by which to reduce crime. Among substance users, if consumption directly causes crime, then another way to lower crime would be to lower consumption. Indeed, a number of studies have shown that crime can be reduced by raising prices of drugs or alcohol.²⁹⁻³³

Using data on a group of at-risk teenagers in Colorado, we examine the effectiveness of mental health and substance abuse treatment in reducing juvenile crimes. This study also focuses on the effectiveness of increased access to treatment for substance abuse and mental illness and higher alcohol prices in reducing crime. As described in detail below, we focus on improved access to treatment and higher alcohol prices since policy makers can easily manipulate the demand for treatment and the demand for alcohol through policy changes, for example, through changes in public health insurance programs or higher excise taxes on alcohol.

Background

There has been very little research examining the effectiveness of mental health treatment in preventing crime by youths, although some forms of intensive treatment, such as multisystemic therapy (MST), have been studied. MST has been shown to have beneficial effects and reduce rates of subsequent arrests, psychiatric symptomatology, and drug use for youth with serious antisocial behavior.^{34,35} Another program, Functional Family Therapy (FFT) has also been demonstrated to reduce delinquency among youth with mental health and substance use disorders,³⁶ as has Multidimensional Treatment Foster Care.³⁷ Although these programs have been tested in randomized trials, thereby dealing with the problem of sample selection, these studies have been limited to small study populations with serious disorders in controlled environments. Broader effectiveness of less intensive mental health services on youth crime has not been established.

There are a number of studies focusing on substance abuse treatment in reducing crime, but this literature applies mostly to adults. Among numerous different treatment programs for substance abuse, most evaluation studies have focused on four primary types: methadone maintenance, therapeutic communities, outpatient drug free programs, and civil commitment programs. Methadone maintenance programs, which provide methadone to drug-dependent individuals as an oral substitute for heroin, have been shown to be successful in reducing both drug consumption and crime.³⁸⁻⁴¹ Therapeutic communities are residential drug and alcohol treatment facilities designed with the goal of helping the individual maintain a drug-free lifestyle. Programs include encounter group therapy and education sessions. Such therapy has also been shown to be successful in reducing arrests.^{42,43}

Outpatient drug-free programs, which provide counseling and training in social skills, seem to be less effective in reducing crime than other types of programs. For example, Hubbard *et al.*⁴⁴ report that the same proportion of clients engaged in illegal activities before and after treatment. Finally, a number of researchers have examined the effectiveness of civil commitment programs. Typically, a drug addict will be ordered by the court to complete one of these programs as an alternative to prison. Results of studies on the effectiveness of these programs typically show a reduction in arrests after treatment.⁴⁵⁻⁴⁷

In a more general study that does not focus on a specific treatment, Saffer *et al.*⁴⁸ look at the impact of state-level expenditures for drug treatment facilities on illicit drug consumption and finds that higher levels of expenditures are associated with reduced drug use. These expenditures include money spent on hospital facilities operated by state or local governments, and payments to private facilities. Saffer⁴⁹ examines the impact of state-level expenditures for drug control activities on crime. Drug control activities include police, courts, prosecution, public defense, education, and drug treatment. He finds that states which spend more per capita on drug control activity have lower

arrests, lower reported property damage and fewer individuals selling drugs.

Jofre-Bonet and Sindelar⁵⁰ also examine the impact of unspecified types of drug treatment programs in reducing crimes. This study follows a sample of inner-city drug users through treatment for drug and alcohol addiction, and relates the changes in drug use to changes in income-generating crimes. They find that reductions in drug use are strongly related to reduction in crime, and suggest that treatment which lowers drug use may be an effective tool for reducing crime.

In short, treatment programs appear to be effective in lowering crime. However, the existing literature tends to focus on limited samples of adults or restricted geographic areas. It also ignores crime prevention and treatment of substance abuse with comorbid mental illness. Further, the studies primarily fall into two main types: those which look at rates of criminal behavior by substance abusing individuals before and after treatment, and those comparing a control group of criminals to a treatment group of criminals. One drawback to the first type of study design is that it is difficult to attribute behavioral changes to the program or the passage of time. Both types may also suffer from biases in sample selection, and the results may not be applicable to a larger youth population.

Methods

Data

The above literature review suggests an empirical model where crime is determined in part by drug and alcohol consumption and poor mental health. If treatment for substance abuse or mental health problems is successful, then such treatment may also reduce criminal activities. We test this hypothesis by estimating a model of crime for a group of at-risk teenagers who are in the Colorado child welfare system (i.e. foster care). We then test a separate model for violent crimes only. The child welfare population is an interesting and relevant population to study because the majority of the children in foster care programs across the country come from abusive or neglectful homes, and as a result, these children exhibit more chronic medical, emotional, and psychological problems than other youth.⁵¹ These children are considered at-risk for criminal behaviors because of the link between mental health and substance abuse problems and crime as discussed above.

Our sample consists of youth who received services from the child welfare system at any time over a three-year period. The child welfare encounter data come from the Colorado Division of Child Welfare and contain records for all youth ages 13 to 18 who received child welfare services in Colorado between July 1994 and June 1997, although the youth in this sample are not necessarily continuously in the child welfare system over this time period. These data include date of entry, age, gender, race, ethnicity, and county of residence. Note that more than three quarters of youth are

receiving child welfare services in their own homes, not out-of-home in foster homes or group homes.

Data on crime come from the Department of Youth Corrections (DYC), which collects information on all youths who are detained. Crime in this study is measured by youth who are arrested and specifically detained by the Colorado Division of Youth Corrections. Their cases are not necessarily adjudicated and may not lead to sanctions. Therefore, our measure of crime is more restrictive than arrests, but less restrictive than sanctioning or commitment. The DYC data contain date of detention and release, as well as offense type. A wide range of offenses is recorded in the system, including violent crimes, property crimes, drug crimes, sex crimes, minor crimes, and status offenses. We exclude detentions due to status offenses and drug offenses, including possession or distribution of controlled substances. For analyses of violent crime, we use detentions for murder, rape, assault, and robbery offenses. In our sample, 19.6 percent of youths are detained by the Department of Youth Corrections at least once during the three-year sample period, and 3.3 percent are detained for violent offenses. When an individual was observed to have multiple detentions, only the initial spell up to the first observed detention was included in the analysis. Consequently, we do not address the issue of recidivism in this study.*

Children in foster care are entitled to benefits under Medicaid, and these benefits include treatment for emotional disorders. Medicaid claims and encounter data provide the information on mental health and substance abuse treatment for the teenagers in our sample.† These data include dates of treatment service and treatment type. Treatment type includes outpatient treatment (including individual and group therapy, crisis and evaluative services, case management, day treatment programs) and services in therapeutic residential treatment facilities. In our sample, 49 percent of youths receive some form of outpatient or residential treatment for mental health or substance abuse at least once during the three-year sample period.

All datasets contain individual-level, encrypted identifiers. Teenagers in the child welfare system during the study period were matched to their Medicaid and detention records using the identifiers. The sample is composed of 6,088 youths. The mean characteristics of the sample are shown in **Table 1**.

Measures

Dependent Variable

Our dependent variables are indicators for whether a youth was detained for any offense and whether a youth was

* The proportion of youth observed to have multiple detentions during our study period is under 10 percent.

† Services that are reimbursed through the state's behavioral health managed care contracts are reported using "encounter data," while services reimbursed under fee-for-service contracts are reported using claims. The Medicaid encounter and claims data were analyzed over a year after the state submission deadline, allowing time for delayed records to be processed.

Table 1. Mean Values

	All Youth	Detained Youth	Non-Detained Youth
Mean Area Treatment Rate	14.5% (0.4)	14.9% (0.4)	14.4% (0.4)
Avg. County Beer Price (\$/six pack)	4.26 (.21)	4.20 (.19)	4.28 (.22)
Individual-level Characteristics			
Received treatment over study period	48.8%	56.7%	47.7%
Age 13 to 14 (reference group)	60.7%	62.2%	60.3%
Age 15 to 16	34.5%	34.9%	34.4%
Age 17 and up	4.8%	2.9%	5.3%
Male	49.0%	68.3%	44.3%
Female (reference group)	51.0%	31.7%	55.7%
White	77.4%	71.2%	78.9%
Black	12.0%	18.2%	10.4%
Other Race (reference group)	10.6%	10.6%	10.7%
Hispanic	28.2%	35.1%	26.5%
Non-Hispanic (reference group)	70.8%	64.9%	73.5%
N (subjects)	6,082	1,191	4,891
N (person months)	82,228	9,866	72,362

Note. Standard Deviations for continuous variables in parentheses

detained for a violent offense only. Data for each individual are aggregated to monthly discrete observations. Consequently, the detention variable takes on a value of 1 if that individual was detained in the respective month and zero if not. Similarly, we aggregate detention for violent offenses by month. Individuals are assumed to occupy only two states, detention-free and detained. The transition rate from one state to the other is the probability of leaving the detention-free state at any time period, given that the individual is not detained up to that time period.

Key Independent Variables

The provision of mental health and substance abuse treatment is our primary explanatory variable of interest. Treatment months is defined as the number of months which an individual was treated in the current or previous two months (i.e., treatment months ranges from zero to three).^{*} Treatment includes outpatient treatment as well as treatment in a therapeutic residential treatment facility (group home). Only youth hospitalized as inpatients (in acute, general and psychiatric hospitals or state mental hospitals) are considered censored at the time of admission as they are not at risk of being detained while in the hospital. None of the treatment

* Models were tested which include treatment up to five months prior. Results are discussed below, but lags past two months are statistically insignificant and are therefore excluded.

visits recorded in this data results from a court-ordered sentence.

Estimating this model will show the propensity of treatment to reduce crime, although a problem will arise if the decision to receive mental health or substance abuse treatment is influenced by the same individual characteristics as the decision to commit a crime. In this case, treatment will be correlated with unobserved omitted variables and will therefore be endogenous, resulting in a biased coefficient. In order to correct for this potential endogeneity, we first use an estimation strategy that accounts for unobserved individual heterogeneity. Details are described below. A second method of avoiding the problems associated with the endogeneity of treatment is to estimate a model of crime that substitutes for treatment those variables that are correlated with treatment, but not crime directly. This is in the same spirit as the crime and substance use papers by Cook and Moore⁵² and DeSimone³² that relate the prices of drugs and alcohol directly to crime. In our case, ideally the price of treatment would serve as such a variable given that a number of studies have shown that the demand for mental health and substance abuse services is responsive to price.⁵³ However, since all children in foster care are eligible for Medicaid, the monetary price of treatment faced by each individual is zero and does not vary. Instead, we use a measure of the full price of treatment, which includes travel and waiting times. This can be represented by county-level treatment rates, calculated as the proportion of all children in foster care who are treated in

the given month, that capture the availability of treatment. We expect that as county treatment rates rise, the full price of treatment falls.*

In a model where crime is determined in part by alcohol consumption, substance abuse treatment may not be the only determinant of alcohol consumption. A number of studies have shown that the consumption of alcohol varies with its price.^{52,54} We include the price of beer in all models to gauge the effectiveness of higher beer prices in reducing crime, holding treatment constant.† Beer prices are available for a number of different cities across Colorado. These data are published quarterly from the American Chamber of Commerce Research Association. Each individual in the sample is assigned a beer price based on the county of residence.

Control Variables

Explanatory variables that do not change over time include demographic variables. Age by category (age 13 to 14, age 15 to 16, and 17 or older) is defined as the age when the individual is first observed, that is, at entry into the child welfare system. We also control for race (whether the individual is white, black, with other races as the reference category) and for whether the individual is Hispanic or not. Month dummies are included for each unique month/year which constitutes the baseline hazard.

Data Analytic Procedures

Duration models are used to examine the structural determinants of detention. These models analyze the decision to make a transition from one discrete state to another. We estimate the conditional probability that an individual observed in the first period (month) will be detained in a subsequent period (month). In particular, we estimate the extent to which characteristics of the individual, alcohol prices, and treatment affect the length of time spent detention-free. Therefore, these methods will quantify the impact of changes in the determinants of detention on the conditional probability of being detained. The starting hazard rate is the probability of being detained in period t , conditional on not being detained prior to t . The starting hazard should rise and fall over time in response to different stimuli. In particular, the results will show how changes in prices of alcohol and the provision of treatment affect length of time an individual remains detention-free.

We model duration using several specifications. The unit of analysis is a spell, which may be right-censored. Right-

censoring occurs if we do not observe an individual being detained during the study period, if the youth is treated as an inpatient in a hospital, or turns 18. Within each spell we observe from 1 to 36 spell months. Conditional exit probabilities in each spell month depend on observed fixed and time-varying covariates. We use maximum likelihood estimation whereby the log likelihood is given by Eq. (1):

$$\log L = \sum_{i=1}^n \{y_i \log h(X_i) + (1 - y_i) \log [1 - H(X_i)]\}, \quad (1)$$

where y_{it} is an indicator variable equal to one if person i exits the state during the interval $[t-1, t]$, $h(\cdot)$ is the density function and $H(\cdot)$ is the cumulative distribution function. The first term is the contribution of an individual who is detained during the study period and the second term is the contribution of an individual who is not detained.

We use a semi-parametric estimation procedure, the complementary log-log specification of Prentice and Gloeckler.^{55*} This is a semi-parametric model, where we estimate a fully non-parametric baseline hazard with a separate parameter for each duration interval. That is, we assume the form of the baseline hazard is a step function with a step at each interval. Unlike a parametric approach, such as a Weibull specification, in this method it is unnecessary to make parametric assumptions concerning the hazard's time dependency that can lead to inconsistent coefficient estimates if the parameterization fits the data badly.

In addition, we estimate a model that incorporates unmeasured heterogeneity, also called frailty. Unmeasured heterogeneity leads to overstated duration dependence (i.e., underestimates of the extent to which the hazard rate increases with duration) and attenuates the magnitude of the impact of covariates on the hazard rate.⁵⁶⁻⁵⁸ Without accounting for unobserved heterogeneity, the results may be biased. We incorporate a gamma mixing distribution to capture unobserved heterogeneity as proposed by Meyer⁵⁹ and Jenkins.⁶⁰

Results

Table 2 presents the effect of treatment months, beer prices and other covariates on the duration hazard. The result table shows exponentiated coefficients or hazard ratios. Values greater than one indicate that the covariate increases the exit probability (increase the likelihood of being detained) while values less than one decrease the exit probability. Column 1 shows that black youth have significantly higher probabilities of exiting into detention (i.e., their detention-free spells are shorter) than other races, as do Hispanic youth and youth who are older. In addition, males have higher exit probabilities than females. The demographic patterns are consistent with evidence from FBI arrest data.⁶¹ The key policy variables in

* Treatment rates are calculated based on the entire sample of youth, not just those detained by the Department of Youth Corrections. The county rate serves as a valid measure of availability of services since it is unlikely that any one individual's behavior will influence the county treatment rate.

† The price of beer is chosen because beer is the most popular alcoholic beverage among youths, and is the most prevalent beverage associated with crime. In surveys of local prison inmates and adults on probation, beer is reported to have been consumed alone or in conjunction with other types of liquor in approximately 80 percent of criminal cases in which any type of alcohol was consumed.²⁰

* It is implemented using `pgmhaz` command in Stata (Version 7).

Table 2. Proportional Hazard Model of Detention for all Offense Types

	No Heterogeneity			Gamma Heterogeneity
	(1)	(2)	(3)	(4)
Treatment months (# of months treated in past 3)	0.87 (0.81-0.94)**		0.83 (0.77-0.91)**	
Treatment Rate		0.03 (0.00-0.29)**		0.03 (0.00-0.31)**
Average County Beer Price	0.59 (0.44-0.81)**	0.69 (0.51-0.94)*	0.61 (0.43-0.85)**	0.70 (0.50-0.98)*
White	0.69 (0.57-0.85)**	0.69 (0.57-0.84)**	0.65 (0.51-0.84)**	0.66 (0.52-0.83)**
Black	1.28 (1.02-1.59)*	1.26 (1.01-1.57)*	1.44 (1.08-1.93)*	1.36 (1.04-1.79)*
Hispanic	1.68 (1.47-1.92)**	1.70 (1.48-1.94)**	1.84 (1.55-2.20)**	1.81 (1.54-2.13)**
Male	2.63 (2.33-2.98)**	2.61 (2.31-2.95)**	3.22 (2.77-3.74)**	3.05 (2.63-3.55)**
Age 15 to 16	1.25 (1.10-1.40)**	1.28 (1.14-1.44)**	1.27 (1.09-1.48)**	1.28 (1.11-1.48)**
Age 17 and up	1.72 (1.23-2.41)*	1.73 (1.25-2.39)*	1.48 (0.99-2.19)	1.54 (1.07-2.24)*
Number of records	82,228	82,228	82,228	82,228
Number of subjects	6,088	6,088	6,088	6,088
Log likelihood	-6,065	-5,980	-6,038	-5,963
Gamma variance			2.01	1.28
Std error of gamma variance			(0.33)**	(.26)**

Note: 95% confidence intervals in parenthesis

* Significant at p>.05 level

** Significant at p>.01 level

Coefficients on time dummies not shown

this analysis also behave as predicted. Youth who receive mental health or substance abuse treatment have significantly lower probabilities of exiting into detention (i.e., their spells are longer). Receiving treatment is associated with a 13 percent decline in the detention hazard per month in treatment. Beer prices also have significant, negative effects on exit into detention, lowering the hazard by 41 percent for every dollar increase in the beer price. Note that a dollar increase in the price of a six-pack of beer represents a 24 percent increase in the average price.

Column 2 uses county treatment rates, the proxy for price of treatment, rather than individual treatment. Coefficients on the demographic variables are similar to Column 1. The hazard rate is less than one and is statistically significant. This implies that youth in counties with higher treatment rates have lower conditional exit probabilities consistent with the prediction that increased availability of treatment improves access and lowers crime. The coefficient on beer prices remains statistically significant and implies a lower probability of exit (a longer period detention free).

Columns 3 and 4 of **Table 2** present estimates from models that incorporate unmeasured heterogeneity. We compare the models with and without heterogeneity terms by testing the significance of the variance parameter in the gamma distribution and by the likelihood ratio test. We find that introducing the heterogeneity terms improves the model fit. The estimated Gamma variance has a z-value of 6.09 (p-value < 0.01) and 4.91 (p-value < 0.01) in each model, while the likelihood ratio statistic for testing the models is 38.05 ($\chi^2 < 0.01$) and 33.84 ($\chi^2 < 0.01$), respectively.

The magnitude of the effect of individual treatment is slightly greater in the model with heterogeneity. Having received treatment lowers the hazard by 17 percent. The demographic patterns are similar in the two models. Results that including unobserved heterogeneity show that males and youth of older ages have higher detention exit rates. In both models, beer prices reduce the detention hazard. Similarly, in column 4, when accounting for unobserved heterogeneity, treatment rates and beer prices both are statistically significant and lower the probability of exit into detention. In all four of the above models, the coefficients on the duration dummy variables (not shown) indicate that the pattern of variation of the baseline hazard with duration is not monotonic.

We ran separate models by gender of the effect of treatment months on detention. We found the effect of treatment months to be similar although somewhat larger in magnitude for boys (19 percent) than for girls (13 percent) (results not shown). Separately, to assess persistence of the treatment effect, we tested models that include a variable measuring treatment during the past three to five months (results not shown). Although treatment during the lagged three to five month period lowered the detention hazard, the coefficient was not statistically significant.

The effect of covariates on the hazard of detention for a violent offense are reported in **Table 3**. We find that receipt of treatment has statistically significant attenuating effect on detention hazards (column 1), while beer prices have a larger effect than in previous models. Treatment is associated with

a 22 percent decline in the hazard per month of treatment, while a dollar increase in beer prices is associated with an 81 percent decline. In contrast to previous models, in models of violent offenses only, the effect of treatment rates is no longer significant (column 2). The effect of beer prices remains statistically significant in column 2.

For violent offenses we also assessed the persistence of the treatment effect by testing models that include a variable measuring treatment during the past three to five months (results not shown). Treatment during the lagged three to five month period lowered the detention hazard, but the coefficient was not statistically significant.

As for all offenses, we find that introducing the heterogeneity term improves the model fit of violent offences. The estimated Gamma variance has a z-value of 5.07 (p-value < 0.01) and 1.92 (p-value < 0.10) in each model, while the likelihood ratio statistic for testing the models is 5.07 ($\chi^2 < 0.05$) and 5.06 respectively ($\chi^2 < 0.01$). Models of detention for violent offenses that incorporate unmeasured heterogeneity also show negative effects of mental health and substance treatment and beer prices on the detention hazard for violent offenses (column 3). In contrast to models of all offense types models, the effect of county treatment rates is not significant for violent offenses, although the effect of beer prices remains negative and significant (column 4).

Discussion and Implications for Policy

This study examines the association of mental health and substance abuse treatment with reductions in detention rates for juveniles in the Colorado child welfare system. This is an important group of youth to study since they are particularly at risk for engaging in criminal behaviors. The majority of the children in foster care programs across the country come from abusive homes and as a result, these children exhibit more chronic medical, emotional, and psychological problems than other youth. Indeed, our analysis shows high detention rates among this group. Consistent with other youth studies we also find that among youth in child welfare those who are male, black, Hispanic and older were likely to be detained earlier than other youth.

Using duration analyses, we find that substance abuse and mental health treatment can be used effectively to delay or prevent youth detention. Specifically, the analysis finds that individuals who receive treatment have lower probabilities of being detained for any offence. It is possible that youth in residential treatment facilities commit fewer crimes because of close monitoring rather than because of improvements in mental health. Such monitoring could lead to fewer crimes, but it may also lead to more detection conditional on a crime being committed.

Similarly, those youth who live in areas with greater treatment availability also have a lower probability of exiting into detention. Accounting for the unobserved heterogeneity makes the magnitude of these effects larger. Also consistent with our theory, higher beer prices lower the detention hazard.

Table 3. Proportional Hazard Model of Detention for Violent Offenses Only

	No Heterogeneity			Gamma Heterogeneity
	(1)	(2)	(3)	(4)
Treatment months (# of months treated in past 3)	0.73 (0.59-0.90)**		0.72 (0.57 - 0.91)**	
Treatment Rate		0.34 (0.00-93.8)		0.22 (0.00-79.75)
Average County Beer Price	0.19 (0.09-0.42)**	0.19 (0.09-0.44)**	0.19 (0.08 - 0.46)**	0.19 (0.08-0.46)**
White	0.73 (0.44-1.19)	0.72 (0.44-1.18)	0.66 (0.35-1.25)	0.67 (0.37-1.20)
Black	1.73 (1.04-2.88)*	1.73 (1.04-2.87)*	1.99 (0.99-3.97)*	1.91 (1.01-3.63)*
Hispanic	1.54 (1.09-2.17)*	1.56 (1.11-2.21)*	1.71 (1.10-2.65)*	1.61 (1.07-2.44)*
Male	2.38 (1.77-3.19)**	2.29 (1.71-3.08)**	1.37 (0.94-1.99)**	2.62 (1.82-3.78)**
Age 15 to 16	1.46 (1.09-1.94)*	1.47 (1.10-1.96)**	1.37 (0.94- 1.99)	1.41 (0.99-1.99)
Age 17 and up	2.90 (1.56-5.40)**	2.96 (1.59-5.51)**	3.59 (1.61-8.01)**	3.17 (1.50-6.70)**
Number of records	92,761	92,761	92,761	92,761
Number of subjects	6,386	6,386	6,386	6,386
Log likelihood	-1,381	-1,386	-1,376	-1,384
Gamma variance			13.11	7.95
Std error of gamma variance			(5.17)**	(4.14)*

Note: 95% confidence intervals in parenthesis
 * Significant at p > .05 level
 ** Significant at p > .01 level
 Coefficients on time dummies not shown

In examining the determinants of detention for violent offences, we show that individuals who receive treatment have lower probabilities of being detained, however, the availability of treatment in the area does not impact the length of time out of detention. The effect of higher beer prices is negative and particularly strong. Given the often cited high correlation between alcohol use and aggression, this last result is not surprising and implies that higher beer prices will reduce both consumption and violent criminal behaviors.

The results of the study are limited by the fact that we can not identify the effectiveness of specific mental health or substance abuse treatment components or the treatment dose. Furthermore, higher beer prices and greater treatment availability may be associated with other characteristics of an area that may explain lower detention rates. In addition, the analysis is conducted on a specialized sample of foster care youth in Colorado and results may not be generalizable.

Addressing the limitations of this study provides direction for future research. The first steps would include examining the effects of mental health and substance abuse treatment on crime among all youth, and on the propensity for recidivism. A finer partition of treatment types might also prove to have implications for crime reduction policies. In addition, the effect of type of foster care placement was not examined here, but should be a focus of future research. Despite these limitations, the group of foster care children examined here has a high rate of criminal involvement and may be relatively easy to target for public policies because they are already in a public system. Results of this study suggest that expansion of health services targeted at these youth may be effective at reducing crime. For violent crime, where the literature shows that substance abuse plays a significant role, stricter alcohol-regulatory policies may also be highly effective.

Acknowledgements

This paper has benefited from discussions at the International Health Economics Association Conference, 2003, San Francisco.

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