Substance Use and Disorder, Involvement in the Drug Trade, and Mortality: A longitudinal study of delinquent youth

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ABSTRACT

Delinquent youth have a greater risk of premature violent death than adolescents in the general population. Involvement in the drug trade and substance use and disorder may be important risk factors for mortality among teens. This paper examines risk factors for premature violent death. We use data from the Northwestern Juvenile Project, a longitudinal study of 1,829 youth who entered the Cook County Juvenile Temporary Detention Center between 1995 and 1998. We investigate three questions: (1) Compared to the general population, do delinquent youth continue to have a higher risk of mortality? (2) Does risk of premature mortality vary by gender, race/ethnicity and age? (3) Are alcohol disorder, drug use, and involvement in the drug trade associated with premature violent death? We found that delinquent youth have higher rates of mortality compared to the general population, irrespective of gender and race/ethnicity. Elevated mortality rates continue into young adulthood, especially in Hispanic males. We also found that early life involvement in the drug trade is a robust risk factor for mortality, net of demographic characteristics and other risk factors.

EXTENDED ABSTRACT

Background

Youth involved in the criminal justice system are at greater risk for early violent death than those in the general population (Lattimore et al. 1997; Teplin, McClelland, et al. 2005). Previous research has also found that selling drugs is associated with violent victimization. For example, Kacanek and Hemenway (2006) found that incarcerated young adults who had sold crack cocaine prior to incarceration were more likely to have been shot than other incarcerated

young adults. Alcohol use and drug use are also significant risk factors for premature violent death and injury (Hser, et al. 2001; Hamrin, Jonker & Scahill 2004; Cunningham, et al. 2009).

This is the second paper on mortality among participants in the Northwestern Juvenile Project. The first paper compared mortality rates to those of the general population, examining key demographic subgroups: gender, race/ethnicity and age. In this paper, we investigate three questions: (1) Compared to the general population, do delinquent youth continue to have a higher risk of mortality in adulthood? (2) Does risk of premature mortality vary by gender, race/ethnicity and age? (3) Are alcohol disorder, drug use, and involvement in the drug trade associated with premature violent death?

Data

Sample Data. Data are from the Northwestern Juvenile Project, a longitudinal study of health needs and outcomes of delinquent youth (Teplin, Abram et al. 2002; Abram, Teplin et al. 2003; Teplin, Mericle et al. 2003).

Baseline Interviews. We recruited a stratified random sample of 1829 youth initially arrested and detained between November 20, 1995, and June 14, 1998, at the Cook County Juvenile Temporary Detention Center (CCJTDC) in Chicago, IL. The CCJTDC is used for pretrial detention and for offenders sentenced for fewer than 30 days. Nearly 90% of detainees at CCJTDC were male and most were racial/ethnic minorities. We stratified our sample by age (10-13 years or ≥14 years), gender, race/ethnicity (African American, non-Hispanic white, and Hispanic), and legal status (processed as a juvenile or an adult). To ensure adequate representation of key subgroups, we oversampled certain strata (e.g. females, Hispanics). Males make up 64.1% of the sample (see Table 1). Over half of the sample are African

Americans (54.9%), over one quarter of the sample are Hispanic (28.6%) and 16.2% of the sample are non-Hispanic whites (see Table 1). Additional information on our methods has been published elsewhere (Teplin, Abram et al. 2002; Abram, Teplin et al. 2003; Teplin, Mericle et al. 2003).

Follow-up Interviews. Follow-up interviews occurred three years after the baseline interview. The risk factors assessed in this paper (e.g. involvement in the drug trade, alcohol disorder, drug use) were measured at the follow-up interview. Participants were reinterviewed in the community, or, if incarcerated, at their correctional facility. Respondents' deaths were tracked throughout the study period and verified by official county records. Because the risk factors of interest were assessed for the first time at the three year follow-up, we estimated the relationship between these risk factors and mortality subsequent to the three year follow-up.

We analyze data provided by the 1751 respondents who completed the first follow-up interview. Ninety-six deaths occurred between baseline and November 1, 2009 (5.2 percent of the original sample, as shown in Table 1). Of these, 34 deaths occurred prior to the three year follow-up, and 62 deaths occurred after the three year follow-up.

Population Data. Population counts by age (15-29), gender, and race/ethnicity are from the Census 2000 Summary File 1 for Cook County, Illinois (U.S. Census Bureau, 2001). Vital Statistics from the Multiple Cause of Death Public Use Files, 2000-2002 are used to estimate death rates in Cook County for the year 2000 (U.S. Department of Health and Human Services, 2002).

Methods

Mortality rates. We estimated death rates in the Cook County community population using the single decrement period life table method. In the delinquent population, mortality rates were estimated using multiple decrement life tables (${}_nd_x^1$=persons dying in the age interval; ${}_nd_x^2$=persons censored in the age interval) (Preston et al., 2001). We used a censoring date of November 1, 2009 to estimate mortality rates for the delinquent population. Data were weighted to reflect the population at the CCJTDC. Because selected strata were oversampled, we used sample weights, based on CCJTDC's demographic characteristics, to estimate prevalence rates and associated standard errors that reflect CCJTDC's population. Taylor series linearization was used to estimate standard errors. (Cochran 1977; Levy and Lemeshow 1999).

Mortality Risk Factors. We estimated the relationship between involvement in the drug trade, illicit drug use, alcohol disorder and subsequent mortality among delinquent (NJP) youth using weighted Cox proportional hazards regression. Regression covariates measured at baseline included gender, race/ethnicity, age, and detention status (adult v. juvenile). Covariates measured at the three year follow-up interview included lifetime drug dealing, dealing drugs in the past three months, , lifetime *use* of illicit drugs other than marijuana (narcotics, opiates, etc), and alcohol use *disorder* in the past 12 months, lifetime gun use, lifetime gang membership, and current gang membership . We include variables for gun use and gang membership in the analysis in order to estimate the relationship between our risk factors of interest and mortality net of these confounding factors that are also associated with violence.

Preliminary Results

Our preliminary findings suggest that compared to the general population, delinquent youth have a greater risk of mortality throughout adolescence and in adulthood. Table 2 shows standardized mortality rates for the NJP population, the standardized rates for Cook County, and their corresponding risk ratio. Mortality rates for the formerly delinquent population were generally higher than those for the community. Among persons age 15 – 19, the mortality rate was nearly four times the expected rate. Males age 15 – 19, African American males age 15 – 19, Hispanic males age 15 – 19, and non-Hispanic males age 15 – 19 all had significantly higher mortality rates than their corresponding general populations. In addition, Hispanic males in older age groups – ages 20 – 24 and ages 25 – 29, also had a significantly higher risk of mortality than the general population.

Despite delinquent females having lower mortality rates than the males, they still had significantly higher risk of mortality than those in the general population. Females aged 15 – 19 and 20 – 24 had more than three times the risk of mortality compared to the general population; females age 25 – 29 had more than two and a half times the risk. African American females overall, particularly those ages 15 – 19, were also more likely to die than those in the general population. Hispanic females had more than ten times the expected rate of mortality. There were too few deaths among non-Hispanic white females and within specific age categories for Hispanic females to estimate reliable mortality rates for these groups.

Figure 1 shows prevalence rates of the causes of death. Most deaths among delinquent youth are due to homicide, specifically, homicide involving a firearm (83% of delinquent

population). This is true for all age groups and among males, African Americans, and Hispanics (not shown).

Are high rates of premature violent death in the delinquent population associated with involvement in the drug trade? We found that by their three year followup interview, 88.4% of delinquent males and 53.5% of delinquent females had reported selling drugs. Table 3 shows that, net of demographic characteristics, those with a lifetime history of drug dealing have a hazard of mortality 4.76 times greater than those who never sold drugs ($p < .05$). Drug dealing during the three years after detention, gang involvement, and alcohol use disorder were also significantly associated with mortality. Even after controlling for multiple risk factors, lifetime involvement in the drug trade remained significantly associated with a greater risk of mortality. Delinquent youth with alcohol use disorder in the past 12 months had a hazard of mortality 3.6 times greater than youth without alcohol disorder (see Table 3). The relationship between alcohol disorder and mortality remained strong and statistically significant even after adjusting for the presence of other risk factors. We found almost no association between illicit drug use and mortality. Gang involvement and past year alcohol use disorder were also significantly associated with mortality, net of other risk factors.

Comment

This paper adds needed information on the relationship between risk factors experienced by delinquent youth and mortality in this at-risk population. Prior studies of death have relied on death *records*, which contain information only on alcohol and drug toxicity (not disorder), and no information on critical risk factors such as involvement in the drug trade and gang membership. This is the first large scale longitudinal study to demonstrate that alcohol

use disorder and past involvement in the drug trade is associated with a greater risk of mortality in delinquent youth. These relationships persisted even taking into account other risk factors such as gang involvement (which is also associated with the drug trade and violence), and substance use and disorder. Our findings have substantial implications for the development of public health policy and the provision of innovative interventions in the juvenile justice system.

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Tables and Figures

Figure 1. Cause of death by age at death (NJP, n=96), weighted

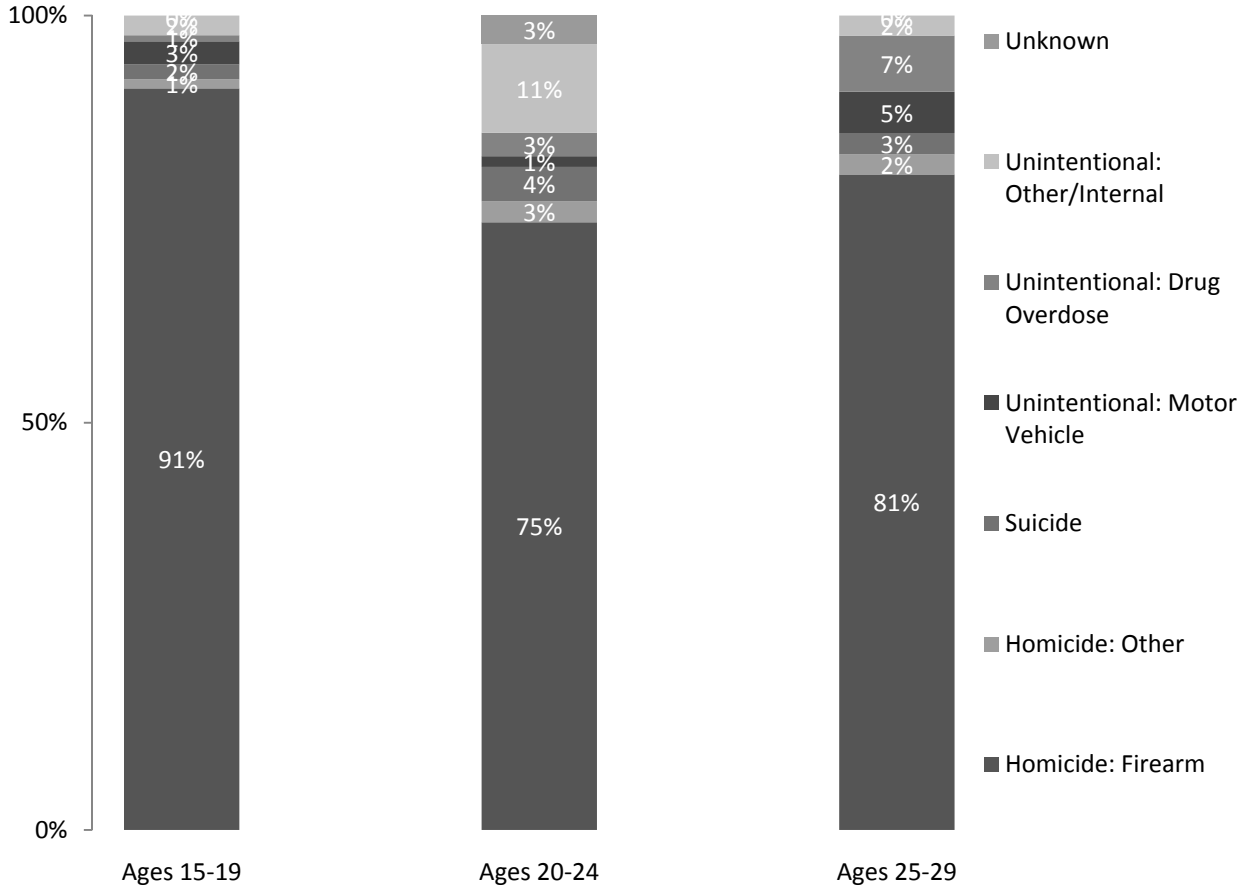
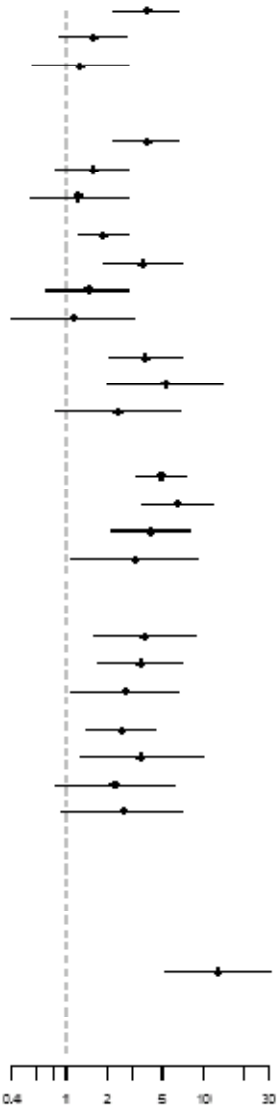


Table 1. Unweighted Demographic Characteristics and Numbers of Deaths in a Sample of Delinquent Youth (N = 1829)

	No. (%)		No. Died
All	1829	(100.0)	96
Sex			
Male	1172	(64.1)	76
Female	657	(35.9)	20
Race/Ethnicity			
African American	1005	(54.9)	47
non-Hispanic white	296	(16.2)	14
Hispanic	524	(28.6)	35
Other	4	(0.2)	0
Legal Status at Detention			
Processed in adult court	275	(15.0)	12
Processed in juvenile court	1554	(85.0)	84
Male			
Race/Ethnicity			
African American	575	(31.4)	35
non-Hispanic white	207	(17.7)	12
Hispanic	387	(33.0)	29
Other	3	(0.3)	0
Age at baseline interview			
10-13 y	309	(26.4)	15
14-16 y	788	(67.2)	58
17+ y	75	(6.4)	3
Age at death			
15 - 19 y	--		35
20 - 24 y	--		27
25 - 29 y	--		14
30 - 34 y	--		0
Female			
Race/Ethnicity			
African American	430	(65.4)	12
non-Hispanic white	89	(13.5)	2
Hispanic	137	(20.9)	6
Other	1	(0.2)	0
Age at baseline interview			
10-13 y	60	(3.3)	0
14-16 y	562	(30.7)	18
17+ y	35	(1.9)	2
Age at death			
15 - 19 y	--		6
20 - 24 y	--		9
25 - 29 y	--		5
30 - 34 y	--		0

Table 2. Standardized Mortality Rates Comparing NJP to Cook County

	Delinquent Population			Cook County Population					
	Rate[a]	95% CI (BS)		Rate[b]	95% CI		Ratio	95% CI[e]	
Total									
15 - 19 y	697	(337,	1056)	178	(149,	207)[c,d]	3.9	(2.3, 6.7)	*
20 - 24 y	623	(277,	970)	393	(344,	443)[c,d]	1.6	(0.9, 2.8)	
25 - 29 y	407	(81,	733)	322	(277,	368)[c,d]	1.3	(0.6, 2.8)	
Males									
15 - 19 y	738	(356,	1120)	189	(157,	220)[c,d]	3.9	(2.3, 6.7)	*
20 - 24 y	654	(273,	1034)	418	(365,	471)[c,d]	1.6	(0.9, 2.8)	
25 - 29 y	418	(73,	763)	340	(291,	389)[c,d]	1.2	(0.5, 2.8)	
African American	650	(376,	924)	347	(317,	379)	1.9	(1.2, 2.9)	*
15 - 19 y	757	(276,	1238)	207	(171,	249)	3.7	(1.9, 7.1)	*
20 - 24 y	687	(221,	1154)	480	(417,	550)	1.4	(0.7, 2.9)	
25 - 29 y	437	-(8,	883)	394	(337,	459)	1.1	(0.4, 3.1)	
non-Hisp white	388	(153,	623)	102	(89,	115)	3.8	(2.1, 7.1)	*
15 - 19 y	412	(29,	794)	78	(58,	102)	5.3	(2.0, 13.9)	*
20 - 24 y	312	-(17,	640)	131	(106,	160)	2.4	(0.8, 7.0)	
25 - 29 y	---	---	---	98	(78,	118)	---	--- ---	
Hispanic	601	(366,	837)	122	(106,	139)	4.9	(3.3, 7.5)	*
15 - 19 y	773	(352,	1195)	118	(91,	152)	6.5	(3.6, 11.9)	*
20 - 24 y	622	(225,	1020)	147	(118,	181)	4.2	(2.2, 8.3)	*
25 - 29 y	319	-(17,	655)	100	(77,	128)	3.2	(1.1, 9.4)	*
Females									
15 - 19 y	181	(34,	329)	48	(36,	64)[d,f]	3.7	(1.8, 8.9)	*
20 - 24 y	254	(88,	420)	73	(57,	92)[d,f]	3.5	(1.7, 7.1)	*
25 - 29 y	253	(30,	476)	94	(76,	116)[d,f]	2.7	(1.1, 6.7)	*
African American	217	(93,	341)	85	(71,	100)	2.6	(1.4, 4.8)	*
15 - 19 y	188	(5,	370)	53	(36,	76)	3.5	(1.3, 10.0)	*
20 - 24 y	190	(5,	375)	85	(61,	114)	2.2	(0.8, 6.2)	
25 - 29 y	307	(3,	611)	119	(91,	151)	2.6	(0.9, 7.2)	
non-Hisp white	---	---	---	39	(32,	48)	---	--- ---	
15 - 19 y	---	---	---	35	(22,	53)	---	--- ---	
20 - 24 y	---	---	---	50	(36,	69)	---	--- ---	
25 - 29 y	---	---	---	34	(23,	47)	---	--- ---	
Hispanic	330	(60,	599)	26	(18,	35)	12.9	(5.4, 30.9)	*
15 - 19 y	---	---	---	35	(20,	57)	---	--- ---	
20 - 24 y	---	---	---	28	(15,	48)	---	--- ---	
25 - 29 y	---	---	---	15	(7,	30)	---	--- ---	



--- We do not report racial/ethnic or age specific rates for groups with 3 or fewer deaths in the delinquent population.

* Statistically significant difference in mortality rates, $p < 0.05$.

CI = Confidence Interval

BS = Bootstrap

a. Deaths per 100,000 person-years.

b. Deaths per 100,000 persons in Cook County, 2000.

c. Confidence interval based on normal approximation to Poisson distribution (sum of independent Poissons).

d. Crude mortality rates across racial/ethnic categories weighted to reflect the racial/ethnic distribution of the CCJTDC.

e. Standard error estimated via the delta method.

f. Confidence interval based on exact Poisson distribution (sum of independent Poissons).

Table 3. Regression of Mortality on Risk Factors: Proportional Hazards Ratios (NJP, n=1751)

Covariate	PH model with demographic characteristics only[1]	PH Models with demographic characteristics + single risk factor[2]							PH Models with demographic characteristics + multiple risk factors[2]				
Male v Female	2.78 *	1.67	2.02	1.44	1.96	1.68	2.44 *	1.89	1.25	1.85	1.65	1.13	1.75
Black v White	1.70	1.29	1.62	1.09	1.39	1.46	1.65	2.15	0.97	1.41	1.13	1.28	1.90
Hispanic v White	1.59	1.38	1.72	0.93	1.28	1.47	1.60	1.95	0.94	1.46	1.34	1.24	1.92
Age	1.05	1.08	1.14	1.02	1.07	1.05	1.11	1.07	1.01	1.07	1.08	0.97	1.02
Processed as Adult v Juv	0.59	0.81	0.69	0.88	0.89	0.89	0.82	0.83	0.88	0.76	0.82	0.92	0.78
Sold Drugs Ever		4.76 *							2.75 *		4.85 *	2.64 *	
Sold Drugs Past 3 Mos			2.80 *							2.23			1.73
Gang Ever				2.37 *					4.11 *			3.56 *	
Gang Current					1.52					1.23			1.03
Used Gun Ever						2.07							
Hard Drug Use Ever							0.97				0.84		
Alcohol Disorder								3.60 *				3.41 *	3.46 *

* Indicates statistical significance at the $p < 0.05$ level.

1 Hazard ratios based on n = 96 deaths since baseline. Demographic characteristics are measured at baseline.
2 Hazard ratios based on n = 62 deaths since Fup 1. Risk factors are measured at Fup 1.
3 All hazard ratios are weighted to account for sampling design.