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The Decline Of The Juvenile Death Penalty: Scientific Evidence Of Evolving Norms

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ABSTRACT

In 2003, the Missouri Supreme Court set aside the death sentence of Christopher Simmons, who was 17 when he was arrested for the murder of Shirley Crook. The *Simmons* court held that the "evolving standards of decency" embodied in the Eighth Amendment's prohibition of cruel and unusual punishments barred execution of persons who committed capital crimes before their 18th birthday. This decision was based in part on the emerging legislative consensus in the states opposing execution of juvenile offenders and the infrequency with which the death penalty is imposed on juvenile offenders. The State sought a writ of certiorari, and the case is now before the U.S. Supreme Court. This article presents results of analyses of empirical data on the use of the death penalty for adolescent homicide offenders in state courts in the U.S. since 1990. The data show that, since 1994, when death sentences for juvenile offenders peaked, juvenile death sentences have declined significantly. In particular, the decline in juvenile death sentences since 1999 is statistically significant after controlling for the murder rate, the juvenile homicide arrest rate, and the rate of adult death sentences. This downward trend in juvenile death sentences signals that there is an evolving standard in state trial courts opposing the imposition of death sentences on minors who commit capital offenses.

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Jeffrey Fagan[*] *and Valerie West*[†]

I. INTRODUCTION

Shortly after the U.S. Supreme Court issued its decision in *Atkins v. Virginia*[1] holding that the execution of mentally retarded persons violated the Eighth Amendment, legal scholars, advocates, and journalists began to speculate that the Court would next turn its attention to the question of the execution of persons who were juveniles – below 18 years of age – at the time they committed homicide. Following the *Atkins* decision, four Justices expressed the view that the rationale of *Atkins* also supported the conclusion that execution of juvenile offenders was unconstitutional.[2] A constitutional test of capital punishment for juveniles was inevitable.

The *Atkins* Court held that capital punishment was an unconstitutionally cruel and unusual punishment for the mentally retarded for two reasons. First, the Court concluded that the impairments associated with mental retardation both reduced the culpability of the mentally retarded, making death a disproportionate punishment for them, and created a "special risk of wrongful execution."[3] Second, the Court found that a national consensus had emerged that death is an excessive punishment for the mentally retarded.[4]

As evidence of that national consensus, the Court pointed to the growing number of states that expressly barred the imposition of the death penalty on the mentally retarded: since 1989, when the Court had last considered the constitutionality of executing the mentally retarded,[5] the number of states with such legislation had grown from 2 to 18.[6] In addition, the Court observed that, even in states where the death penalty was theoretically a permissible punishment

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[1] 536 U.S. 304 (2002).

[2] *See In re Stanford*, 537 U.S. 968 (2002) (Stevens, J., dissenting from denial of petition for writ of habeas corpus) (joined by Justices Souter, Ginsburg, and Breyer); *see also Patterson v. Texas*, 536 U.S. 984 (Stevens, J., dissenting from denial of certiorari); *id.* (Ginsburg, J., dissenting from denial of certiorari) (joined by Justice Breyer).

[3] *See Atkins*, 536 U.S. at 320-21.

[4] *See id.* at 316.

[5] *See Penry v. Lynaugh*, 492 U.S. 302 (1989).

[6] *See Atkins*, 536 U.S. at 314-15.

for the mentally retarded, it was rarely imposed: since 1989, only five states had executed offenders known to be mentally retarded.[7]

Like the question of execution of the mentally retarded, the question of the constitutionality of the death penalty for juveniles was last visited by the Supreme Court in 1989. That year, in *Stanford v. Kentucky*,[8] the Court concluded that the death penalty was not inherently disproportionate to the culpability of adolescents and that individualized assessments could adequately sort out which juveniles were sufficiently morally culpable.[9] And it held that no national consensus barred the imposition of capital punishment on 16- or 17-year-old juveniles.[10]

The juvenile death penalty is now before the Supreme Court again. In January of this year, the Court granted certiorari to review the Missouri Supreme Court's decision in *Simmons v. Roper,*[11] which relied on *Atkins* to hold that the execution of persons who committed homicide before reaching their eighteenth birthday is unconstitutional. The court cited the immaturity and consequent reduced culpability of juvenile offenders[12] and the special risk of wrongful execution for juvenile offenders, due in part to the risk of false confession.[13] In addition, the court concluded that, since *Stanford* was decided in 1989, a national consensus had emerged opposing the death penalty for juvenile offenders. Evidence of this consensus was found in both the increasing number of states that ban the juvenile death penalty by statute and the infrequency with which juries now impose the punishment of death on juvenile offenders even in jurisdictions where it is legislatively authorized.[14]

Although a growing body of research has addressed the issues of juveniles' lesser culpability and greater risk of wrongful execution,[15] discussions of the declining use of the death penalty against juveniles have been largely descriptive. This article provides statistical analyses of the available data regarding changes in the use of the death penalty for juveniles over time.

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[7] *See id.* at 316.

[8] 492 US 361 (1989).

[9] *See id.* at 374-77.

[10] *See id.* at 370.

[11] 112 S.W.3d 397 (Mo. 2003).

[12] *See id.* at 412.

[13] *See id.* at 413.

[14] *See id.* at 410.

[15] *See, e.g.,* Mary Beckman, *Crime, Culpability and the Adolescent Brain*, 305 SCIENCE 596 (2004) (describing recent neuropsychological studies showing that development of critical frontal lobe brain functions related to impulse control, decision making and reasoning is incomplete at age 18, and may not be completed until age 21 or later); Jeffrey Fagan, *Atkins, Adolescence and the Maturity Heuristic: Rationales for Categorical Exemption of Minors from Capital Punishment,* 33 N. M. L. REV 207 (2003) (discussing evidence of juveniles' immaturity and the risk of false confessions, and the risk of error in attempts to assess individual juveniles' culpability); David Tanenhaus & Steven Drizin, "*Owing to the Extreme Youth of the Accused"*: *The Changing Legal Response to Juvenile Homicide*, 92 J. CRIM. L. & CRIMINOLOGY 641, 653, 671-689 (2002) (on the special risk of false confessions for adolescents); Elizabeth Scott & Laurence Steinberg, *Blaming Youth*, 81 TEX. L. REV. 799 (2002) (on the diminished culpability of adolescents owing to their deficits in psycho-social maturity, and the need for law to accommodate these facts).

The number of juvenile death sentences has declined sharply since 1994, when 18 juveniles were sentenced to death.[16] In 2003, only 2 juveniles were sentenced to death, and one of these was a re-sentence following a reversal of a previous sentence.[17] Adult death sentences have declined at a slower pace during this time, from a recent peak of 320 in 1996 to 143 in 2003.[18]

The decline in the number of juvenile death sentences since *Stanford* may simply reflect a lower juvenile homicide arrest rate and a reduced supply of juvenile defendants eligible for death sentences. But the decline in juvenile death sentences may also signal the emergence of a societal norm against the imposition of capital punishment on juvenile offenders, expressed through juries' sentencing decisions, prosecutors' decisions not to seek death sentences for juvenile offenders, or both.[19]

In order to evaluate these competing explanations for the decline in juvenile death sentences, we first conducted a descriptive analysis of trends over time, considering both the absolute number of death sentences imposed on

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[16] *See* Victor L. Streib, *The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes, January 1, 1973 - June 30, 2004*, at 9 tbl. 3, *available at* http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf.

[17] In the first eight months of 2004, two juveniles were sentenced to death. *See id.* at 9, tbl. 3*; id.* at 21, 23. *See*, Andrew Tilghman, Teen Convicted of Capital Murder, Houston Chronicle, August 6, 2004, at A1 (*available at* http://www.chron.com/cs/CDA/printstory.mpl/metropolitan/2723330). The data necessary to place these recent sentences in context, such as the juvenile homicide arrest rate, will not be available until the end of the year. Accordingly, we do not include these juvenile death sentences in the analyses *infra*.

Nevertheless, we do not anticipate that the inclusion of these two 2004 cases will alter the trends we identify in Sections III and IV *infra*. A fluctuation of one juvenile death sentence or even two in a single year is expected within trends of longer duration, and does not change the statistical identification of a continuous trend of decline over time. Such fluctuations are known in social science and financial economics as "random walks," a process consisting of a sequence of discrete steps of fixed length and limited duration. See, Barry D. Hughes, *Random Walks and Random Environments, Vol. 1: Random Walks* (1995). Random walks follow a normal distribution, with a probability greater than 95% that the process will return to its initial starting point or take no more than one standardized step in any direction from its origin. *See*, Eric W. Weisstein, Random Walk --1-Dimensional, *Mathworld*, *available at* http://mathworld.wolfram.com/RandomWalk1-Dimensional.html (visited August 16, 2004). In a random walk, these discrete steps occur within longer statistical trends, and do not predict the onset of an increase or decline that would alter the identification of a continuous time trend. For example, burglary rates in the U.S. have declined from 110 burglaries per 1,000 households in 1973 to 27.7 in 2002. *See*, Bureau of Justice Statistics, U.S. Department of Justice, National Crime Victimization Survey Property Crime Trends, 1973-2002, *available at* http://www.ojp.usdoj.gov/bjs/glance/tables/proptrdtab.htm (visited August 16, 2004). Within this 20 year period when burglary rates declined more than 75 percent, one-year increases in the burglary rate were measured in four of the 20 years.

[18] The figure for 2003 represents the projected number of death sentences for that year. *See* Death Penalty Information Center, *Death Sentences By Year, 1973 - 2003, available at* www.deathpenaltyinfo.org/article.php?scid=9&did=873.

[19] *See* Fagan, supra note 9; *see also* David O. Brink, *Immaturity, Normative Competence, and Juvenile Transfer: How Not to Punish Minors for Major Crimes*, 82 TEX. L. REV. 1555 (2004).

juvenile offenders and the rate at which juvenile offenders are sentenced to death (indexed to the homicide rate and to the rate at which juveniles are arrested for homicide). We then performed a multivariate analysis to determine whether the decline in the use of the juvenile death penalty is statistically significant after controlling for other competing explanations. These analyses provide an empirical foundation for determining whether the striking decline in the use of the juvenile death penalty reflects an emerging societal norm opposing the punishment of death penalty for persons who committed their crimes before the age of 18.

II. THE JURISPRUDENCE OF EVOLVING NORMS IN THE JUVENILE DEATH PENALTY

Evolving norms and standards are at the heart of Eighth Amendment jurisprudence. The Supreme Court has often stated that "the Amendment must draw its meaning from the evolving standards of decency that mark the progress of a maturing society."[20] Accordingly, a punishment may be unconstitutionally cruel and unusual under the Eighth Amendment if there is a current societal consensus against the imposition of that punishment. Indicia of evolving standards were set forth in *Coker v. Georgia*,[21] where the Supreme Court charted future deliberations on this question by stating that evolving standards should be measured by "objective factors to the maximum possible extent."[22] *Coker* and subsequent cases have relied primarily on two objective factors to assess societal consensus with regard to the death penalty: (1) state legislation, and (2) sentencing decisions by juries.[23] We briefly consider the first factor and then turn to the second, which is the focus of this article.

A. State Legislation

State legislation demonstrates that a growing number of states oppose capital punishment for juveniles. In the 15 years since the *Stanford* decision, no state has lowered its age threshold for the juvenile death penalty from 18 years of age to 17 or 16, although *Stanford* set the lower boundary for a death sentence at 16.[24] Instead, during this period, six states prohibited capital punishment for juveniles by statute: Kansas (1994),[25] New York (1995),[26] Montana (1999),[27]

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[20] *See, e.g., Trop v. Dulles*, 356 U.S. 86, 101 (1958) (plurality); *Atkins*, 536 U.S. at 311-12.

[21] 433 U.S. 584 (1977).

[22] *Id*. at 592.

[23] *See id.*; *Atkins*, 536 U.S. at 314-16.

[24] *See Stanford*, 492 U.S. at.380.

[25] *See* Kan. Stat. Ann. § 21-4622.

[26] *See* N.Y. Penal Law § 125.27.

[27] *See* Mont. Code Ann. § 45-5-102.

Indiana (2002),[28] South Dakota (2004),[29] and Wyoming (2004).[30] In addition, the Washington Supreme Court's 1993 *Furman* decision interpreted Washington's death-penalty statute as excluding the death penalty for persons under 18.[31] Including the eleven states that had legislatively prohibited the juvenile death penalty prior to the *Stanford* decision, 18 of the 38 states that permit the death penalty now expressly bar its use for offenders under the age of 18.[32] Thirteen jurisdictions bar the death penalty altogether.[33]

Other states have passed legislative bans on the juvenile death penalty in one or both houses of their state legislatures, a trend that the Supreme Court noted in *Atkins* as states moved to ban execution of mentally retarded defendants.[34] In 2004, New Hampshire passed legislation in both houses banning the juvenile death penalty, but the governor vetoed the legislation. And in two of the three most active juvenile death sentencing states,[35] Texas (2002) and Florida (2001, 2002, and again in 2004), one house of the state legislature voted to ban death sentences for juveniles. These legislative developments suggest a societal trend away from use of the death penalty for offenders under 18.

B. Jury Sentencing Decisions

In addition to looking at state legislation, the Supreme Court has consistently examined data on jury sentencing decisions in order to ascertain the existence of a societal consensus against the use of the death penalty for a particular group.

In *Coker v. Georgia*,[36] the Court explained:

> "[T]he jury . . . is a significant and reliable objective index of contemporary values because it is so directly involved." . . . [I]t is thus important to look to the sentencing decisions that juries have made in the course of assessing whether capital punishment is an appropriate penalty for the crime being tried.[37]

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[28] *See* Ind. Code Ann. § 35-50-2-3.

[29] *See* S.D. Codified Laws § 23A-27A-42.

[30] *See* Wyo. Stat. Ann. § 6-2-101(b).

[31] *See State v. Furman*, 858 P.2d 1092, 1103 (1993).

[32] *See* Streib, *supra* note 16, at 7 tbl. 2. The 11 states that prohibited the juvenile death penalty prior to *Stanford* are California, Colorado, Connecticut, Illinois, Maryland, Nebraska, New Jersey, New Mexico, Ohio, Oregon, and Tennessee. *See id.*

[33] *See* Streib, *supra* note 16, at 7 tbl. 2.

[34] *See Atkins,* 536 U.S. at 315.

[35] *See infra* tables 6 and 7 and figures 4a and 4b.

[36] 433 U.S. 584 (1977).

[37] *Id.* at 596 (quoting *Gregg v. Georgia*, 428 U.S. 153, 181 (1976)).

Accordingly, in support of its holding that the death penalty is an excessive punishment for the crime of rape of an adult woman,[38] the Court relied in part on the fact that between 1973 and 1977, Georgia juries had sentenced defendants to death for the crime of rape only six times.[39]

In *Enmund v. Florida*,[40] the Court employed a similiar analysis in holding that death was an unconstitutional punishment under the circumstances of that case – involving an accomplice to a robbery in which another perpetrator shot and killed the robbery victims -- for a defendant who had neither killed nor intended to kill.[41] The Court stated:

> Society's rejection of the death penalty for accomplice liability in felony murders is also indicated by the sentencing decisions that juries have made. As we have previously observed, "[t]he jury ... is a significant and reliable objective index of contemporary values because it is so directly involved." The evidence is overwhelming that American juries have repudiated imposition of the death penalty for crimes such as petitioner's.[42]

Similarly, in *Thompson v. Oklahoma*,[43] a plurality of the Court relied on evidence that, between 1982 and 1986, only 5 of 1861 persons under 16 who were arrested for homicide were sentenced to death to support its conclusion that there was a societal consensus against the use of the death penalty for offenders under 16.[44] And, most recently, in *Atkins*, the Court noted—as evidence of a national consensus against execution of the mentally retarded—that the execution of mentally retarded offenders was "uncommon" and that only five states had executed defendants known to be retarded since the Court's earlier decision in *Penry*.[45]

Consistent with the constitutional framework set out in these decisions, this article conducts an empirical examination of the frequency with which juries impose the death penalty on defendants who were under the age of 18 when they committed their crimes.

C. A Note on Prosecutorial Discretion

This article focuses on sentencing decisions by juries, and gauges the rate at which juries sentence juvenile offenders to death by comparing the number of juvenile death sentences to the number of juvenile offenders arrested for

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[38] *See id.* at 592.
[39] *See id.* at 597.
[40] 458 U.S. 782 (1982).
[41] *See id.* at 801.
[42] *Id.* at 794 (quoting *Coker*, 433 U.S. at 596 (in turn quoting *Gregg*, 428 U.S. at 181)) (citations omitted).
[43] 487 U.S. 815 (1988).
[44] *Id.* at 832-33 & n.39.
[45] *Atkins*, 536 U.S. at 316.

homicide. Nevertheless, it should be noted that decisions by prosecutors as to whether to charge a particular defendant with a capital crime—which intervene between arrest and sentencing—will also influence the rate at which juvenile offenders are sentenced to death.

As Justice O'Connor noted in her concurrence in *Thompson*, data on the number of juvenile death sentences and the number of juvenile homicide arrests, without more, "do not indicate how many juries have been asked to impose the death penalty for crimes committed [by juveniles], or how many times prosecutors have exercised their discretion to refrain from seeking the death penalty in cases where the statutory prerequisites might have been proved."[46] Justice O'Connor concluded that, in part for that reason, the sentencing statistics on which the *Thompson* plurality relied were "not dispositive," even though they did "support the inference of a national consensus opposing the death penalty for 15-year-olds."[47]

Although data regarding charging decisions by prosecutors would certainly give a fuller picture of the use of the juvenile death penalty, a statistically reliable analysis of the preferences of prosecutors is probably beyond the capability of social science. Reliable and consistent data regarding prosecutors' decisions whether to seek the death penalty for juveniles are very hard to obtain, if they exist at all, for three reasons: (1) uncertainty about the existence of comprehensive written records of the reasons for case-specific charging decisions, (2) uncertainty that prosecutors will fully open their records to analysis, and (3) uncertainty that age-specific factors are fully acknowledged on the record in these decisions. Accordingly, it is not possible, given the available data, accurately to isolate the separate influences of prosecutorial decision-making and jury decision-making on the use of the juvenile death penalty.

We nevertheless believe that the data analyzed in this article provide the best available empirical foundation for an analysis of societal consensus regarding the juvenile death penalty. Although the data may reflect prosecutors', as well as juries', choices, those actions of prosecutors are relevant to the calculus of evolving norms. Like the actions of juries, prosecutors' charging decisions reflect the will of the people. They respond to the interests of victims, as well as to the societal interest in seeking punishments that are proportionate to the severity of the offense and that realize retributive concerns. For that reason, the Supreme Court stated in *Enmund* that "it would be relevant" to the constitutional analysis of evolving standards "if prosecutors rarely sought the death penalty" for a particular group of offenders, "for it would tend to indicate that prosecutors, who represent society's interest in punishing crime, consider the death penalty excessive" for that group of offenders.[48]

Moreover, as discussed further below, *see infra* Part V, the results of our multivariate analysis demonstrate that the decline in the use of the juvenile death penalty is statistically significant after controlling for the decline in the murder

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[46] *Thompson*, 487 U.S. at 852-53 (O'Connor, J., concurring in the judgment).
[47] *Id.*
[48] *Enmund*, 458 U.S. at 796.

rate, the decline in the juvenile homicide arrest rate, the general decline in the use of the death penalty, and measures of political pressure and punitiveness that correlate with use of the death penalty. Accordingly, even if some part of the decline is due to the choices of prosecutors, the multivariate analysis supports the conclusion that those choices were driven by a specific societal norm against the juvenile death penalty, rather than by other social and political factors that might affect prosecutors.

III. RESEARCH DESIGN AND METHODS

A. Overview

To test for evidence of an evolving standard in the use of the juvenile death penalty since 1989, when the Supreme Court last addressed the constitutionality of the juvenile death penalty in *Stanford*, we examined trends and patterns in the use of the death penalty for juvenile offenders during the period from 1990—the year following the *Stanford* decision—to 2003.

In order to understand the significance of changes in the frequency with which the death penalty is imposed on juvenile offenders, it is necessary to take account of the decline in the homicide rate and, in particular, in the juvenile homicide rate, beginning in the 1990s. As Figure 1a shows, the homicide rate in the United States peaked in 1991 and has declined steadily since 1993.[49] As Figure 1b shows, an even steeper decline has occurred during the same period for juvenile homicides; the rate for homicides committed by juveniles ages 14-17 peaked in 1993 and has declined steadily since that year.[50] Any estimate of the magnitude of the decline in juvenile death sentencing since 1990 must therefore account for the general decline in the supply of defendants – both juveniles and adults – who were eligible for the death penalty. Only trends that are independent of changing homicide rates would reflect an evolving standard in death sentencing. Accordingly, we examine data from 1990 through 2003 to determine whether there has been a decline in the number of death sentences imposed on juvenile offenders that is not explained by the decline in the juvenile homicide rate.

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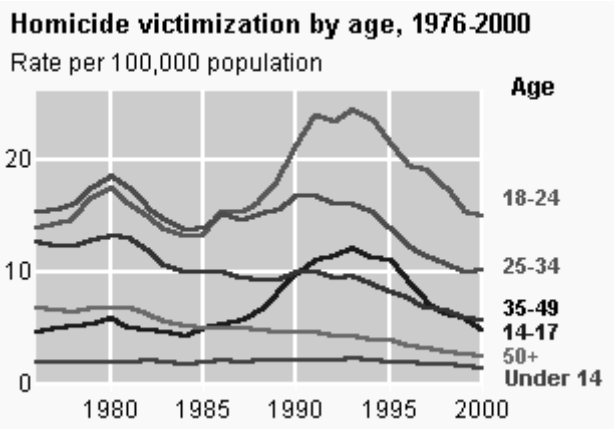
[49] *See also* Alfred Blumstein, *Disaggregating the Violence Trends*, in THE CRIME DROP IN AMERICA 13, 20-24 (A. Blumstein & J. Wallman eds., 2000). The homicide rate per 100,000 persons has followed a cyclical pattern over the past 30 years, with peaks in 1974 (9.8), 1980 (10.2) and 1991 (9.8), followed in each instance by declines of varying durations. *See* Bureau of Justice Statistics, *Homicide Trends in the U.S.*, *available at* www.ojp.usdoj.gov/bjs/homicide/tables/totalstab.htm (last visited June 7, 2004). In addition to reaching a record high nationally in 1991, the homicide rate reached record levels in 14 of the largest 100 cities in the United States in that year. *See generally* Franklin E. Zimring & Gordon Hawkins, CRIME IS NOT THE PROBLEM: LETHAL VIOLENCE IN AMERICA (1997).

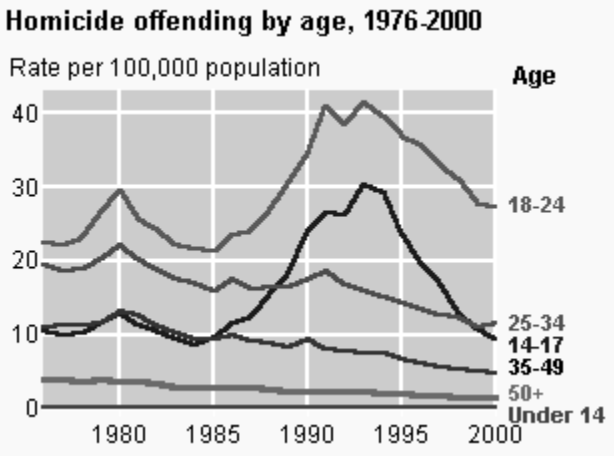
[50] *See also, e.g.,* Philip J. Cook & John H. Laub, *After the Epidemic: Recent Trends in Youth Violence*, 29 CRIME AND JUSTICE 1 (2002).

Figure 1a



Source: U.S. Department of Justice, Bureau of Justice Statistics, http://www.ojp.usdoj.gov/bjs/homicide/teens.htm#vage

Figure 1b



Source: U.S. Department of Justice, Bureau of Justice Statistics, http://www.ojp.usdoj.gov/bjs/homicide//teens.htm#oage

The research design is a simple cross-sectional prospective analysis of patterns and trends at the state level for each year beginning in 1990. We include as observations for each state only the years in the study interval when there was a valid juvenile death sentencing statute in effect.[51]

Following a series of descriptive analyses, we report the results of a series of multivariate statistical models that test whether the rate of decline in juvenile death sentences is simply an artifact of the decline in homicides by juvenile offenders since 1993 or is a trend indicative of changes in social and legal norms. To evaluate these competing claims, we analyzed the rate of decline in the imposition of the death penalty on juvenile offenders relative to homicide arrest rates for juveniles. We also distinguished trends in the juvenile death penalty from broader social trends in the use of capital punishment for adults. That is, we compared the decline in death sentences per homicide for juveniles to the rate at which death sentences were imposed on young adult defendants – ages 18-24 – to show that the decline in the use of the death penalty is specific to juveniles. A rate of decline in the number of juvenile death sentences that is greater than the decline in juvenile homicide arrests, and greater than comparable declines for adult death sentences, is evidence of changing social and legal norms. Accordingly, these analyses test whether there is a statistical trend that signifies growing rejection of the use of the death penalty for minors.

B. Death Sentences and Persons Sentenced to Death

Throughout this article, we distinguish between death sentences for juveniles and juveniles sentenced to death. These counts vary slightly, as we show in Tables 3, and Figures 3a and 3b *infra*. For example, one juvenile in 2002 and another in 2003 were re-sentenced to death following reversals of earlier death sentences. There are valid reasons to examine each of these dimensions of the juvenile death penalty, and we do so whenever possible in the descriptive analyses. However, in the multivariate analyses predicting the use of the death penalty and its rate of decline, we use only new sentences, or persons (juveniles and adults) sentenced to death.

We do this for three reasons. First, death sentences imposed post-appeal are not independent of the initial death sentence. This presents a host of well-known statistical problems, particularly concerning tests of significance for non-independent observations.[52] Second, death sentences issued post-appeal reflect dynamics that are influenced by both the appeals process and the initial sentencing process. The relative contributions of each of these legal dynamics to a subsequent re-sentence are unclear and perhaps unknowable. To be re-sentenced to death, a defendant must have been initially sentenced, have had that sentence overturned upon review at some point later in time (often, years later), and then

[51] For example, the Washington Supreme Court construed the state's death penalty statute as not applying to juvenile offenders in 1993. Accordingly, for Washington, we include only four years of observations.

[52] *See generally* Michael Finkelstein & Bruce Levin, STATISTICS FOR LAWYERS (2002).

have been re-sentenced to death following a new trial. Time to review and outcomes at review vary widely across sentencing jurisdictions, and these differences in review periods further complicate comparisons of cases and causes of death sentences.[53] Third, not all death sentences that are overturned upon review are sent back for a new sentence; only a small fraction result in a new death sentence.[54] It is unknown exactly what factors govern the outcome of cases post appeals, but it would be foolish to assume that they are identical to those which influence the initial sentencing process.

C. Data Sources

We constructed a database on state trends in death sentences for juveniles and adults. We then integrated data on state trends in crime and punishment, and included indices of social, economic and political trends that are correlated with death sentences, crime, and criminal justice. The database includes all death sentences from 1990 to 2003; no sampling was used or needed. The data used here are administrative data, collected from official data sources, including the U.S. Census, the Bureau of Justice Statistics' database on capital punishment,[55] and the Uniform Crime Reports[56] maintained by the U.S. Department of Justice to provide a crime-recording and accounting system. We also used the comprehensive index of juvenile death sentences maintained by Professor Victor Streib, which is widely used in the analysis of the juvenile death penalty.[57] Table 1 provides an overview of data domains and sources; Appendix A shows details on data sources and measures.

D. Data Analysis Procedures

1. Descriptive Analyses. We first report results of descriptive analyses showing patterns and trends in death sentencing for juveniles and adults. We computed both absolute numbers of death sentences and the rate at which juveniles are sentenced to death, expressed as number of death sentences per 100 juvenile homicide arrests.[58] Because juvenile death sentences since *Stanford* are

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[53] *See* James Liebman et al., *A Broken System Part II: Why There Is So Much Error in Capital Cases, and What Can Be Done About It* (2002), *available at* www2.law.columbia.edu/brokensystem2/report.pdf.

[54] *See id.*

[55] *See* Tracey Snell & Thomas J. Bonzcar, Capital Punishment 2002 (NCJ 201848) (2003), *available at* www.ojp.usdoj.gov/bis/abstract/cp02.htm (last visited July 6, 2004). Data are publicly available at National Archive of Criminal Justice Data, Institute for Social Research, University of Michigan, www.icpsr.umich.edu/cgi-bin/archive.prl?study=3958.

[56] U.S. Department of Justice, Federal Bureau of Investigation, www.fbi.gov/ucr/ucr.htm (last visited May 12, 2004). Data are publicly available at National Archive of Criminal Justice Data, Institute for Social Research, University of Michigan, http://www.icpsr.umich.edu/NACJD/ucr.html.

[57] Streib, *supra* note 16.

[58] To account for the lag between homicide arrests and death sentences, we lagged homicide arrests by two years.

Table 1. Overview of Data Domains and Sources

Domain	*Source*
Juvenile Death Sentences	Victor Streib, Juvenile Death Penalty Website[1]
Adult Death Sentences	U.S. Department of Justice, Bureau of Justice Statistics, Capital Punishment files[2]
Homicide Victimization Patterns and Characteristics	U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, Compressed Mortality Files
Juvenile and Adult Arrests	U.S. Department of Justice, Uniform Crime Reports, Supplemental Homicide Reports;[3] The Sourcebook of Criminal Justice Statistics, Bureau of Justice Statistics 1988 –2002.
Social and Economic Characteristics	Data collected from previous research, and data supplied from other published research projects[4]
Crime and Criminal Justice Data	Annual series of reports and data on state and federal prison populations, U.S. Department of Justice, Bureau of Justice Statistics.[5]

[1] Streib, *supra* note 16, http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf (visited August 4, 2004).

[2] See, Thomas P. Bonczar and Tracy L Snell., "Capital Punishment, 2002 ." *Bulletin*. NCJ 201848, Washington, DC: United States Department of Justice, Bureau of Justice Statistics, Nov 2003. Data and codebooks are available at National Archive of Criminal Justice Data, Inter-University Consortium for Social and Political Research, Institute of Social Research, University of Michigan.

[3] Uniform Crime Reporting Program Data [United State]: Supplementary Homicide Reports 1976-2001(ICPSR Study #s, 3108, 3448, and 3722). The Sourcebook of Criminal Justice Statistics, Bureau of Justice Statistics 1988 –2002.

[4] See, for example, H. Naci Mocan and R. Kay Gittings, *Getting Off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, XLVI JOURNAL OF LAW AND ECONOMICS 453 (2003). Professor Mocan graciously provided his data, including economic and population characteristics and measures of punishment and other criminal justice case processing indicia.

[5] See, for example, Paige Harrison and Thomas P. Bonzcar, *Prisoners in 2002* (NCJ 200248), available at http://www.ojp.usdoj.gov/bjs/pub/pdf/p02.pdf.

concentrated in a small number of states — Texas, Florida, and Alabama account for more than half of the juvenile death sentences imposed from 1990 to 2003[59] — we also analyze state-specific figures to identify trends in these three states that disproportionately contribute the largest share of juvenile death sentences.

2. Multivariate Tests. To determine whether there is a statistically significant downward trend in juvenile death sentencing, we estimate models of the number of juvenile death sentences using zero-inflated Poisson regression models. Poisson techniques are appropriate to identify factors that predict the number of occurrences of an event within a specific observation period.[60] However, in this case, there are a greater number of zeros than one typically expects in a Poisson distribution: 262 of the 334 observations are equal to zero. In other words, there are 262 state-year data points when there were valid juvenile death sentencing statutes in effect, but no juvenile death sentences were imposed. Accordingly, we use a zero-inflated Poisson (ZIP) model to estimate trends in juvenile death sentences.[61] Appendix B and Section V *infra* discuss the statistical construction of the analytic model and the rationale for using a state grouping as an inflation adjustment.

IV. TRENDS AND PATTERNS IN JUVENILE DEATH SENTENCES

Table 2 shows the current lineup of states by age of eligibility for capital sentencing for juvenile offenders; it also shows the states that imposed at least one juvenile death sentence at any time during the study period. Several states, such as Utah and Delaware, had valid statutes but did not have any juvenile death sentences from 1990-2003.

A. Trends by Time across States

Juvenile death sentences have been rare events since 1990. We counted juveniles sentenced to death (excluding resentencings) in each year in each state while that state had a valid juvenile death sentence statute. Figure 2a shows that most state-years had no activity: there were 262 state-year observations with no juveniles sentenced to death. When states did sentence juveniles to death, most sentenced only one juvenile to death in a year (52); and rarely were there more than two. Figure 2b shows that death sentences were more frequent for persons ages 18-24. There were no persons in that age group sentenced to death in 120 of the state-year data points. However, some states frequently used the death penalty for this group: there were 18 state-years with more than 10 persons ages 18-24 sentenced to death.

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[59] *See* Streib, *supra* note 16.

[60] *See, e.g.*, Peter Kennedy, A GUIDE TO ECONOMETRICS (1995); William Greene, ECONOMETRIC ANALYSIS (5th ed. 2000).

[61] *See, e.g.,* Christopher Zorn, *An Analytic and Empirical Examination of Zero-Inflated and Hurdle Poisson Specifications*, 26 *SOC.* METHODS & RESEARCH 368 (1998).

Table 2. Capital Sentencing History and Age Eligibility by State 1990-2003

	Minimum Age Eligible for Capital Sentencing 2004		
Active Juvenile States 1990-2003	*Sixteen*	*Seventeen*	*Eighteen*
Alabama	Alabama	Florida	California
Arizona	Arkansas	Georgia	Colorado
Arkansas	Arizona	New Hampshire	Connecticut
Florida	Delaware	North Carolina	Federal System
Georgia	Idaho	Texas	Illinois
Kentucky	Kentucky		Indiana*
Louisiana	Louisiana		Kansas
Mississippi	Mississippi		Maryland
Missouri	Nevada		Missouri*
North Carolina	Oklahoma		Montana*
Nevada	Pennsylvania		Nebraska
Oklahoma	South Carolina		New Jersey
Pennsylvania	Utah		New Mexico
South Carolina	Virginia		New York
South Dakota*			Ohio
Texas			Oregon
Virginia			South Dakota*
Washington*			Tennessee
Wyoming*			Washington*
			Wyoming*

Data Sources: http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf; http://www.abanet.org/crimjust/juvjus/resources.html#context; *Simmons v. Roper* 112 S.W.3d 397 (2003)

* The minimum age was raised to 18 in South Dakota and Wyoming in 2004; Indiana in 2002; Missouri in 2003; Montana in 1999; and, Washington in 1993.

Figure 2a. State-Year Counts of Juveniles Sentenced to Death, 1990-2003

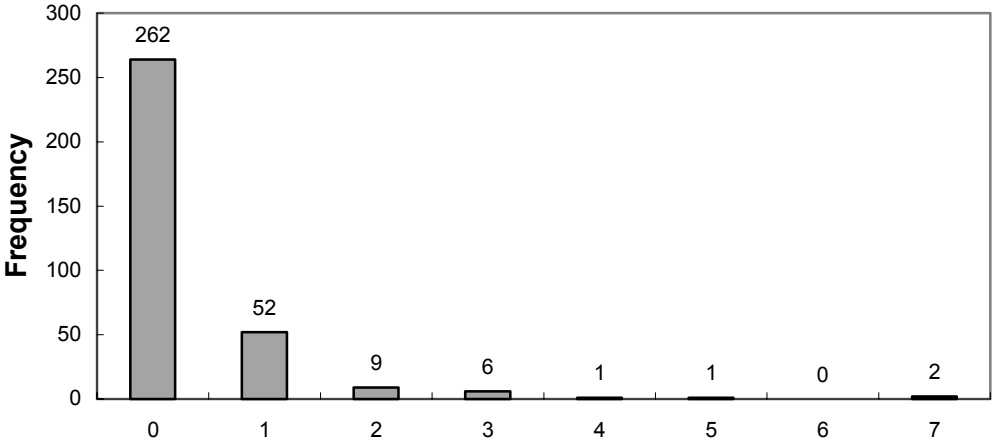
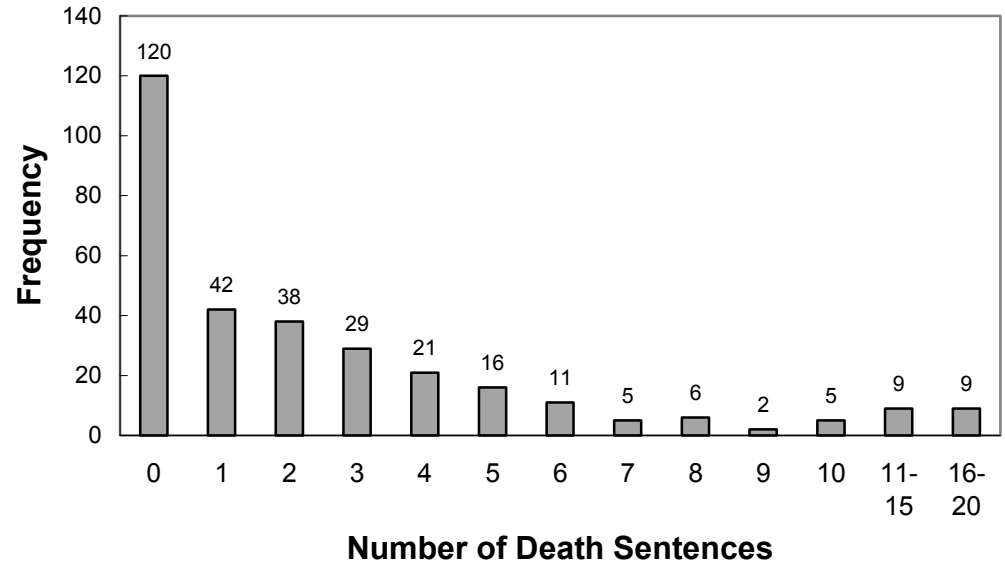


Figure 2b. State-Year Counts of Persons Ages 18-24 Sentenced to Death, 1990-2003



As Table 3 shows, a total of 112 juvenile defendants received death sentences from 1990-2003. These totals exclude persons who were re-sentenced to death following reversals of earlier convictions and death sentences. Table 3 shows that 57 persons were sentenced to death in states with a minimum age of 16, and 55 were sentenced to death in states with a minimum age of 17. The peak year for juveniles sentenced to death was 1994, when 15 juvenile offenders were newly sentenced to death. Following a more recent peak of 14 juvenile offenders sentenced to death in 1999, the number of juvenile offenders sentenced to death has declined each year. In 2000, the number of persons receiving juvenile death sentences dropped sharply to seven, a decline of 50 percent. The number declined again to three in 2002, and one in 2003. Table 3 also shows that the number of juvenile death sentences, as distinguished from the number of persons sentenced to death, followed a similar trend during this period.

Table 3. Juvenile Death Sentences and Juveniles Sentenced to Death by Year in States with Capital Punishment for Juveniles, by Minimum Age of Eligibility*, 1990-2003

	Juveniles Sentenced to Death			Juvenile Death Sentences		
	Minimum Age			*Minimum Age*		
Year	*16*	*17*	*Total*	*16*	*17*	*Total*
1990	6	2	8	6	3	9
1991	2	3	5	2	3	5
1992	2	4	6	2	4	6
1993	4	2	6	5	2	7
1994	8	7	15	10	8	18
1995	4	8	12	4	9	13
1996	7	5	12	7	5	12
1997	3	5	8	3	5	8
1998	7	3	10	7	4	11
1999	7	7	14	7	7	14
2000	3	4	7	3	4	7
2001	1	4	5	2	5	7
2002	2	1	3	3	1	4
2003	1	0	1	1	1	2
Total	57	55	112	62	61	123

Source: Victor L.Streib, The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes January 1, 1973-June 30, 2004, available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf (visited August 12, 2004).

* Data include first death sentences that originated during the study period. Data include death sentences for two defendants 15 years of age, the first in 1990 in Alabama, the second in 1991 in Florida. The current minimum death penalty age is 17 in Florida and 16 in Alabama.

The rate of decline in the number of juveniles sentenced to death is greater than the decline in the number of adults sentenced to death, both those in the next closest demographic group – ages 18-24 – and persons age 25 and older. Table 4 compares the number of persons sentenced to death in each of these three age groups from 1990 to 2002.[62] For example, the number of juveniles sentenced to death declined from 14 in 1999 to 3 in 2002, a drop of 79%. In the 18-24 age bracket, the number of persons sentenced to death declined from 89 to 43 in the same time period, a decline of 52%; among persons 25 and older, the number of persons sentenced to death declined from 161 to 97 during this period, a drop of 40%.

Table 4. Total Persons Sentenced to Death by Year and Age in Juvenile Death Penalty States, 1990-2002

Year	*Under 18*	*18-24*	*25 and Over*	*Total*
1990	8	69	178	255
1991	5	91	168	264
1992	6	98	164	268
1993	6	112	154	272
1994	15	121	163	299
1995	12	122	164	298
1996	12	109	177	298
1997	8	100	155	263
1998	10	112	166	288
1999	14	89	161	264
2000	7	69	146	222
2001	5	55	99	159
2002	3	43	97	143
Total	111	1,190	1,992	3,293

Sources: Victor Streib, The Juvenile Death Penalty Today: Death Sentences And Executions For Juvenile Crimes, January 1, 1973 - April 30, 2004. Available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf; Bureau of Justice Statistics, U.S. Department of Justice, Capital Punishment 2002, http://www.ojp.usdoj.gov/bjs/pub/pdf/cp02.pdf

Another way to gauge the decline is to examine the drop from the peak rate during the study period. The number of juveniles sentenced to death declined from the peak yearly incidence of 15 (in 1994) to 3 (in 2002), a decline of 82%. For persons ages 18-24, the number of persons sentenced to death declined from a peak incidence of 122 (in 1995) to 43 (in 2002), a decline of 65%. For persons 25

[62] Table 4 excludes juveniles sentenced to death in 2003, since comparable data are not available for adults during that year.

and older, the number of persons sentenced to death has increased and declined cyclically during the study period, declining from a peak of 178 (in 1990) to 154 (in 1993), increasing again to 177 (in 1996), and then declining again to 97 (in 2002). The total decrease from the peak of 178 in 1990 to the low of 97 in 2002 is 45.5%. Thus, considering either of these two age categories, the rate of decline in the number of juveniles sentenced to death is far greater than the rate for older murder defendants.

The same trends are evident when we examine the total number of death sentences (including re-sentencings), as opposed to the total number of persons newly sentenced to death (excluding re-sentencings). Figure 3a shows the changes over time in the total number of death sentences imposed per year, comparing juvenile defendants with defendants 18-24 years of age. Figure 3b shows the changes over time in the total number of persons sentenced to death per year (excluding re-sentencings), comparing the same age groups.[63]

[63] The trends in juvenile death sentences in the post-*Stanford* era differ in two important respects from the trends in juvenile death sentences in the decade preceding *Stanford*. First, Table 5 shows that the count of juveniles sentenced to death (excluding re-sentencings) from 1980 to 1989 fluctuated in a "roller-coaster" pattern of increases and declines over the decade. Starting with six juveniles sentenced to death in 1980, the number increased to 13 in 1982, then declined to four in 1984 before rising again to eight in 1986. A one-year decline in 1987 (to two) was followed by another increase in 1988 (to five), then another decline to one in 1989. Thus, in this decade, no period of decline lasted longer than two years. In comparison, Table 4 shows that juvenile death sentences in the post-*Stanford* period featured longer and more sustained declines of three years (1995-1997) and four years (2000-2003).

Table 5. Persons Under 18 Sentenced to Death, 1980-1989

Year	*Juvenile Death Sentences*
1980	6
1981	6
1982	13
1983	6
1984	4
1985	5
1986	8
1987	2
1988	5
1989	1

Second, the rate of juvenile death sentences per juvenile homicide arrest also is substantially lower in the post-*Stanford* era compared to the rate in the decade preceding *Stanford.* Although there were more juvenile death sentences post-Stanford compared to the preceding decade, the juvenile homicide arrest rate was far lower during the 1980s than the 1990s. The national homicide arrest rate for 16-year-olds rose from 12 per 100,000 in 1985 to 36 per 100,000 in 1995; the rate for 17-year-olds rose from 20 per 100,000 in 1985 to 51 per 100,000 in 1995. *See* Alfred Blumstein, *Disaggregating the Violence Trends*, in THE CRIME DROP IN AMERICA 13, 20-24 (A. Blumstein & J. Wallman eds., 2000). From 1980 to 1989, we calculated that the rate of death sentences per juvenile homicide arrest, in the states with valid juvenile death penalty statutes, was 1.06. From 1990 to 2003, the comparable rate was 0.76, about 28% lower. (See note

Figure 3a. Death Sentences By Year and Age, States with the Death Penalty for Juveniles, 1990-2003

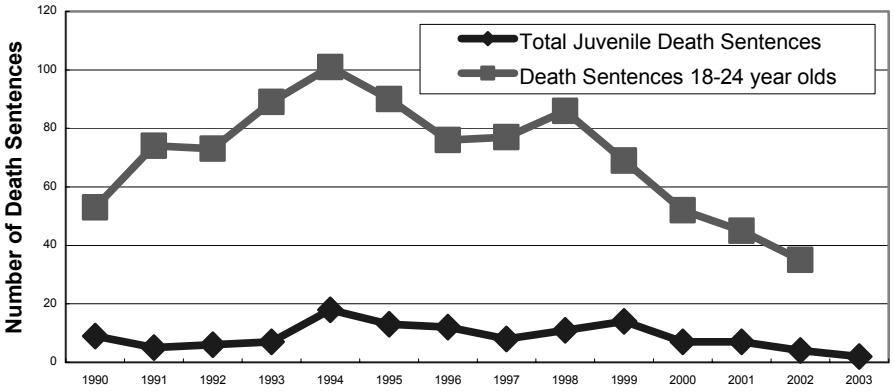
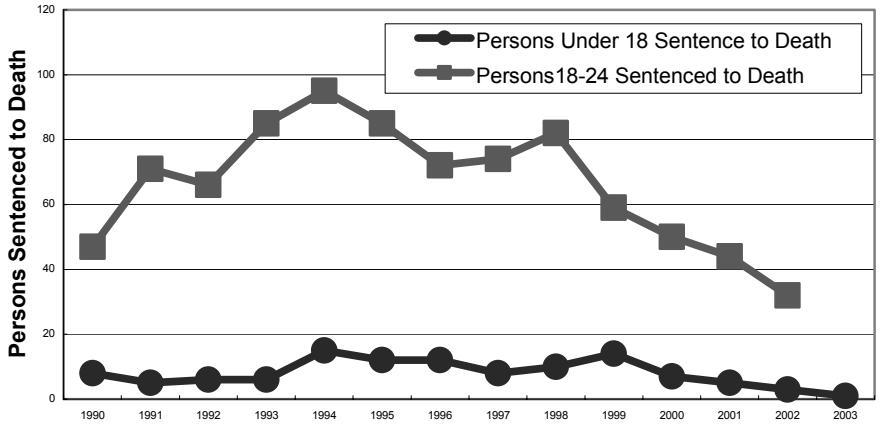


Figure 3b. Persons Sentenced to Death By Year and Age, States with the Death Penalty for Juveniles, 1990-2002



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73 *infra,* regarding the limitations of juvenile homicide arrest data in the UCR.)

The lower rate in the 1990s is even more noteworthy given the dramatic increase in juvenile homicide arrest rates nationally from the decade of the 1980s to the decade of the 1990s and the punitive climate toward juvenile crime that consequently characterized the 1990s. *See*, Patricia Torbet et al., STATE RESPONSES TO SERIOUS AND VIOLENT JUVENILE CRIME, U.S. DEP'T OF JUSTICE (1996) (showing that since 1990, every state has adopted one or more statutory strategies to transfer some chronological juveniles to criminal courts). *See, generally*, Barry C. Feld, BAD KIDS: RACE AND THE TRANSFORMATION OF THE JUVENILE COURT (1996) (showing how the boundaries of the juvenile court have been reduced by punitive attitudes toward adolescent offenders, and the increasing prevalence of violent crime and minority youths); Franklin E. Zimring, AMERICAN YOUTH VIOLENCE (1999) (discussing trends toward greater use of adult criminal sanctions for juvenile offenders); David Garland, CULTURE OF CONTROL (2001) (discussing changes in societal attitudes toward crime and punishment and their origins in cultural and political change, both in the U.S. and the U.K.).

B. State Comparisons

Most juvenile death sentences during the study period were concentrated in three states: Texas, Florida, and Alabama. Since 1973, these three states accounted for 114 of the 226 juvenile death sentences in the United States (50.4%). Tables 6 and 7 show that from 1990 to 2002, these three states accounted for 65 of the 111 juveniles newly sentenced to death (58.6%), and 71 of the 121 total juvenile death sentences (58.7%).

Table 6 and Figures 4a and 4b show that the concentration of juvenile death sentences in these three states correlates positively with their overall death sentencing patterns.[64] Texas ranks first in juvenile death sentences, first in death sentences for young adults ages 18-24, and first in total adult death sentences in the U.S. since 1990. Alabama ranks second, fourth and fifth, respectively, in these three categories, and Florida ranks third, second and second, respectively, in these categories. A second group of states[65] sentenced between five and eight juvenile offenders to death during the study period, ranking them fourth through sixth. Among these "middle" ranked states, their ranks for number of persons ages 18-24 sentenced to death varied from third (North Carolina) to thirteenth (South Carolina), and their ranks for total number of adults sentenced to death ranged from third (North Carolina) to twelfth (Mississippi).

[64] In Figures 4a and 4b, the states are arrayed from left to right according to the number of persons sentenced to death during the study period (4a) and number of juvenile death sentences (4b).

[65] Those states are Louisiana, Arizona, Mississippi, North Carolina, South Carolina, and Virginia.

Table 6. Persons Sentenced to Death in States with Valid Juvenile Death Penalty Law by State*, Age, and Rank, 1990-2002

	Age and Rank					
	Under 18		***18-24***		***All Adults***	
State	*Sentences*	*Rank*	*Sentences*	*Rank*	*Sentences*	*Rank*
TX	36	1	205	1	436	1
AL	17	2	70	4	160	5
FL	12	3	119	2	334	2
LA	8	4	39	8	90	9
MS	6	5	34	9	71	12
AZ	5	6	27	11	103	7
NC	5	6	75	3	230	3
SC	5	6	22	13	72	11
VA	5	6	32	10	72	11
GA	2	7	44	6	93	8
MO	2	7	18	14	83	10
NV	2	7	25	12	64	13
PA	2	7	60	5	190	4
AR	1	8	14	15	47	14
KY	1	8	8	18	27	17
OK	1	8	43	7	120	6
WA	1	8	2	19	6	19
DE	0	9	10	16	28	16
ID	0	9	2	19	15	18
IN	0	9	9	17	29	15
MT	0	9	1	20	4	21
NH	0	9	0	21	0	23
SD	0	9	2	19	5	20
UT	0	9	1	20	5	20
WY	0	9	0	21	2	22

Sources: Victor Streib, The Juvenile Death Penalty Today: Death Sentences and Executions For Juvenile Crimes, January 1, 1973-June 30, 2004. Available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf; Bureau of Justice Statistics, U.S. Department of Justice, Capital Punishment 2002, www.ojp.usdoj.gov/bjs/pub/pdf/cp02.pdf;

*Montana (1999), Indiana (2002) and Washington (1993) ended capital sentencing for juveniles during the study period. Data for adults sentenced to death in these three states are only for the period during which these states able to sentence a juvenile to death.

Figure 4a. Persons Sentenced to Death by Age and State, in Active Juvenile Death Sentencing States, 1990-2002

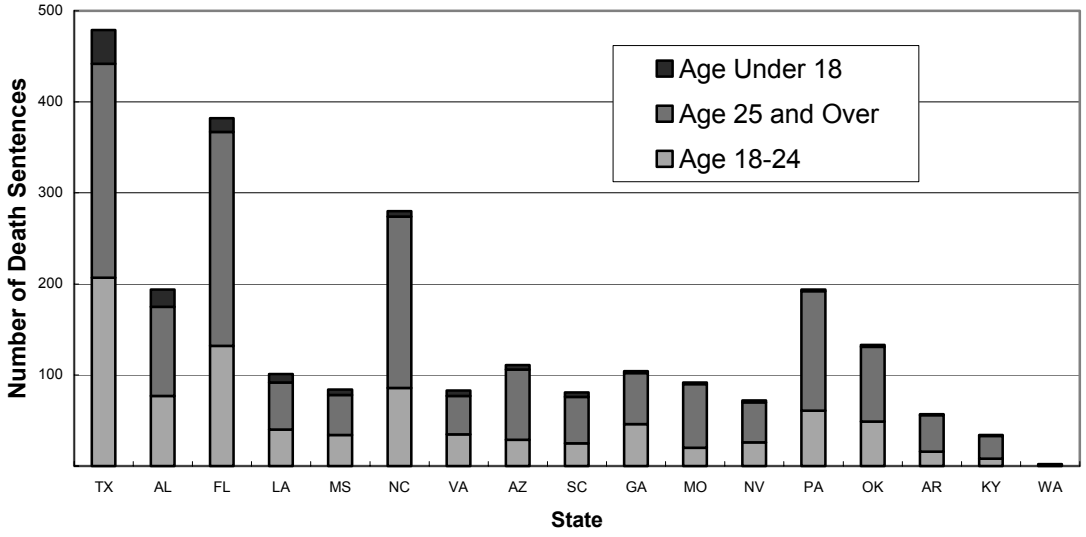
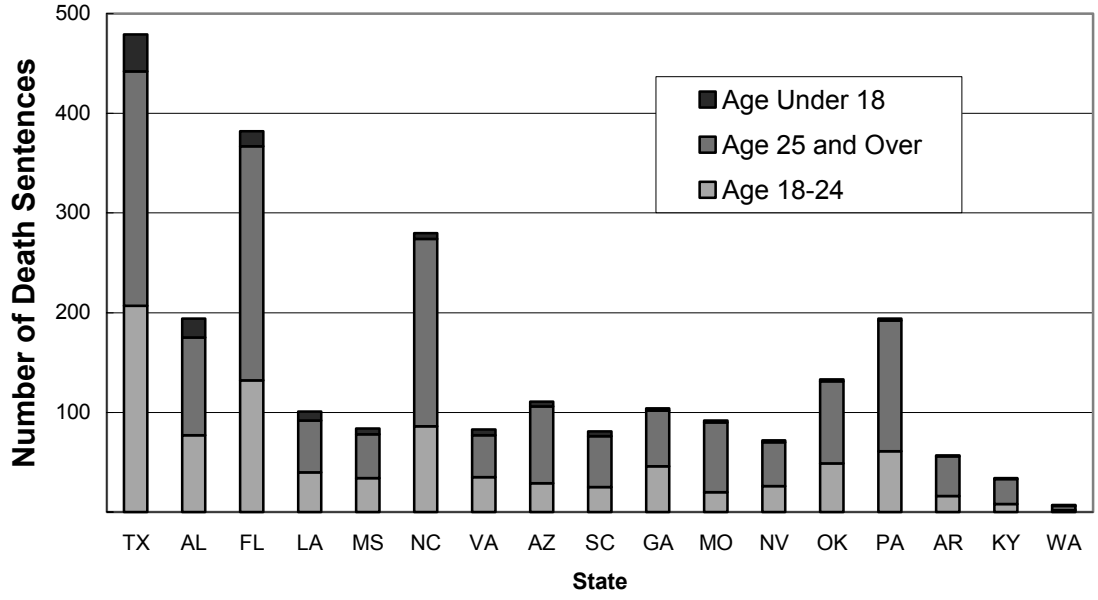


Figure 4b. Death Sentences by Age and State, in Active Juvenile Death Sentencing States, 1990-2002



As Table 6 shows, there is a small group of states whose rankings on juvenile death sentencing are inconsistent with their ranking on adult death sentencing. For example, Oklahoma had only one juvenile offender sentenced to death between 1990 and 2002, but had 120 adults sentenced to death during this period, a ratio of 120:1. Pennsylvania similarly had only two juveniles sentenced to death, but 190 adults sentenced to death, a ratio of 95:1.

The states with no juveniles sentenced to death during the study period generally ranked lowest in number of adults sentenced to death as well. Nevertheless, there are three states – Delaware, Idaho, and Indiana – that had no juvenile death sentences during the study period but had between 15 and 29 adult death sentences per state. Accordingly, there appear to be quite different norms influencing death sentencing patterns for juveniles and adults in several states. [66]

Table 7 shows the trends over time in number of persons sentenced to death in the three highest ranking juvenile death penalty states – Texas, Alabama, and Florida – and the other juvenile death penalty states from 1990-2002. The trends over time in these two groups of states suggest important distinctions in their death sentencing patterns. Figure 5a shows that the number of juveniles sentenced to death in these three states exceeded the numbers of juveniles sentenced to death in all other states combined for most years in the time series. The gap between these three states and the others was especially large from 1995-97, and again in 1999.[67]

[66] State ranks can be somewhat misleading when they are considered separately from the homicide arrests that create a pool of death-eligible defendants or when juvenile and adult data are aggregated. Professor John Blume and his colleagues reported that from 1976 to 1998, Oklahoma and Nevada imposed the most death sentences per homicide arrest. *See* John Blume et al., *Explaining Death Row's Population and Racial Composition*, 1 J. EMPIRICAL LEGAL STUDIES 165 (2004); *see also* Adam Liptak, *Study Revises Texas' Standing as a Death Penalty Leader*, N.Y. TIMES, Feb. 14, 2004, at A10. These data do not consider juveniles separately from adults, and Table 6 shows that there are stark differences in Oklahoma and Nevada between juvenile and adult death sentences. For example, Oklahoma had one juvenile death sentence compared to 120 adult death sentences, or 0.8% of all death sentences. In contrast, the comparable rate in Texas is 5.3%; in Florida, the rate is 3.5%, and in Alabama, the rate is 6.9%. In subsequent analyses, we index the juvenile death sentence rate to the juvenile homicide arrest rate, in effect disaggregating the results reported by Professor Blume and his colleagues to develop indicia specific to juvenile death sentences. *See*, *infra* sections IV.C and V.

[67] We limit these comparisons to persons sentenced to death; the patterns for total death sentences are nearly identical.

Table 7. Number of Persons Sentenced to Death, and Death Sentences, in Texas, Florida, and Alabama, Compared to Other States, 1990-2002

Texas, Florida, Alabama

	Death Sentences			***Persons***		
Year	*Total*	*18-24*	*Under 18*	*Total*	*18-24*	*Under 18*
1990	76	23	6	69	19	5
1991	85	30	3	79	29	3
1992	90	36	5	79	30	5
1993	77	38	2	75	38	2
1994	113	48	9	104	45	7
1995	94	41	8	93	40	8
1996	86	34	8	79	33	8
1997	70	30	6	68	29	6
1998	93	38	6	91	38	5
1999	85	29	9	80	25	9
2000	66	27	3	66	27	3
2001	49	24	4	48	24	2
2002	58	18	2	55	17	2
Total	1042	416	71	986	394	65

Other JDP States

	Death Sentences			***Persons***		
Year	*Total*	*18-24*	*Under 18*	*Total*	*18-24*	*Under 18*
1990	114	30	3	108	28	3
1991	126	44	2	120	42	2
1992	117	37	1	105	36	1
1993	140	51	5	129	47	4
1994	149	53	9	134	50	8
1995	147	49	5	126	45	4
1996	132	42	4	125	39	4
1997	131	47	2	120	45	2
1998	134	48	5	123	44	5
1999	116	40	5	106	34	5
2000	97	25	4	91	23	4
2001	66	21	3	65	20	3
2002	58	17	2	51	15	1
Total	1527	504	50	1403	468	46

Source: Victor Streib, The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes, January 1, 1973 - June 30, 2004. Available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf.
Source: Capital Punishment 2002, Bureau of Justice Statistics, U.S. Department of Justice, http://www.ojp.usdoj.gov/bjs/pub/pdf/cp02.pdf

Figure 5a. Juveniles Sentenced to Death in High States Compared to Other States, 1990-2002

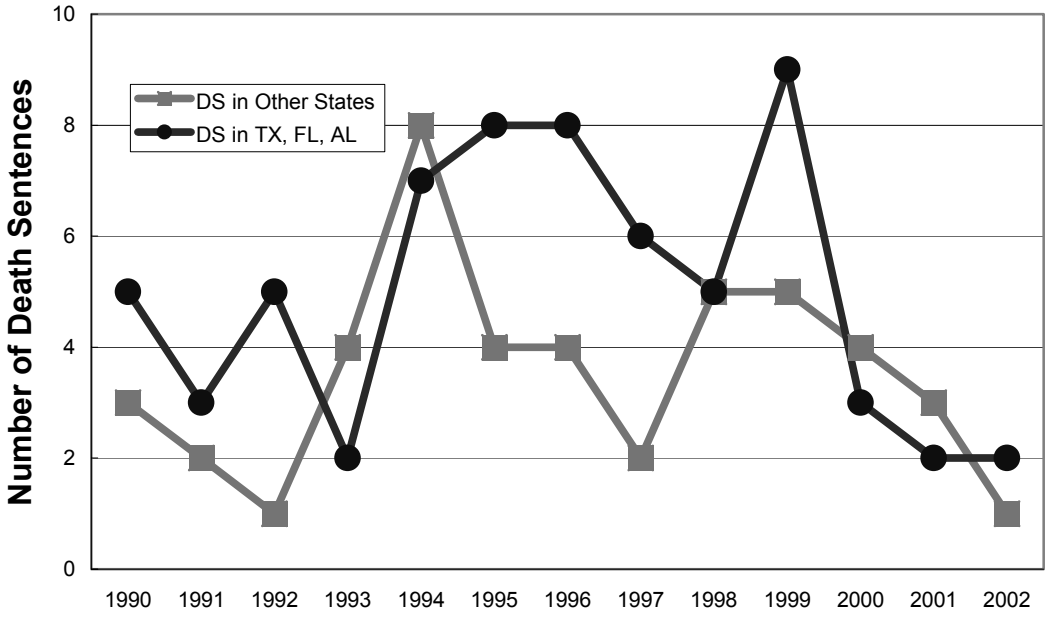
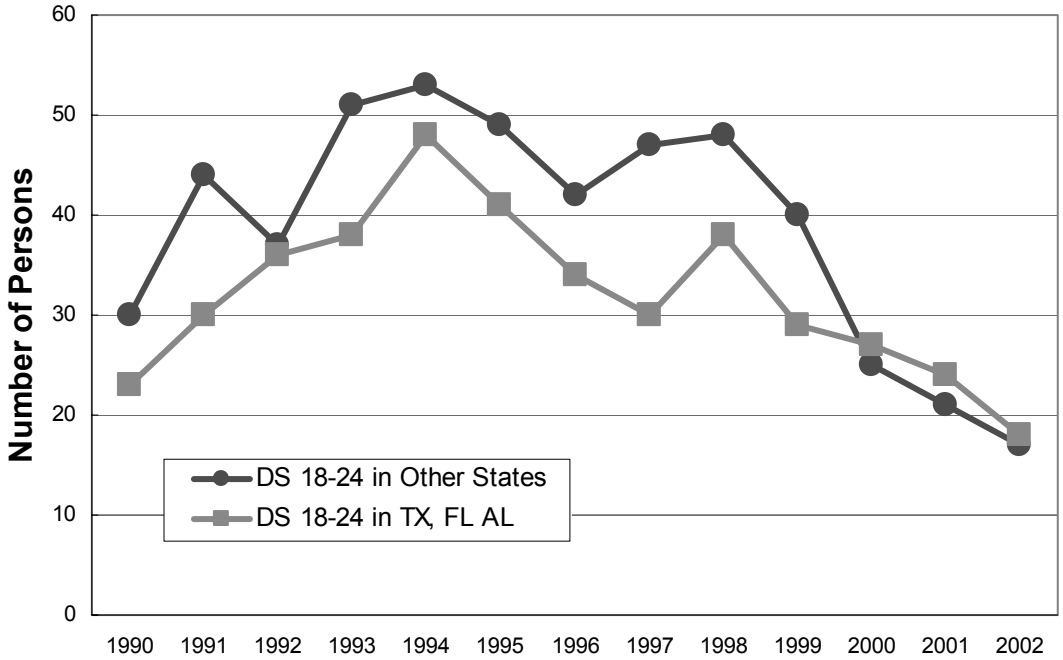


Figure 5b. Persons Ages 18-24 Sentenced to Death in High States vs. Other States, 1990-2002



However, the number of juveniles sentenced to death in these three high-rate states declined beginning in 1997, and (after a one-year increase) declined sharply after 1999. Accordingly, the general secular decline in juvenile death sentences was evident in all the juvenile death-penalty states, not just in the states that used it most often or in other states that had used it less frequently.

Figure 5b shows the trends in death sentencing of defendants 18-24 years of age for the two groups of states. The trend lines are nearly identical, and both show a secular decline beginning in 1999 for this age group. The decline in death sentencing of persons 18-24, however, is not as steep as the decline for juveniles. Accordingly, comparing Figures 5a and 5b suggests that the decline in death sentencing rates is more pronounced for juveniles than for young adults, both in the states that had used the juvenile death penalty most often and in states that had used it less frequently.[68] In subsequent multivariate analyses,[69] we introduce controls for juvenile homicide arrests and populations below age 18 in each state and year, so that the trends in juvenile death sentences are indexed to the homicide arrest rate.

C. Juvenile Death Sentences and the Declining Homicide Rate

The possible counterfactual argument to the claim that declining numbers of juvenile death sentences signals an evolving standard opposing capital punishment for juveniles, is that any observed decline may simply reflect declines in juvenile homicide offending. As the supply of juvenile offenders eligible for death sentences decreases, we would expect the number of juvenile death sentences to decline. If there is an evolving standard that is specific to juveniles, we would expect the number of juvenile death sentences per homicide or per homicide arrest to decline at a faster rate than the number of adult death sentences per homicide, or per homicide arrest. But if death sentences are declining generally, we cannot claim that there is an evolving standard that is specific to juveniles. We explore this question by examining trends over time, first in the number of juvenile and adult death sentences per homicide, and second in the number of juvenile and adult death sentences per homicide arrest.

1. Juvenile and Adult Death Sentences per Homicide. Table 8 shows the number of persons sentenced to death per 1,000 homicide victimizations in the U.S. from 1990-2002 for persons under 18, persons ages 18-24, and persons 25 and older. (We include all homicide victimizations to compute the death sentencing rates, not just homicide victimizations within each corresponding age group. Although some juveniles commit homicides against persons within their own age group, most juvenile homicide offenders kill persons outside their own age group, usually persons three or more years older.[70]) These trends are shown graphically in Figures 6a, 6b, and 6c.[71]

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[68] We omitted 2003 from Figure 5a, so that the years align with Figure 5b.

[69] *See*, infra section V.

[70] From 1985 to1995, in cases where the age of the offender is known, about one in four

The data in Table 8 and Figures 6a, 6b, and 6c show that all three age-specific distributions reflect a curvilinear pattern of increases followed by declines. However, the decline is greater for persons below 18 years of age. From 1994 to 2002, the rate of death sentences per homicide for juveniles declined from 1.29 in 1994 to 0.35 in 2002, a decline of 72.9 percent. Since 1999, the rate declined from 1.67 per 1,000 juvenile homicide arrests to 0.35 in 2002, a decline of 79.0 percent.

Both of these substantial declines for juvenile homicide offenders were far greater than the declines for adults. The number of homicide offenders ages 18-24 sentenced to death per 1,000 homicide victimizations declined by 58.4% from the peak of 9.01 death sentences per homicide in 1998 to a low of 3.75 in 2002.[72] Among persons 25 and older, death sentences per 1,000 homicide victimizations declined 37.9%, from a peak of 13.46 in 1999 to 8.31 in 2002. Figures 6a, 6b and 6c illustrate this comparative difference in the declines in juvenile homicide arrests per 1,000 homicides.

While these figures suggest a sharp contrast between the trends for juvenile and adult death sentencing, they are hardly dispositive of the claim that juvenile death sentencing rates are declining faster than rates for adults. That is, we cannot rely solely on the death sentencing rate per homicide victimization. Many homicides may not be eligible for capital punishment; clearance rates for homicides vary extensively over time and across jurisdictions; and changing laws can expand or narrow the types of crimes that may qualify for capital punishment. Having said that, there is no reason to assume that the percentage of offenders who are deemed to be death-eligible would vary across states, or that this proportion within any state would vary one year to the next. In other words, although not all homicides are eligible for capital punishment, there is no reason to expect variation between states, or from one year to the next within any one state, in the proportion of homicides in any age group that are capital offenses, and it is therefore reasonable to assume that the estimates are not biased by these factors.

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of the victims of homicide offenders ages 13-17 were within the same age group. Three-fourths of the victims of juvenile homicide offenders were 18 years of age or older, and most of those were age 25 and older. *See* Philip J. Cook & John H. Laub, *The Unprecedented Epidemic in Youth Violence*, 24 CRIME & JUSTICE 27, 48-50 & tbls. 3-5 (1998). From 1988-99, we analyzed the Supplemental Homicide Reports (SHR) to measure the relationship between age of victim and age of offender, in homicide cases where the offender age is known (*see* Table 2 and Appendix A) (data not shown, available from authors). We find a pattern nearly identical to the pattern found by Cook and Laub: 25.5 percent of juvenile homicide offenders kill persons who also are juveniles, while 74.5 kill persons who are over age 17. Cook and Laub show in Tables 4 and 5 that the these patterns are stable for 1985, 1991, and 1995, despite enormous differences in the juvenile homicide arrest rate at that time.

[71] Note that the trend lines for juveniles and persons 18-24 in Figure 6 are arrayed against different axes.

[72] 2002 is the last year when accurate age-specific homicide arrest data are available nationally.

Table 8. Persons Sentenced to Death Per 1,000 Homicides by Year and Age, 1990-2002

	Age			
Year	***≤ 17***	***18 - 24***	***≥ 25***	***Total***
1990	.68	4.02	10.61	15.31
1991	.40	5.69	9.85	15.94
1992	.51	5.64	9.65	15.80
1993	.50	7.02	9.42	16.94
1994	1.29	8.20	11.05	20.63
1995	1.12	7.95	11.41	20.48
1996	1.20	7.17	11.96	20.33
1997	.82	7.57	10.95	19.34
1998	1.10	9.01	13.41	23.51
1999	1.67	7.03	13.46	22.15
2000	.83	5.96	12.15	18.95
2001	.58	5.06	7.48	13.11
2002	.35	3.75	8.31	12.41

Source: Victor Streib, The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes, January 1, 1973 - April 30, 2004. Available at http://www.law.onu.edu/faculty/streib/JuvDeathApr302004.pdf; Capital Punishment 2001, Bureau of Justice Statistics, U.S. Department of Justice; U.S. Department of Justice, Federal Bureau of Investigation, Crime in the United States, various years, http://www.fbi.gov/ucr/ucr.htm

Another way to consider these data is to examine the ratio of persons sentenced to death per 1,000 homicides in the various age groups. In 1998, for example, based on the figures in Table 8, the ratio of persons 18-24 sentenced to death per homicide to juveniles sentenced to death per homicide was 8.2 (9.01 | 1.10). In 2002, the ratio was 10.71 (3.75 | 0.35). In 1998, the ratio of persons over age 25 sentenced to death per homicide to juveniles sentenced to death per homicide was 12.2 (13.41 | 1.10); in 2002, it was 23.7 (8.31 | 0.35). Thus, there was a substantial gap in death sentences per homicide between juveniles and adults, and the gap increased over time. While prosecutors and juries have always been more reluctant to seek or use capital punishment for juveniles, that reluctance seems to be growing steadily.

Figure 6a. Juveniles Sentenced to Death By Year Per 1,000 Homicides in Juvenile Death Penalty States, 1990-2002

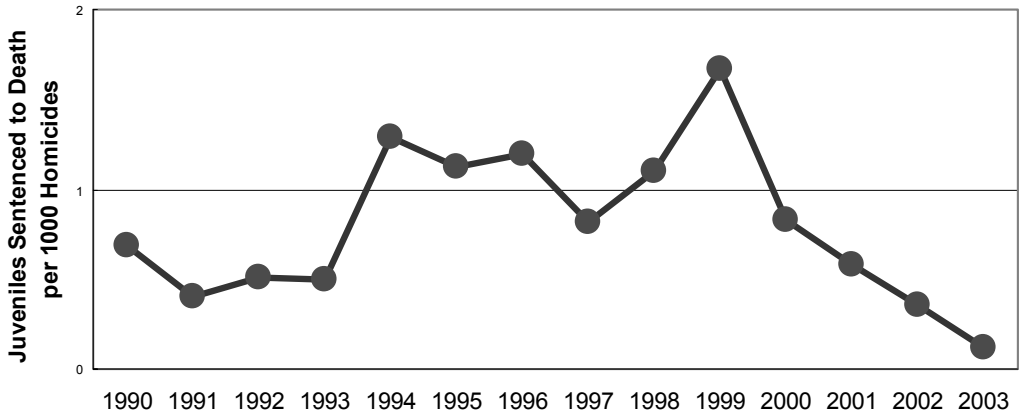


Figure 6b. Persons 18-24 Sentenced to Death per 1,000 Homicides by Year, Juvenile Death Penalty States, 1990 - 2002

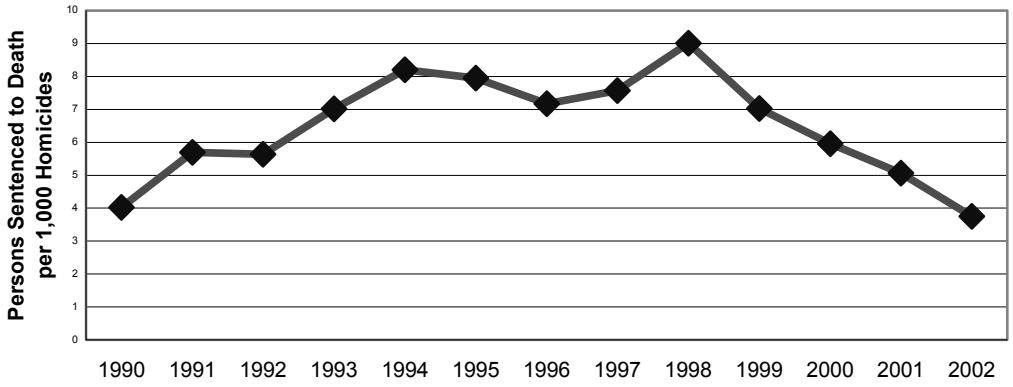
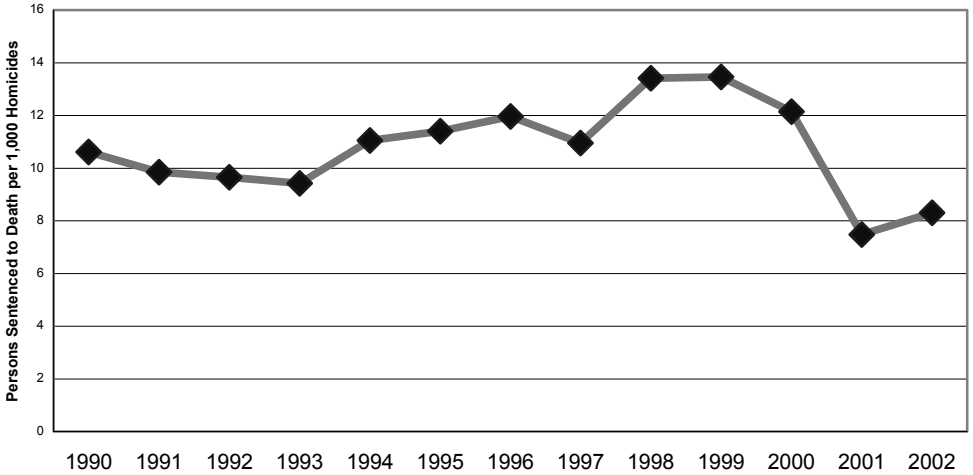


Figure 6c. Persons Age 25 and Over Sentenced to Death per 1,000 Homicides by Year, Juvenile Death Penalty States, 1990-2002



2. Juvenile and Adult Death Sentences per Homicide Arrest. We next turn to death sentences per homicide arrest. Homicide arrests are an important baseline from which to gauge trends in death sentences, since arrestees are the supply of defendants for capital trials and sentences. Not all arrests for homicide are for capital murder, but again we assume that between-state differences in types of homicide and clearance rates are stable within years, and therefore year-to-year differences in the juvenile-adult comparisons are reliable estimators of the attitudes of juries and prosecutors when we compare states over time. In Figure 7 and Table 9, we compute the rate of persons sentenced to death per 100 homicide arrests both for juveniles and for all adults, for the post-*Stanford* era.[73]

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[73] We use all juvenile homicide arrests for persons below 18 years of age, rather than specific counts of homicide arrests for 16- and 17-year old homicide offenders. (Specific counts of persons 16 and 17 years of age who were death-eligible do not exist.) There are both conceptual and practical reasons for this decision.

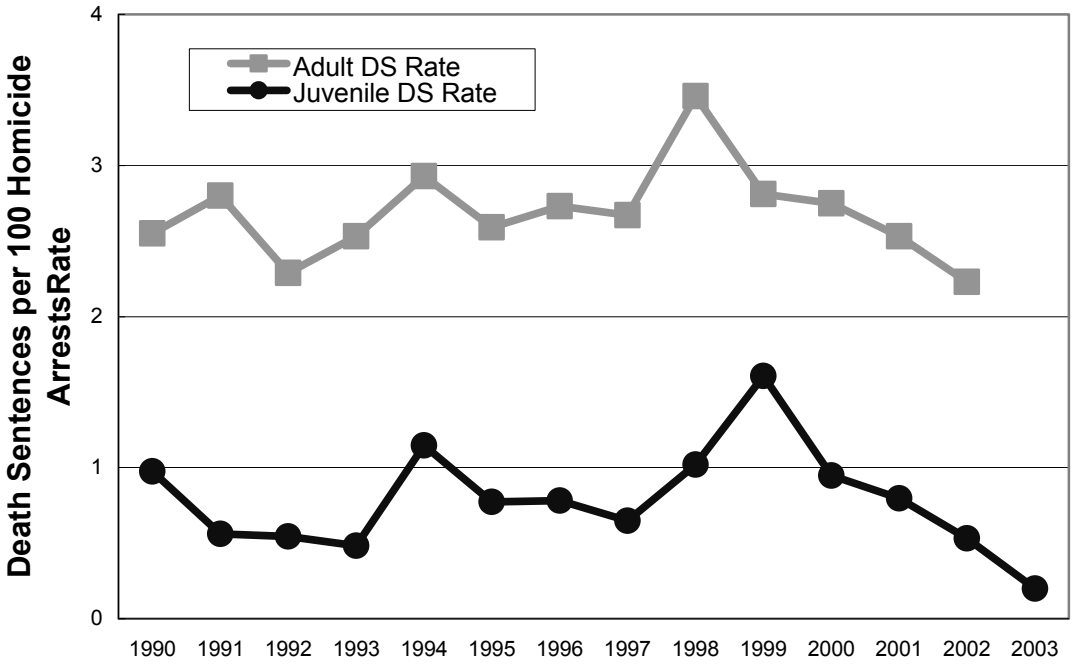
The practical reasons are data availability and missing data. To estimate the count of homicide arrests of 16- and 17-year olds by state and year, we first turned to the Supplementary Homicide Reports (SHR), a specialized homicide data reporting system maintained by the Federal Bureau of Investigation as part of its Uniform Crime Report system. See www.ojp.usdoj.gov/bjs/homicide.addinfo.htm (visited July 7, 2004). These data do report the age of the offender, but they do not provide information on arrestees' capital eligibility. There are critical missing data problems in the SHR, as well. These data do not provide full coverage of all states, either within a given year, or over time. For example, data for Florida are absent from the Supplementary Homicide Reports for 9 of the 14 study years. For states with reported events, it is unknown if the observed variation in the number reporting agencies is due to actual variation in the number of agencies with homicide arrests, or to a failure to report. For example, homicide arrest data for Alabama are based on as few as two reporting agencies in 1999 and as many as 100 in 1994. Most states, large and small alike, follow this pattern. For example, the range in Texas is 305 to 226 reporting agencies and in Montana the range is 1 to 14 reporting agencies over the study period. Using incomplete data from the SHR on age-specific juvenile homicide arrests would risk censoring whole states and years, and would likely bias estimates of juvenile death sentences by inflating the rate at which juveniles are sentenced to death in some states but not others.

To account for missing data, we then turned to the *Sourcebook of Criminal Justice Statistics* (www.albany.edu/sourcebook, visited July 7, 2004). The *Sourcebook* integrates data from over 100 sources of criminal justice information in the U.S. The *Sourcebook* reports the total number of persons under the age of 18 arrested for homicide, but not age-specific counts by state and year. In general, the *Sourcebook* provided fuller coverage and, when all juvenile arrests were compared between these two data sources, consistently reported a higher number of juvenile arrests.

We therefore adopted a conservative approach: for each state-year observation, we used the larger number of homicide arrests of persons under the age of 18 from the SHR and the *Sourcebook.* Since we use all juvenile homicide arrests, including arrests of those under 16 and therefore too young to be sentenced to death, our calculation of the rate at which juveniles are sentenced to death is somewhat lower than the rate would be if only arrests of 16- and 17-year-olds were considered. Nevertheless, since all states and years are similarly affected by this bias, and assuming the age-specific distribution of juvenile homicide arrests varies little from year to year, we can make reliable comparisons over time between states. *See* Alfred Blumstein, *Disaggregating the Violence Trends*, *supra* note 49, at 20-24.

Conceptual reasons reflect the political ecology of states and courts in sentencing juvenile homicide offenders. It is reasonable to assume that death sentences for eligible juvenile offenders (ages 16 and 17) would be influenced by total patterns of juvenile homicide, especially those that receive political attention and popular interest. These will include juvenile homicide offenders

Figure 7. Persons Sentenced to Death Per 100 Homicide Arrests Lagged by Two Years, 1990-2003



under 16, whose actions may well be generalized politically and culturally to the broader pool of juvenile homicide offenders.

Table 9. Juveniles and Adults Sentenced to Death per 100 Homicide Arrests Lagged Two Years, 1990-2003

	Juveniles			*Adults*		
Year	*Juvenile Death Sentences*	*Homicide Arrests Lagged Two Years*	*Juvenile Death Sentences per 100 Homicide Arrests*	*Adult Death Sentences*	*Homicide Arrests Lagged Two Years*	*Death Sentences per 100 Homicide Arrests*
1990	8	719	.97	171	6693	2.55
1991	5	891	.56	194	6919	2.8
1992	6	1102	.54	179	7801	2.29
1993	6	1243	.48	199	7870	2.53
1994	15	1307	1.15	223	7613	2.93
1995	12	1550	.77	207	8002	2.59
1996	12	1535	.78	192	7043	2.73
1997	8	1234	.65	181	6776	2.67
1998	10	981	1.02	204	5894	3.46
1999	14	871	1.61	172	6118	2.81
2000	7	739	.95	152	5526	2.75
2001	5	627	.80	109	4310	2.53
2002	3	563	.53	103	4610	2.23
2003	1	502	.20	--	--	--

Source: Victor Streib, The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes, January 1, 1973 - June 30, 2004. Available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf; Capital Punishment 2002, Bureau of Justice Statistics, U.S. Department of Justice, available at www.ojp.usdoj.gov/bjs/pub/pdf/cp02.pdf; U.S. Department of Justice, Federal Bureau of Investigation, Crime in the United States, various years, http://www.fbi.gov/ucr/ucr.htm

In these analyses, we lag the homicide arrests by two years, to reflect the fact that there is generally a significant lapse of time between arrest and sentencing. We estimate an interval of two years based on prior research on processing of capital cases.[74] To verify the validity of the two-year time lag, we estimated the time from arrest to death sentence based on records in samples of 10 cases from 1990 to 1999 in Texas, Florida and Alabama, the three states with the highest number and percentage of juvenile death sentences.[75] The lag ranged from 7 to 38 months across these cases; the average time lag was 21.9 months and the median time lag was 24 months. Accordingly, we use a time lag of 24 months in estimating the duration from arrest to sentencing.

Table 9 and Figure 7 show that prior to 1999, the rate of juveniles sentenced to death per 100 homicide arrests varied from year to year with no consistent upward or downward trend. Although the rate at which juveniles were sentenced to death was well below the rate for adults throughout the period, the two trend lines moved roughly in lockstep. Since 1999 – the peak year for juveniles -- the rate of decline in the rate of juveniles sentenced to death per juvenile homicide arrest has been far greater than the decline in the rate for adults since its peak (in 1998). The rate for juvenile cases declined from 1.61 to .20 between 1999 and 2003, a drop of 87.6%; by comparison, for adult cases, the rate declined from 3.46 to 2.23 between 1998 and 2002, a drop of 35.5%. Thus, the rate of decline for juveniles during this period was more than 2.5 times the rate of decline for adults. By any mathematical index of comparative rate change, the change for juvenile death sentences has been far greater than that for adult death sentences.

This trend was evident both in the three high-rate states and in states that sentence juveniles to death less frequently. Figure 8a shows the trend for Florida, Alabama, and Texas from 1990 to 2002. (Data for adult death sentences in 2003 have not yet been released). Since 1998, there has been a very small decline in adults sentenced to death per 100 homicide arrests in the three high-rate states. Figure 8a shows that the rate fell from 3.85 adults sentenced to death per 100 homicide arrests in 1998 to 3.35 in 2002, a decline of 13.0%. For juveniles, on the other hand, there was a sharp decline in the rate of persons sentenced to death per homicide arrest, from 3.06 in 1999 to 1.07 in 2002—a decline of 65%. Even if we consider the 1999 peak as an outlier or temporary departure from a longer-term trend, the juvenile rate still declined from its 1990 rate of 1.61 to the

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[74] *See* James Liebman et al., A Broken System, Part I: Error Rates in Capital Cases, 1973-1995, *available at* http://www2.law.columbia.edu/instructionalservices/liebman/.

[75] We reviewed 10 randomly selected cases from both urban and rural counties across each state, representing each state's major population center as well as medium- and small-sized counties. The range of years spanned the decade from 1990-2000. We excluded 2001 and later due to the small number of juvenile death sentences and the attendant sampling problems. We computed the time from incident to arrest, and then from arrest to death sentence. In Florida, the lag time from arrest to sentencing ranged from seven to 26 months, and averaged 15.8 months. In Alabama, the average length of time between arrest and death sentence was 26 months, with a range of 15 to 38 months. In Texas, the lag time from arrest to sentence was 23.4 months, with a range of 11 to 38 months. Data and citations are available from the authors.

Figure 8a. Persons Sentenced to Death Per 100 Homicide Arrests Lagged Two Years, Texas, Alabama and Florida, 1990-2002

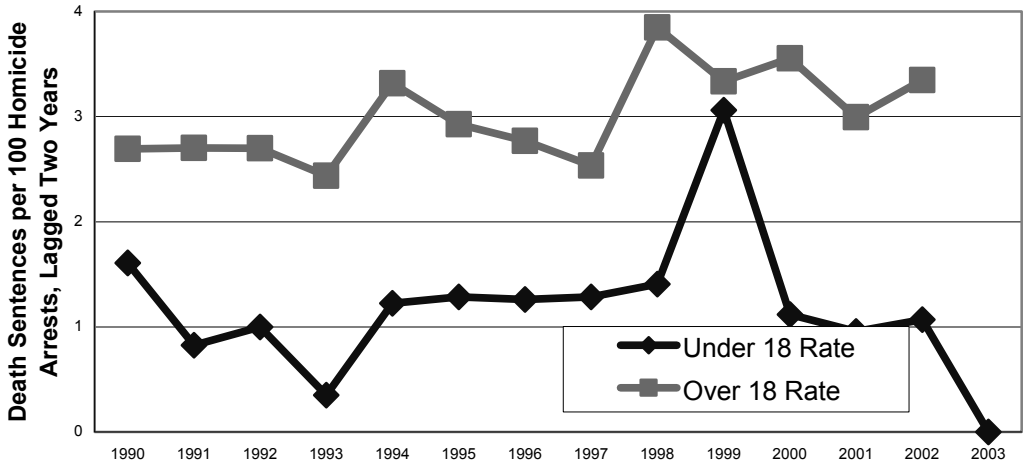
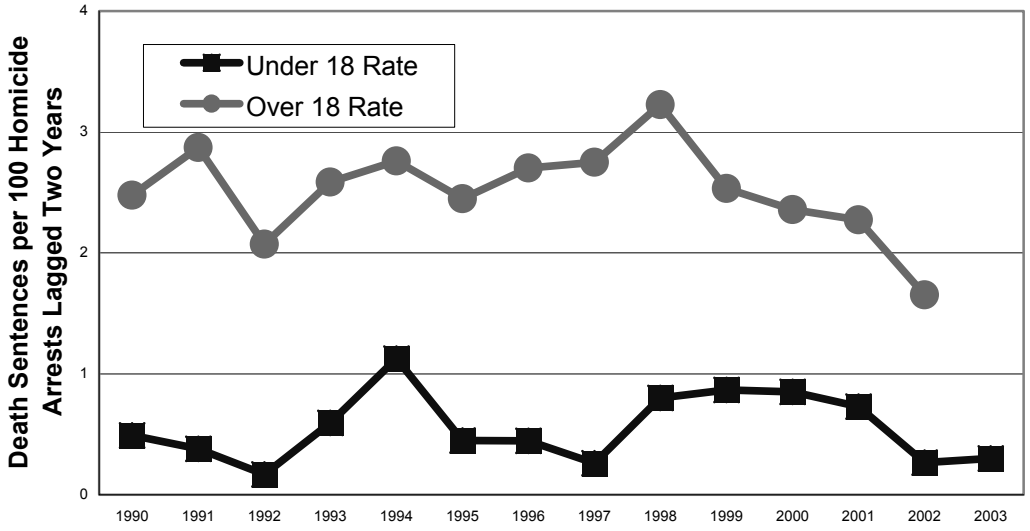


Figure 8b. Persons Sentenced to Death Per 100 Homicide Arrests Lagged Two Years, Medium and Low Juvenile Death Sentencing States, 1990-2002



2002 rate of 1.07, for a drop of 33.5%. Again, the rate of decline for juvenile death sentences per homicide arrest s is twice that of adults. Either interpretation leads to the conclusion that there has been a secular decline in the frequency of juvenile death sentences in the three states that account for the majority of juvenile death sentences—and that the decline has been significantly greater than the analogous decline for adults.

But the downward trend is not confined to these three states. In the remaining juvenile death penalty states, the decline in the rate of juveniles sentenced to death per 100 juvenile homicide arrests was greater than the decline for adults. As Figure 8b shows, the rate for juveniles declined from 0.87 in 1999 to .27 in 2002, a drop of 69.0%. By comparison, the adult rate dropped from a peak of 3.23 in 1998 to 1.65 in 2002, a drop of 48.9%.

These figures show that in both high- and low-rate death sentencing states, the decline in the rate at which juveniles are sentenced to death significantly outstrips the analogous decline in adult death sentencing. Once again, these trends support the conclusion that societal norms are shifting away from the use of the juvenile death penalty.

V. MODELING THE DECLINE IN JUVENILE DEATH SENTENCES: EVIDENCE OF EVOLVING NORMS

The preceding sections show that there has been a large and sustained decline in the use of the juvenile death penalty in state courts since 1989, compared to declines in death sentences for adults. The decline for juveniles is greater than the decline for adults in absolute numbers, and it is also greater than the analogous decline for adults after sentencing rates are indexed to the homicide rate and to the homicide arrest rate.

There are several possible counterfactual explanations for the decline in juvenile death sentences: a decline in the supply of cases due to a lower murder rate and fewer juvenile homicide arrests; changes in the size of the youth population; a general social trend opposing death sentences for both young adults (ages 18-24) and juveniles; the presence of other social and political factors that would alter the political ecology and legal context of charging and death sentencing.[76]

Accordingly, we tested whether changes in the social, political, and normative cultures of the U.S. have produced an evolving standard that increasingly opposes the use of capital punishment specifically for juveniles. We estimated multivariate statistical models to examine the contributions of several factors that might produce a decline in juvenile death sentences, including the possible counterfactual explanations that challenge the claim that there is an "evolving standard" opposing the juvenile death penalty.

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[76] *See, e.g.*, James Liebman et al., *A Broken System, Part II, supra* note 53.

A. Model Estimation

1. Model Forms. We use two different forms of Poisson regression methods to identify factors that predict juvenile death sentences, and to model changes in the rate of juvenile death sentences over time. Poisson regressions generally are appropriate for predicting a count of discrete events.[77] Events such as the number of insurance claims, the number of doctor visits, incidence of diseases, crime incidence, number of days a child is absent from school, the number of icebergs in a shipping lane in the North Atlantic, all can be modeled using Poisson regression. These models try to predict why these events occur in some locales or to some persons and not others, and how often they occur if they occur at least once. See Appendix B for details on the derivation of Poisson models.

Poisson distributions typically assume that events are inevitable, and that they follow some known distribution or frequency pattern. In this condition, there are very few non-occurrences, even though most events occur infrequently, and there are a small number of observations that have higher counts of events. So, for example, very few children miss no days during the school year, most children are absent from school only a few days a year, a small number of children are absent regularly (perhaps once a month), and an even smaller number are frequently absent. But suppose we are observing a particularly healthy group of children, and school absence is rare. The event (school absence) is not inevitable, and we need to know, first, who is absent at least once, and among those, who is absent more or less often. That is, the few who miss any school at all are absent at varying rates, most of them quite rarely but a few more often. These two distributions of absence would require two different processes or models to account for the high number of zeros and the relatively infrequent occurrence of school absence.

This is the rationale for the two forms of Poisson regression: Poisson models, which model the factors that predict the event being observed, and Zero-Inflated Poisson (ZIP) models, which also model these predictors but accommodate distributions with a large number of zero observations.[78] Both model forms treat each observation as an independent event and estimate regression models that predict the count of these events from a known set of potential explanatory factors. But they differ in one critical statistical respect: in contrast to a Poisson model, the ZIP model combines equations that reflect the "dual regime" data-generating processes: one that generates the count of non-zero events, and a second that produces the observed distributions.[79] Appendix B provides details on the mathematical foundation of both Poisson and ZIP regression models.

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[77] See *infra* Appendix B.

[78] See, e.g., Greene, *supra* note 60; Zorn, *supra* note 61; *see also* Jeffrey M. Woolridge, ECONOMETRIC ANALYSIS OF CROSS-SECTIONAL AND PANEL DATA (2003).

[79] *See* Zorn, *supra* note 61, at 2.

One question remains: what is the threshold of overdispersion, or how many zero-observations would compel an analyst to abandon a Poisson regression model and use a ZIP model? To test the appropriateness of using a ZIP model rather than a traditional Poisson model, Professor Quang H. Vuong proposed a test statistic that is well suited for situations where the distributions (Poisson, in this case) can be anticipated.[80] Vuong's statistic is $V = \sqrt{n}\ \overline{m} / s_m$, where m_i is the log of the ratio of the predicted probabilities from the extended model and the Poisson model log $(\hat{P}_e / \hat{P})_i$. The limiting distribution of V is a standard normal distribution. Large positive values favor the extended model (the ZIP model), and large negative values favoring the Poisson or nonzero-inflated version of the model.[81] Values close to zero in absolute value favor neither model.[82]

In the analyses that follow, we estimate models using both model forms. In the first stage, we estimated ZIP models, and included the Vuong test. The results were inconclusive, i.e., not statistically significant, but not zero either. Accordingly, we used both the ZIP model and the more conservative "hurdle" Poisson specification.[83] The results are reported in Tables 10 and 11.

2. Procedures. In each model form, the dependent variable is juveniles sentenced to death; we did not include re-sentences, for reasons discussed earlier. The general analytic model estimates the probability of a juvenile death sentence in a state-year, controlling for the number of juvenile homicide arrests lagged by two years (i.e., the supply of persons eligible for the death penalty).[84] In the zero-inflated Poisson (ZIP) model, we specify an inflation factor that adjusts for the excessive number of zeros in the dataset (see Appendix B). Most of the zeros are located in states with medium and low total death sentencing rates.[85] Therefore, we include a binary variable as an indicator of whether the state is one of those that produces a high number of zeros.

We include an indicator for both a linear time trend (Time) and a quadratic time trend (Time x Time, or Time^2). Time^2 accounts for the non-linear shape of the distribution of both juvenile death sentences and juvenile homicide arrests over the study period.[86] We include a dummy (binary) variable for the most recent four-year period of sustained decline in juvenile death sentences (2000-

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[80] *See* Q. H. Vuong, *Likelihood Ratio Tests for Model Selection and Non-nested Hypotheses*, 57 ECONOMETRICA 307 (1989).

[81] *See* J. Scott Long, REGRESSION MODELS FOR CATEGORICAL AND LIMITED DEPENDENT VARIABLES (1997).

[82] *See id.*

[83] *See* Yin Bin Cheung, *Zero-inflated Models for Regression Analysis of Count Data: A Study of Growth and Development*, 21 STATISTICS IN MEDICINE 1461,1462-66 (2002).

[84] The time lag between arrest and death sentencing for juveniles is approximately two years. *See supra* Part IV.C.2.

[85] Texas, Florida, and Alabama account for 65 of the 112 juveniles sentenced to death from 1990-2003. *See* Tables 6-7.

[86] This curvilinear distribution is an inverted "U", with an increase in the early 1990s followed by a peak in 1994 and then a decline (with an interim spike in 1999) through 2003. *See* figures 3a and 3b.

2003), to test whether the number of juvenile death sentences after the 1999 spike is lower than in the years before (Post-1999).

We then include an interaction term in separate models – a multiplier of each of the time trends by the Post-1999 variable – to test specifically whether the slope of the downward trend after 1999 is significant. This is a critical test of the existence of an evolving standard regarding the juvenile death penalty. By testing for the significance of the slope (downward trend) with both the linear and quadratic time trend, we can show whether the rate of change – that is, the slope of the downward trend – is a significant predictor of the juvenile death sentencing rate. We do this separately for the interaction of the post-1999 measure with the linear time trend (TIME) and the quadratic time trend ($TIME^2$), and report the results as separate models. In each table, we report the regression coefficients, whether they are statistically significant, and the overall model statistics that show its strength and predictive power. As we show below, we obtain similar results with similar implications using these two constructions of the time trend.

The models control for the supply of juvenile homicide defendants by including the number of juvenile homicide arrests as an "offset" in the model.[87] We lag the count of juvenile homicide arrests by two years,[88] and use the logged value to relieve the effects of skewness and outliers on the regression models. The use of an offset is a method for specifying an "exposure" variable, which identifies the size of the population that might be affected by the causal factors.[89] The results and predicted death sentencing rates are adjusted to reflect this exposure measure, but a significance test for this variable is not computed in this procedure. In the ZIP model, we include an "inflation" factor that adjusts the results to reflect the large number of zero observations (see Appendix B). In the non-inflated Hurdle Poisson models, we address this factor by using a binary (dummy) variable that indicates whether the state is a medium or low death sentencing state to adjust for zero-inflation.[90] The exposure and inflation measures are included in each iteration (stage) of the analyses. Note that we do not report the effects of the inflator in either set of models (it was not significant in either specification).

We also include a control variable for the number of death sentences for 18-24 year old defendants in each state-year during the period. We use the natural log of this count, since the count is skewed. By controlling for death sentences in this next oldest age bracket, we can determine if the decline in juvenile death sentences is predicted by a more general secular trend opposing the

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[87] The offset is the functional equivalent of computing a rate of death sentences per juvenile homicide arrest. But by including the count as the dependent variable, and the offset as a predictor, we allow for the possibility that the joint distributions may vary over time. This is one of the essential components of a Poisson model. *See* Greene, ECONOMETRIC ANALYSIS, *supra* note 60.

[88] The two year time lag is designed to adjust for the time delay between arrest and sentencing. *See supra* Part IV.C.2.

[89] Bruce K. Armstrong et al., PRINCIPLES OF EXPOSURE MEASUREMENT IN EPIDEMIOLOGY (1992).

[90] *See* table 3, *supra*, for data on the number of death sentences by state.

death penalty, or if the decline for juveniles is age-specific and distinct from other norms on capital punishment.

Additional control variables include the murder rate per 100,000 population, and the residual of the murder rate. The residual is an estimator that allows us to control for unmeasured variables that contribute to state-level variation in the murder rate. Since the murder rate is correlated with several state-level social structural variables,[91] we estimated regression equations that predict the homicide rate in each state-year from these variables. The unstandardized residuals from these regressions represent the components of the murder rate that reflect factors that are not represented by these well-known and widely tested social structural factors. Since these same state-level social structural factors are correlated with death-sentencing rates,[92] we include several in the models predicting juvenile death sentences. We also include measures of political pressure and punitiveness that were significant predictors of death sentencing and error rates in death sentences.[93] Finally, we include the percentage of the total population that is below age 18, as a proxy for the size of the population at risk for both juvenile homicide and capital punishment.

To test for the robustness of these models, we re-estimated each set – ZIP and Poisson models – using a series of alternate assumptions, to demonstrate the stability of the results using alternate specifications of the basic findings. These alternate specifications address the disproportionate contributions of the three high juvenile death sentencing states to the overall distribution of juvenile death sentences. Accordingly, we first estimate models with all states, followed by a model excluding Texas, and a third model excluding the three high death sentencing states of Texas, Florida, and Alabama. In this way, we can estimate the generality of the decline in juvenile death sentences in both high- and low-rate states. Finally, for each of the full models – the models with all predictors with

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[91] Murder and social structural variables are endogenous, and determining causal direction often is difficult. *See, e.g.*, Kenneth C. Land, Patricia McCall, & Lawrence E. Cohen, *Structural Covariates of Homicide Rates: Are There Any Invariances Across Time and Social Space?*, 95 AM. J. SOCIOLOGY 922, 922-32 (1990); Lauren J. Krivo & Ruth D. Peterson, *The Structural Context of Homicide: Accounting for Racial Differences in Process*, 65 AM. SOCIOLOGICAL REV. 547 (2000). *See generally* Robert J. Sampson & Janet H. Lauritsen, *Individual-, Situational-, and Community-Level Risk Factors*, in UNDERSTANDING AND PREVENTING VIOLENCE 1 (A.J. Reiss, Jr. & J.A. Roth eds., 1994). In addition, many of the social structural factors that explain and predict homicide rates at the state level also predict death sentencing rates. *See* Liebman et al., *A Broken System, Part II*, *supra* note 53. Including both homicide and social structure in the same model raises risks of multicollinearity and endogeneity that would distort the regression results. Also, since the murder rate is serially correlated from year to year, controls are needed to adjust for the potential inflation of its contribution to death sentencing. Computing the residual accomplishes this. Accordingly, we use a measure of the residual of the murder rate to account for the unique contributions of the murder rate in each year to the prediction of juvenile death sentences. We compute the residual by estimating a regression model with the murder rate as the predictor and social structural variables, such as poverty and family structure, as the predictors.

[92] *See* Liebman et al., *A Broken System, Part II*, *supra* note 53; Blume et al., *supra* note 66.

[93] *See* Liebman et al., *A Broken System, Part II*, *supra* note 53.

the linear interaction term, and the models with all predictors and the quadratic interaction term – we graphically show the adjusted rate of juvenile death sentences that accounts for the influence of the other factors.

The means and standard deviations of all the variables are shown in Appendix C.

B. Results

The results of the models using the linear interaction term are shown in Table 10. The first three columns in Table 10 report the results of the ZIP models, and the second three report results of (non-zero-inflated) Poisson regressions. In each cell, we show the regression coefficient and the standard error (in parentheses). We report statistical significance ($p < .05$) by showing a coefficient in bold; coefficients that are near significance ($p > .05$ but $p < .10$) are shown in italics.[94]

In the full model in Table 10, the Post-1999 * TIME interaction is significant: the coefficient of -.81 shows that the downward trend in death sentences after 1999 is statistically significant after controlling for the number of juvenile homicide arrests, the general time trends, the adult (18-24) death sentence rate, the murder rate, the residual of the murder rate,[95] the youth population, and the state covariates. Note also that the murder rate is significant and positive: there are more death sentences in state-years with higher homicide rates.

The model excluding Texas is shown in the second column of Table 10. We exclude Texas because of its substantially higher number of both juvenile and adult death sentences, including the high proportion of all death sentences that are given to juveniles. This concentration of death sentences not only is substantively important, but it also carries the possibility of biasing or skewing the results due to a disproportionate contribution made by one state.[96]

This model produces the same result. In fact, the coefficient for the time interaction is slightly larger (-.83). This model shows that in states other than Texas, there is a significant downward trend in juvenile death sentences after 1999, controlling for the number of juvenile homicide arrests, adult death sentences (ages 18-24), the murder rate, and the youth population.

The third column in Table 10 shows the results of the ZIP regressions, this time excluding the three states with the highest number of juvenile death sentences. These states accounted for more than half of the juvenile death

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[94] Note that the tables do not show the results for the state covariates, since they are not directly related to the research question. These data are available from the authors.

[95] The residual measures the year-to-year variation in homicide rates and its relationship to social structural factors that predict both death sentences and homicide rates. *See supra* note 92 and accompanying text.

[96] *See, e.g.*, Richard Berk, *New Claims about Executions and General Deterrence: Déjà Vu All Over Again?*, J. EMPIRICAL LEGAL STUDIES (forthcoming) (showing that the correlation between execution and homicide is heavily skewed by the high incidence of execution in Texas).

Table 10. Zero-Inflated Poisson Regressions of Juvenile Death Sentences over Time, Linear Time Interaction, Controlling for Juvenile Homicide Arrests, Homicide Rate, Youth Population, and State Covariates* (b, robust standard error)

	ZIP Model			Poisson Model		
Predictors	***Full Model***	***Excluding Texas***	***Excluding FL, TX, AL***	***Full Model***	***Excluding Texas***	***Excluding FL, TX, AL***
Time	***-.34***	**-.46**	-.39	***-.35***	**-.47**	-.36
	(.03)	(.22)	(.33)	(.19)	(04)	(.32)
Time^2	***.03***	***.04***	.04	*.03*	**.04**	.03
	(.02)	(.02)	(.03)	(.02)	(.02)	(.02)
Post-1999 Time	**8.35**	**8.64**	8.18	**8.40**	**8.69**	7.75
	(3.59)	(4.09)	(5.01)	(3.56)	(4.06)	(4.99)
Death Sentences 18-24 (logged)	.10	.15	.16	.13	.17	.13
	(.21)	(.21)	(.25)	(.19)	(.19)	(.26)
Post 1999 * Time Interaction	**-.81**	**-.83**	-.74	**-.81**	**-.83**	-.70
	(.32)	(.37)	(.46)	(.32)	(.37)	(.46)
Murder Rate (logged)	***1.33***	***.75***	***2.60***	**1.42**	**1.83**	1.97
	(.76)	(.96)	(1.37)	(.73)	(.92)	(1.35)
Residual - Murder Rate	-.02	-.06	-.22	-.03	-.06	-.20
	(.09)	(.11)	(.14)	(.09)	(.05)	(.14)
Youth Population (logged)	-.11	.06	-.17	-.10	.28	-.30
	(.23)	(.42)	(.52)	(.23)	(.42)	(.53)
Model Statistics						
N of Observations	354	320	292	334	320	292
N of Zero Observations	262	260	250	262	260	250
Log Likelihood	-173.90	-147.42	-103.83	-173.91	-147.46	-.102.72
Chi-Square	32.21	30.42	11.10	41.89	34.89	25.46

* All coefficients adjusted for zero-inflation parameter and offset (homicide arrests of adolescents below 18). Significant predictors ($p<.05$) shown in **bold,** significant predictors ($p< 10$ and $>.05$) shown in ***bold italics.*** Medium-low states shown in Table __.

§ Coefficients for state-level covariates not shown, available from authors. State-level covariates include: ratio of black to white homicide victimization; percent black population; percent population living in urban areas; political pressure index (Liebman et al., 2002, *supra* note 53); and, punitiveness index (Liebman et al., 2002, *id.*).

sentences since 1990.[97] This time, none of the predictors is statistically significant. The coefficient for the time interaction is slightly lower than in the other two ZIP models (-.70), but it is not statistically significant (p=.11). The result is not surprising, considering how sparse death sentencing was after 1999 in the other states with valid juvenile death penalty statutes.

The next three columns in Table 10 show results of the non-zero-inflated Poisson regressions. Recall that we used this form of Poisson regression because the Vuong tests on the ZIP models were inconclusive. The conservative approach in that situation is to estimate the models using Poisson methods, and compare the similarity of the two sets of results. The pattern of results in all three models is nearly identical. The coefficients are nearly identical, and the pattern of statistical significance is similar. The coefficient for the interaction term again approaches significance (p=.12), but does not reach the standard threshold of p=.05. The only difference between the ZIP and Poisson models in the third and sixth models is in the coefficients for the murder rate. This predictor is not significant in the model excluding the three high juvenile death sentencing states.

Overall, the regression models reported in Table 10 show a statistically significant downward trend in juvenile death sentences in the years after 1999 across a range of models that control for a wide range of social and legal factors, and under two different modeling strategies.

Table 11 shows a parallel set of analyses, using the quadratic interaction term of Post-1999 * $Time^2$, substituting the quadratic term $TIME^2$ in the interactions with the post-1999 indicator. This is an alternate test of the significance of the downward slope of death sentences, a more restrictive test that specifies a more accelerated decline. A significant interaction term under these conditions would signify that the downward slope meets a more rigorous and demanding test of its trajectory over time.

The pattern of results is identical. The coefficients for the interaction of $TIME^2$ * Post-1999 are smaller compared to the coefficients in Table 10, but this is not surprising, given the more demanding test using the quadratic time interaction term. Even with this more restrictive test, the quadratic time interaction is statistically significant in four of the six models; it is not significant in the models that exclude the three high juvenile death penalty states (Texas, Alabama and Florida).

[97] *See* Streib, *supra* note 16.

Table 11. Zero-Inflated Poisson Regressions of Juvenile Death Sentences over Time, Quadratic Time Interaction, Controlling for Juvenile Homicide Arrests, Homicide Rate, Youth Population, and State Covariates* (b, robust standard error)

	ZIP Model			**Poisson Model**		
Predictors	***Full Model***	***Excluding Texas***	***Excluding FL, TX, AL***	***Full Model***	***Excluding Texas***	***Excluding FL, TX, AL***
Time	***-.35***	**-.47**	-.40	***-.35***	**-.48**	-.36
	(.19)	(.22)	(.33)	(.19)	(22)	(.32)
Time^2	***.03***	***.04***	.04	**.03**	*.04*	.03
	(.02)	(.02)	(.03)	(.02)	(.02)	(.02)
Post-1999 Time^2	**3.44**	**3.63**	3.70	**3.46**	**3.65**	3.49
	(1.66)	(1.88)	(2.26)	(1.65)	(1.87)	(2.24)
Death Sentences 18-24 (logged)	.10	.15	.17	0.13	.17	.14
	(.21)	(.21)	(.26)	(.19)	(.19)	(.26)
Post 1999 * Time Interaction	**-.03**	**-.03**	-.03	**-.03**	**-.03**	-.03
	(.01)	(..02)	(.02)	(.01)	(.02)	(.02)
Murder Rate (logged)	***1.35***	***1.77***	***2.63***	**1.44**	**1.85**	1.99
	(.76)	(.96)	(1.37)	(.73)	(.92)	(1.36)
Residual - Murder Rate	-.02	-.06	-.22	-.03	-.07	-.20
	(.09)	(.11)	(.14)	(.09)	(.11)	(.14)
Youth Population (logged)	-.11	.06	-.17	-.10	.05	-.30
	(.23)	(.42)	(.51)	(.23)	(.42)	(.53)
Model Statistics						
N of Observations	334	320	292	334	320	292
N of Zero Observations	262	260	250	262	260	250
Log Likelihood	-173.81	-147.34	-103.80	-173.91	-147.38	-.102.69
Chi-Square	32.38	30.57	11.17	41.89	35.04	25.51

* All coefficients adjusted for zero-inflation parameter and offset (homicide arrests of adolescents below 18). Significant predictors (p<.05) shown in **bold,** significant predictors (p< 10 and >.05) shown in ***bold italics.*** Medium-low states shown in Table __.

§ Coefficients for state-level covariates not shown, available from authors. State-level covariates include: ratio of black to white homicide victimization; percent black population; percent population living in urban areas; political pressure index (Liebman et al., 2002, *supra* note 53); and, punitiveness index (Liebman et al., 2002, *id*).

Table 12. Persons Sentenced to Death by State and Year, 2000-2003

	Year				
State	*2000*	*2001*	*2002*	*2003*	*Total*
Texas	2	1	1		4
Alabama			1		1
Florida	1	1			2
Arizona	1	1		1	3
North Carolina	1	2			3
Louisiana	1		1		2
Nevada	1				1
Arkansas					
Delaware					
Georgia					
Idaho					
Indiana				NA	
Kentucky					
Missouri†					
Mississippi					
New Hampshire					
Oklahoma					
Pennsylvania					
South Carolina					
South Dakota*					
Utah					
Virginia					
Wyoming*					
Total	7	5	3	1	16

* Wyoming and South Dakota banned the death penalty for juveniles by legislation in 2004.
† Missouri banned the death penalty for juveniles in August, 2003.
Source: Victor L. Streib, The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes January 1, 1973-June 30, 2004, available at , http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf (visited August 4, 2004).

Overall, the results in Tables 10 and 11 provide consistent evidence under a variety of measurement and model specification conditions of a significant downward trend in juvenile death sentences in the U.S., especially in the period following 1999. Only when we exclude the three high states is the critical interaction term not significant.

The lack of significance when these three states are excluded may be the result of the extreme sparseness of juvenile death sentences beginning in 2000, especially in the other states. Table 12 shows that 72 of the 80 possible state-year observations are zeros for the states, other than Texas, Alabama, and Florida, that had valid statutes during this time. Only one state (North Carolina) had more than one juvenile death sentence in any year during that period. This is a greater proportion of zeros than is observed across the earlier period (1990-1999), when 199 of 243 observations were zero, and for the entire study period, when 264 of 334 observations were zero. It is not surprising, then, that the third and sixth models in each table are not significant. Achieving a valid statistical prediction of such rare events is difficult, even under optimal and efficient measurement and sampling conditions. These patterns of sparse data provide additional evidence of the decline of juvenile death sentencing since 1999.

In the last stage of the analysis, we generated predicted values for juvenile death sentences that are adjusted for the explanatory variables in the regression model. That is, we show the predicted rates of juvenile death sentences per juvenile homicide arrest, adjusted for all the predictors in these models. Figures 9 and 10 show the predicted values for juvenile death sentences per juvenile homicide arrest that were generated from the full ZIP models (with all states) in Tables 10 and 11. On a second axis, we show the juvenile homicide arrest count, lagged by two years as it is in the multivariate models.[98] Figure 9 uses the linear Time interaction term to compute the predicted juvenile death sentence rates; Figure 10 uses the more restrictive adjustment based on the quadratic ($Time^2$) interaction. The figures are nearly identical. They show that the peak adjusted rate of juvenile death sentences per juvenile homicide arrest was in 1996 (earlier than 1999), and declined thereafter other than a one-year increase in 1999. The figures also show a widening gap between the predicted values for juvenile death sentences and juvenile homicide arrests beginning in 2000. This four year sustained decline in juvenile death sentencing, when indexed to the juvenile homicide arrest rate, and controlling for the murder rate, together with the longer seven year decline in the adjusted rates, suggests the presence of legal and social dynamics that have reduced the use of the juvenile death penalty nearly to zero.

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[98] For example, the 1990 predicted JDS rate is predicted from the 1988 juvenile homicide arrest count. The 1988 time point for juvenile arrests is shown in conjunction with the 1990 JDS datapoint. At the other end of the series, the 2001 juvenile homicide arrest count is shown with the 2003 JDS datapoint.

Figure 9. Juvenile Death Sentences per Year, Adjusted for Predictors including Linear Trend, by Juvenile Homicide Arrests (Lagged 2 Years), 1990-2003

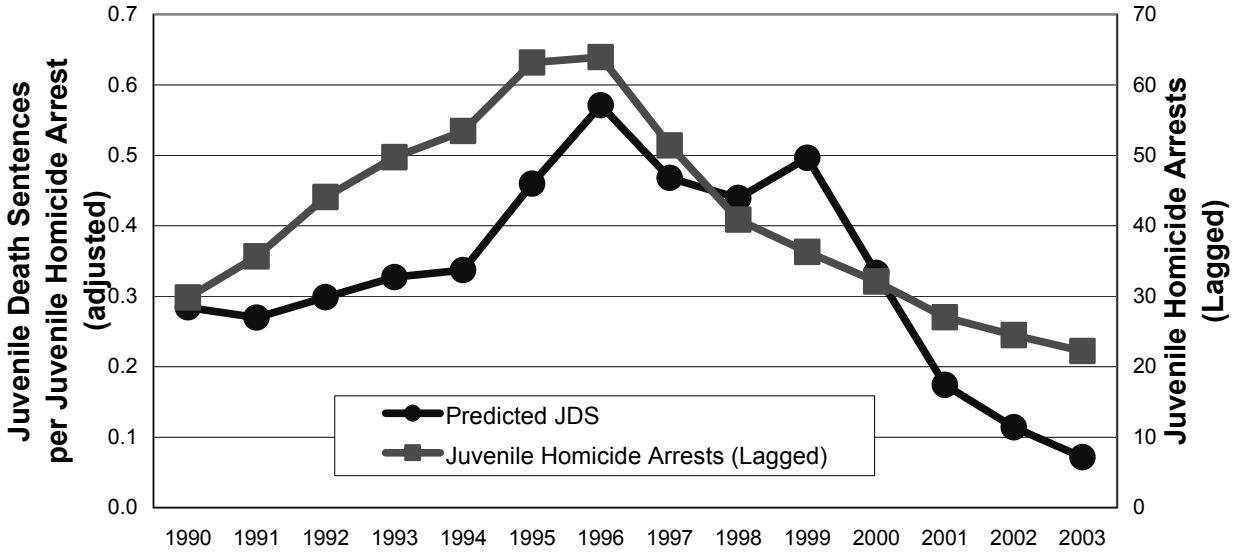
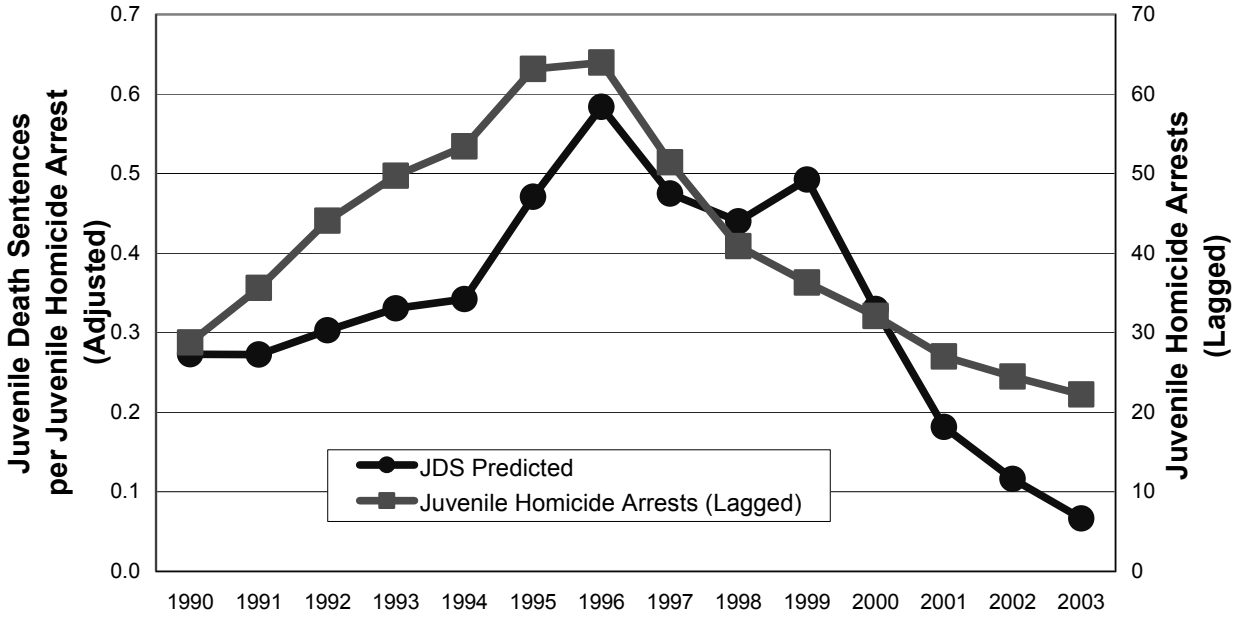


Figure 10. Juvenile Death Sentences per Year, Adjusted for Predictors including Quadratic Time Trend, by Juvenile Homicide Arrests (Lagged 2 Years), 1990-2003



Finally, in Figures 11 and 12, we show the predicted rates of juvenile death sentences together with 95% confidence intervals (CIs). A CI is a range of values that has a high probability of containing the effect or parameter being estimated.[99] If other information about the value of the parameter is available, it should be taken into consideration when assessing the likelihood that the interval contains the parameter. In this context, this means that the effects of time trends, juvenile homicide arrests, the murder rate, population size, and social and political covariates are included in the estimation of the confidence intervals for each year. Generally, the width of the CI gives us some idea about how uncertain we are about the unknown parameter (see precision). When the data are sparse, as in the case of the declining number of juvenile death sentences and the generally high number of zeros across the study period, a wider confidence interval reflects the sensitivity of the estimates of these very low frequency events to the predictors that are included in the statistical model.

Figures 11 and 12 show again that the predicted juvenile death sentence rate per juvenile homicide arrest is declining over time. The trends are nearly identical for either of the two predictions: the predicted rate controlling for the linear interaction term of Post-1999 by Time, or the more restrictive condition of Post-1999 by $Time^2$. Generally, the predicted rate of juvenile death sentences per juvenile homicide arrest is declining, especially since 1999, and the confidence intervals are stable throughout the period. While the confidence intervals widen after 1999, they do not widen to an extent that would raise doubts about the functional form of the overall time trend. Moreover, the widening confidence intervals are a reflection of the sparseness of the data beyond 1999: from 14 juvenile death sentences in 1999 to seven (2000), five (2001), three (2002) and one (2003) (see Table 12). The estimates of death sentences per homicide are particularly sensitive under these conditions, a factor that accounts in part for the widening confidence intervals. But the fact of one death sentence in 2003, and the small and declining number in the preceding years, is unavoidable and uncontestable. The stability and narrow bite of the CIs under these conditions suggests that the predicted rate of death sentences per juvenile homicide rate is reliable.

[99] The 95% confidence interval is constructed in such a way that 95% of such intervals will contain the parameter. Similarly, with a 99% confidence interval, 99% of the confidence intervals will contain the parameter. For example, if the parameter being estimated were μ, the 95% confidence interval might look like:

$$12.5 \leq \mu \leq 30.2$$

Figure 11. Juvenile Death Sentences per Juvenile Homicide Arrest by Year with 95% Confidence Intervals, Adjusted for Linear Time Trend and Other Predictors, 1990-2003

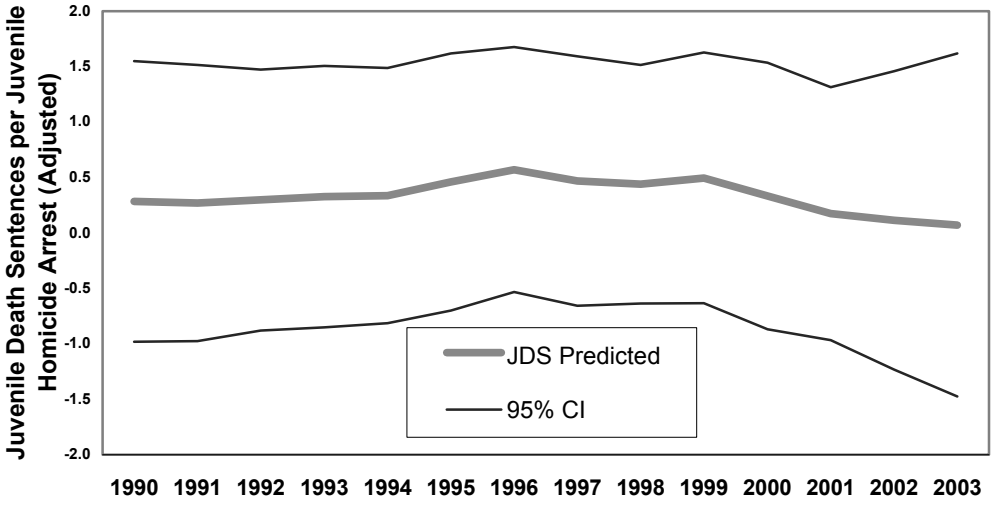
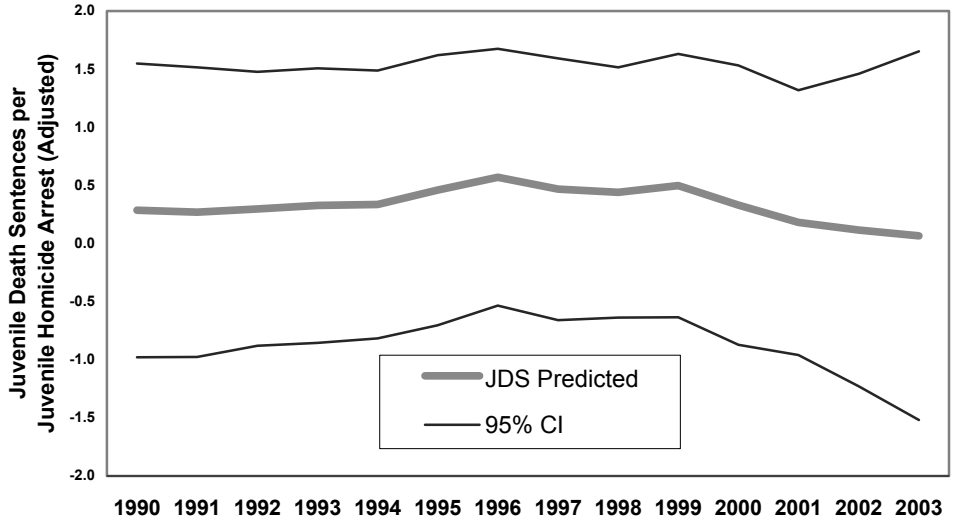


Figure 12. Juvenile Death Sentences Per Juvenile Homicide Arrest by Year with 95% Confidence Intervals, Adjusted for Quadratic Time Trend and Other Predictors, 1990-2003



VI. CONCLUSION

In 2003, the Missouri Supreme Court ruled in *Simmons v. Roper* that the execution of offenders under the age of 18 violates the evolving standards of decency embodied in the Eighth Amendment's prohibition against cruel and unusual punishments. The *Simmons* court relied in part on two objective indicia of an emerging national consensus against the juvenile death penalty: the growing number of states that have enacted legislation barring the juvenile death penalty, and the infrequency with which juries choose to inflict the punishment of death on a juvenile offender. The *Simmons* case is now before the Supreme Court, which last considered the constitutionality of the juvenile death penalty in 1989 in *Stanford v. Kentucky*. The first marker of evolving standards, state legislation, suggests a steady erosion of support for capital punishment of juveniles since *Stanford*. This article analyzes the available data regarding the second marker of evolving standards: the frequency with which juries impose the death penalty on juvenile offenders. We conclude that the decline in the use of the juvenile death penalty since *Stanford* is evidence of an emerging societal norm opposing the use of the death penalty for juveniles.

To reach this conclusion, we analyzed empirical data regarding the use of the death penalty for adolescent homicide offenders in state courts in the U.S. since 1990. The data show that the number of juveniles sentenced to death (excluding resentencings) has declined sharply since *Stanford*, from a peak of 15 in 1994, and a more recent peak of 14 in 1999, to one in 2003. (Total death sentences, including resentencings, have shown a similar decline.) The decline in the number of juveniles sentenced to death since *Stanford* has been greater than the parallel decline for adults ages 18-24 and for adults 25 and over, suggesting an age-specific decline. The decline in juveniles sentenced to death is striking, and is greater than the analogous decline for adults, even after the sentencing rate is indexed to the declining homicide rate and to the declining homicide arrest rate.

Comparing the states, we found that the declines for juveniles are greater than for adults both in the highest juvenile death sentencing states and in other states, when we index the sentencing rate to the homicide arrest rate. Texas is an outlier for death sentences, but the pattern of decline in death sentences in Texas and other high-rate states is comparable to the rest of the states that permit death sentences for juveniles.

Using two types of multivariate statistical analyses, we found that the decline in juvenile death sentences is statistically significant (greater than chance) after we control for competing explanations for its decline: the decline in the murder rate, the decline in the number of juveniles arrested for homicide, secular declines in death sentences for other age groups, changes in the size of the youth population, changing political and social contexts, and changes in the general punitiveness of the criminal justice system. The results are consistent across different measurement and analysis conditions.

These results are compelling evidence that, even in the states that theoretically permit the use of the juvenile death penalty, there is an emerging

societal norm opposing the death penalty for juvenile offenders—which has in the last several years reduced the number of juveniles sentenced to death almost to zero. Its disuse signals that the juvenile death penalty may no longer be needed.

APPENDIX A. DATA SOURCES AND MEASURES

1. Death Sentences and Persons Sentenced to Death

We compiled data on the number of persons sentenced to death and death sentences from two sources:

- Juveniles on Death Row. *The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes January 1, 1973-June 30, 2004*, available at http://www.law.onu.edu/faculty/streib/documents/JuvDeathJune302004NewTables.pdf. This is a website maintained by Professor Victor Streib for nearly two decades with a comprehensive list of juveniles who have received death sentences and their dispositions.

- U.S. Department of Justice, Bureau of Justice Statistics, Capital Punishment in the United States, 1973-2002 (ICPSR STUDY 3958). Compiled by the U.S. Department of Commerce, Bureau of the Census. First ICPSR Edition April 2004. Available at http://www.icpsr.umich.edu.

Counts of juvenile death sentences and persons under 18 sentenced to death were obtained from Professor Victor Streib's website. While this information is also available from Capital Punishment in the United States, Professor Streib's data provides fuller coverage and more information on each death sentence and person sentenced to death. Included in the Streib data are the outcome of each sentence and the final disposition of the case, as well as the age and race of each person sentenced to death. We used the Streib archive to create a database of death sentences of persons below age 18 at the time of their capital offense. Unique identifiers were assigned to each death sentence and each person sentenced to death. Also included in the electronic file are the state and year of the death sentence, age at the time of the offense, a sequential sentence number, and whether the person was executed. Counts of persons sentenced to death are for persons who were first sentenced within the study period. Counts of death sentences are for any death sentenced issued during the study period.[100]

Data on adult death sentences (by age) and persons sentenced to death for those who were age 18 and over at the time of the offense were obtained from Capital Punishment in the United States, 1973-2002 (ICPSR Study 3958). This publicly available datafile provides cumulative and updated annual data on prisoners sentenced to death. Capital Punishment in the United States includes information on each prisoner's age at the time of the offense and his or her date of birth. It includes year and month of the arrest, but does not include information on the data of the offense. Therefore, age was computed by subtracting the year and month of birth from the year and month of arrest.

[100] There are 4 cases in which the original death sentence occurred prior to the study period. These cases are included only in the counts of death sentences, but not in the counts of persons sentenced to death.

Counts of death sentences by age, state, and year were constructed by aggregating each age category to the state and sentencing year. Counts of persons sentenced to death by age, state, and year are for persons who were *first* sentenced within the study period. Totals for death sentences and persons sentenced to death are the sum of the juvenile counts and the counts of those over the age of 17.

2. Crime and Punishment

State Crime Trends. Crime data are from the FBI Uniform Crime Reports Department of Justice, FBI, Uniform Crime Reports for the United States: Crime in the United States, 1973-2001, available in spreadsheets at http://bjsdata.ojp.usdoj.gov/dataonline/. These files include broad trends on all reported FBI Index Crimes.

Homicide Trends. State homicide and victimization data, including by race, are from the Vital Statistics of the United States or other data compilations generated by the Centers for Disease Control and Prevention National Center for Health Statistics. Data for 1973-1992 are from Vital Statistics of the United States, Mortality Detail Files, 1968-1992 (ICPSR STUDY 7632, 6798). Data for 1993-1998 are from Centers for Disease Control and Prevention National Center for Health Statistics, Compressed Mortality File, 1989-98 CD-ROM Series 20, No 2C ASCII Version. Data after 1998 are from CDC Wonder, the Centers for Disease Control data extraction engine at http://wonder.cdc.gov. Through 1992, the relevant data sources list homicide victims by state of death. After 1993, the relevant data source lists homicide victims by state of residence. Data for 2001 exclude all victims from the events of September 11th.

Punishment Trends. Annual state prison population data are taken from the National Corrections Reporting Program. Data are from electronic spreadsheets available from Bureau of Justice Statistics Spreadsheets- Crime & Justice Electronic Data http://www.ojp.usdoj.gov/bjs/dtdata.htm#prisoners. Data from 1999-2001 are taken from the Sourcebook of Criminal Justice Statistics, U.S. Department of Justice, Bureau of Justice Statistics, Sourcebook of Criminal Justice Statistics.

Drug Arrests. Crime data are from the FBI Uniform Crime Reports Department of Justice, FBI, Uniform Crime Reports for the United States: Crime in the United States, 1973-2001.[101]

Age Specific Homicide Arrests. Annual homicide arrests are taken from The Uniform Crime Reporting Program Data [United State]: Supplementary Homicide Reports 1976-2001(ICPSR Study #s, 3108, 3448, and 3722). Additional arrest data was taken from The Sourcebook of Criminal Justice Statistics, Bureau of Justice Statistics 1988–2002. Juvenile and adult homicide arrests are based on the greater value of these two data sources.[102] Due to non-reporting issues and difference in age categories used in

[101] Drug arrests for Florida are from unpublished data provided by the Florida Department of Law Enforcement. Missing data from other states were linearly interpolated.

[102] Data for Kansas were largely missing and are taken from Kansa Bureau of Investigation and

these two data sources, counts of juvenile homicide arrests include all arrests of persons under the age of 18. Adult homicides arrests are for all ages over 17.

3. State Demographic and Socio-Economic Characteristics

Population, Poverty, and Urbanization Data. State population, socio-economic and racial composition data are from the United States Census Bureau Data. Population totals and racial composition are taken from Estimates by Age, Sex, and Race; Estimates of the Population of States by Age, Sex, Race and Hispanic Origin: 1981 to 1989. For 1990 to 2000, Summary Tape File 3C(STF3C) population totals and racial composition are the linear interpolation of the 1990 and 2000 values. For 2001 total population and racial composition are from Census Bureau estimates available at http://eire.census.gov/popest/data/states .

Age Structure and Urbanization. The age structure and percentage of the population in urban areas for each state were taken from the United States Census Bureau's Census of the Population 1990 and 2000, available in spreadsheets from http://factfinder.census.gov. Between census years were linearly interpolated and the values for the age structure in 1988 and 1989 were set at the 1990 values. For 1988 and 1989 the percentage of the population in urban areas was taken from the Statistical Abstracts of the United States.

Poverty. The percentage of each state's population below the poverty line was taken from the Census Bureau's annual poverty estimates, available from http://factfinder.census.gov.

4. Political and Electoral Contexts

Political Pressure. Indices of the political pressure on state trial court and appellate judges from judicial selection techniques were developed by Liebman et al.[103] based on provisions of each state's Constitutions and codes governing judicial selection for trial court judges, supplemented by information from the National Center for State Courts.[104]

Variables[105]

Juveniles Sentenced to Death:

Counts of persons under the age of 18 sentenced to death by state and year.

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are available at http://www.accesskansas.org/kbi; Florida data were also missing and are taken from the Florida Department of Law Enforcement publications available at http://www.fdle.state.fl.us/.

[103] *See* Liebman et al., *A Broken System, Part II*, *supra* note 53, at E-4.

[104] *See* C. Flango & D. Rottman, *Appellate Court Procedures* (Nat'l Center for State Courts, 1998); D. Rottman & C. Flango, *State Court Organization 1998* (Nat'l Center for State Courts, 2000); American Bar Association , *Standards on state Judicial Selection 2000* (ABA Standing Committee on Judicial Independence, Commission on State Judicial Selection 2001).

[105] All predictors are lagged by two years.

Time:

The 14 years in the study period taken as a linear trend from the beginning to the end of the study.

Time Squared:

A quadric term for time; time is squared.

Year Greater Than 1999:

All years greater than 1999 are coded as 1, and all years 1999 and before are coded as zero.

Interaction with Time:

The interaction of Year Greater than 1990 with Time.

Interaction with Time Squared:

The interaction of Year Greater than 1990 with Time Squared.

Murder Rate (logged):

The natural log of the number of murders in a state and year per 100,000 state residents in the state and year.

Population Under 18 (logged):

The natural log of the population that is under the age of 18.

Population 15 and Above (logged):

The natural log of the population that is age 15 and above in each state year.

Percent of the Population Under 25:

The percentage of the population in a given state and year that is under age 25.

Black White Victimization Rate:

The state's Black homicide victims per 100, \000 Black population divided by its rate of White homicide victims per 100,000 White population.

Percent Black:

Percentage of the state's population that is Black.

Percent Urban:

Percentage of the state's population in urban areas as defined by the United States Census Bureau.

Percent Below Poverty:

The percentage of the state's population below the poverty line.

Political Pressure Index:

A measure of the extent to which a state's trial court judges are subject to political repercussions based on their judicial performance through political or electoral politics. The index combines the way in which judges are selected, the way they are retained, and the length of the first term.[106]

Punishment Index:

The ratio of the number of inmates incarcerated in prison in the state per 100 Index FBI Crimes reported in the state in that year.

Juveniles Arrested for Homicide (logged):

The number of persons under the age of 18 arrested for homicide in a state year.

Homicide Residual:[107]

The un-standardized residual for each state year of the homicide rate regressed on a vector of predictors. For each year starting in 1988 the homicide rate was

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[106] For a fuller discussion of this variable, see Liebman et al., *supra* note 53.

[107] Model statistics are on file with the authors.

regressed, using ordinary least squares, on the percentage of the population under 25, the percentage of the population that is Black, the percentage of the population in urban areas, the percentage of the population below poverty, the number of drug arrests, and the natural log of the population age 15 and above.

APPENDIX B. DATA ANALYSIS STRATEGY

The Poisson distribution is a discrete distribution which takes on the values y = 0, 1, 2, 3, ….. It is often used as a model for the number of events (such as the number of telephone calls at a business or the number of accidents at an intersection) in a specific time period. It is useful in studies of law and crime to model the number of crimes or the number of prison sentences. The probability distribution for a Poisson process is defined as:

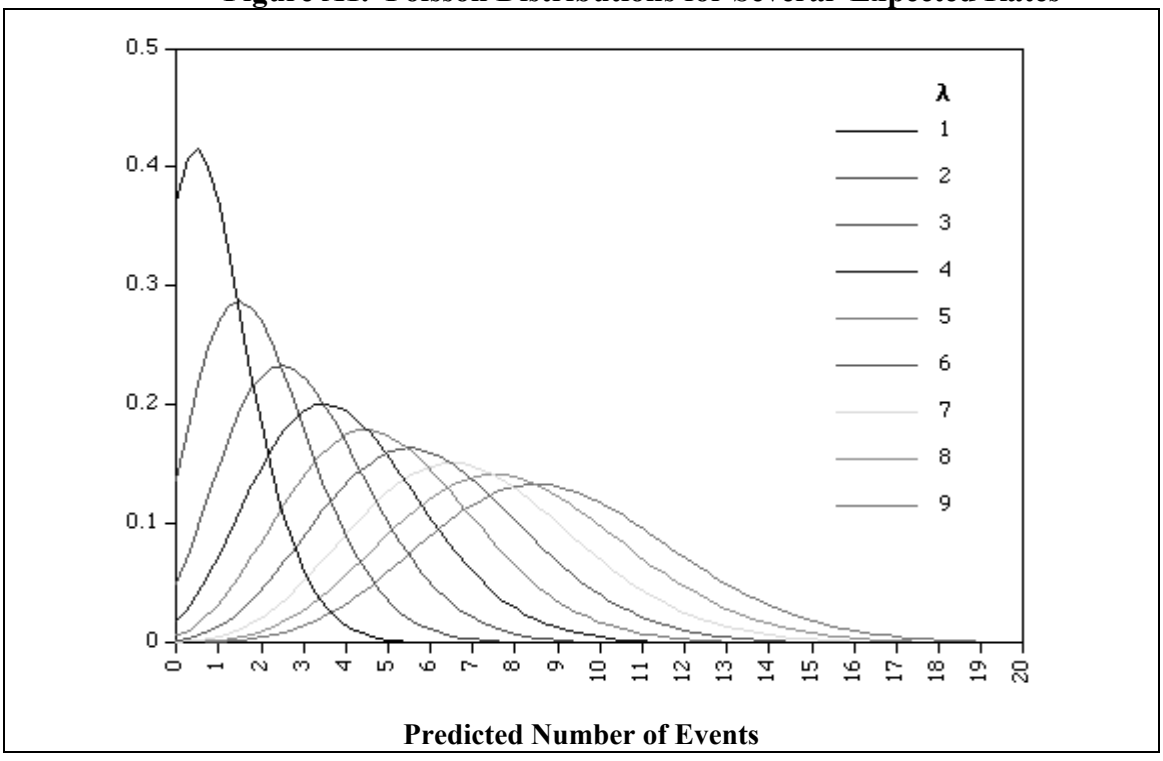
$$p(y = y_i) = \frac{e(-\lambda_i)\lambda_i^{y_i}}{y_i!} \quad y = 0,1,2,3,....$$

where ;

$$E[y_i] = \lambda_i = e^{\beta X_i}$$

The exact distribution depends on the expected rate of occurrence of the event of interest (λ), and X is a vector of explanatory variables. When λ is low, the distribution is skewed to the left. When λ is high, the distribution more closely resembles a normal distribution. In the Figure A1 below, The horizontal axis is the predicted number of events, and the vertical axis is the probability that a specific number of events will be observed given the expected rate of occurrence. The tallest function, and d the one that is most leftward skewed, is the distribution when λ = 1. The distribution that is farthest to the right, when λ=9, closely resembles a normal distribution.

Figure A1. Poisson Distributions for Several Expected Rates



However, the Poisson distribution may not accurately predict the occurrence of a discrete event when these events are rare within an observational period. Many social events are characterized by a very high number of zero counts, producing distributions similar to the λ = 1 distribution in

Figure A1. That is, the Poisson model may be inaccurate if there is a separate process that seems to be influencing not just the frequency of an event, but whether the event itself occurs at any rate greater than zero.[108] In other words, there may be two data generating processes that produce the observed distribution: one which generates a non-zero observation, and a second that generates a count of non-zero events.

We face that situation in this study: there are 264 state-years with no juvenile death sentences, out of a total of 335 observations. The number of juvenile death sentences might be zero either because there are too few homicide arrests to produce an eligible pool of defendants, or because the jurisdiction simply chooses not to use this sentencing option, regardless of the characteristics of the pool of juvenile homicide defendants or the characteristics of the crimes they committed. In either case, this is a separate phenomenon from a process that generates a count of events once the decision is made to use the process. Once the hurdle is crossed so that a non-zero count is generated, it is likely to be quite low, so the distribution will resemble the $\lambda=1$ curve in Figure A1.

Accordingly, we use a statistical procedure known as zero-inflated Poisson analysis.[109] In this procedure, the hurdle from a zero to a non-zero count is modeled separately as a binary outcome, and then introduced into the second stage specification of the non-zero event counts. The final model is an exponential function of (possibly different) explanatory variables. The contributions of potential explanatory variables are tested in both components of the model, as:

$$p(y_i = 0) = p_i + (1 - p_i)e^{(-\lambda_i)}$$

$$p(y_i = y) = \frac{p(1 - p_i)e(-\lambda_i)\lambda_i^{\,y}}{y!}$$

Whenever these models are used, robustness checks are essential to check for the stability of predictors under different model specification conditions that challenge assumptions about the causes in the skewness of the dependent variable in the face of skewed predictors. We include such checks by varying the predictor (explanatory) variable sets to use data from several sources and, more important, with different distributional properties.[110]

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[108] This situation is especially problematic when the non-zero events themselves are highly skewed. The risks of unreliable predictions with highly skewed data, including both predictors and outcomes, are well-known and thoroughly discussed in many statistics texts. The skewed non-zero observations have strong leverage over the data. Efforts to model these results to fit these unusual distributions tend to result in a domination of the data by these extreme cases, and they will unduly influence the results. Leverage turns into influence when the extreme values of one variable are paired with extremes of the response variable (in this case, juvenile homicide arrests and juvenile death sentences). The results usually then reflect the few anomalous cases, not the majority of the observations. *See, e.g.*, D.R. Cook & Sanford Weisberg, APPLIED REGRESSION, INCLUDING COMPUTING AND GRAPHICS (1999).

[109] *See* Diane Lambert, *Zero-Inflated Poisson Regression, with an Application to Defects in Manufacturing*, 343 TECHNOMETRICS 1 (1992); Greene, *supra* note 60.

[110] *See generally* Zorn, *supra* note 61.

APPENDIX C. DESCRIPTIVE STATISTICS

Table C1. Data Description, Means, Standard Deviations

Variable	*Minimum*	*Maximum*	*Mean*	*Standard Deviation*
Persons Under 18 Sentenced to Death	0.00	7.00	0.34	0.86
Homicide Arrests Under 18 (Logged)	0.00	5.91	2.96	1.43
Time	1.00	14.00	7.38	4.02
Time ^{2}	1.00	196.00	70.55	61.56
Binary: Year Greater Than 1999	0.00	1.00	0.27	0.45
Persons 18-24 Sentenced to Death (Logged)	0.00	3.04	0.92	0.88
Time * Year Greater Than 1999	0.00	14.00	3.40	5.60
Time ^{2} * Year Greater Than 1999	0.00	196.00	42.80	71.53
Murder Rate (Logged)	0.19	3.06	1.92	0.59
Residual of Homicide Rate	-4.64	4.42	0.04	1.53
Population Under 18 (Logged)	11.65	15.59	13.55	0.95
Ratio: Black/White Homicide Victimization Rate	0.00	35.27	5.56	4.23
White Homicide Victimization Rate	0.90	12.85	5.09	2.39
Percent Black Population	0.00	0.37	0.13	0.11
Percent Population in Urban Areas	22.91	92.25	66.56	14.28
Political Pressure Index	3.00	9.00	7.27	1.90
Punishment Index	1.77	21.70	8.12	3.35
N	334			

Table C2. Correlation Matrix (Pearson R, two-tailed p)

	< 18 DS	< 18 Homicide Arrests	Time	Time ^{2}	Yr. > 1999	18-24 DS Logged	Time* Yr.> 1999	Time^2 * Yr.> 999	Murder Rate Logged	Residual	Pop < 18 Logged	Blk/Wht Hom. Rt	White Hom. Rate	Pct. Black	Pct Urban	Pol Pressure Index
< 18 Homicide Arrests	0.42															
	0.00															
Time	-0.05	-0.05														
	0.21	0.19														
Time ^{2}	-0.08	-0.08	0.97													
	0.08	0.07	0.00													
Year > 1999	-0.11	-0.10	0.78	0.86												
	0.02	0.03	0.00	0.00												
18-24 DS Logged	0.44	0.70	0.03	0.00	-0.03											
	0.00	0.00	0.27	0.49	0.29											
Time*Year.> 1999	-0.12	-0.11	0.79	0.88	0.99	-0.04										
	0.01	0.03	0.00	0.00	0.00	0.23										
Time ^{2} *Year.> 1999	-0.12	-0.11	0.79	0.89	0.98	-0.05	0.99									
	0.01	0.02	0.00	0.00	0.00	0.19	0.00									
Murder Rate logged	0.31	0.76	-0.17	-0.19	-0.20	0.55	-0.20	-0.20								
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
Residual	0.09	0.11	0.02	0.02	0.02	0.05	0.02	0.01	0.32							
	0.05	0.03	0.39	0.39	0.37	0.18	0.38	0.39	0.00							
Pop < 18 logged	0.37	0.87	0.12	0.12	0.11	0.68	0.11	0.11	0.55	0.01						
	0.00	0.00	0.01	0.01	0.02	0.00	0.02	0.02	0.00	0.44						
Blk/Wht Homicide Rate	-0.07	0.16	-0.09	-0.11	-0.10	0.00	-0.11	-0.11	0.08	0.11	0.19					
	0.10	0.00	0.05	0.02	0.03	0.50	0.02	0.02	0.08	0.02	0.00					
White Homicide Rate	0.36	0.56	-0.17	-0.18	-0.19	0.51	-0.19	-0.18	0.76	0.40	0.39	-0.18				
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Pct. Black Population	0.18	0.51	0.04	0.05	0.04	0.37	0.04	0.04	0.71	-0.03	0.38	-0.05	0.29			
	0.00	0.00	0.21	0.20	0.22	0.00	0.22	0.22	0.00	0.30	0.00	0.20	0.00			
Pct Urban Population	0.17	0.38	0.15	0.14	0.11	0.29	0.11	0.11	0.14	0.02	0.38	0.11	0.32	-0.14		
	0.00	0.00	0.00	0.01	0.02	0.00	0.02	0.02	0.00	0.39	0.00	0.02	0.00	0.01		
Political Pressure Index	0.15	0.22	-0.03	-0.03	-0.02	0.20	-0.02	-0.02	0.33	0.30	0.21	-0.12	0.44	-0.02	-0.03	
	0.00	0.00	0.28	0.30	0.35	0.00	0.35	0.35	0.00	0.00	0.00	0.01	0.00	0.33	0.31	
Punishment Index	0.03	-0.04	0.68	0.69	0.60	0.09	0.61	0.61	0.04	-0.05	0.00	-0.23	-0.05	0.34	-0.03	-0.13
	0.29	0.23	0.00	0.00	0.00	0.05	0.00	0.00	0.21	0.19	0.49	0.00	0.16	0.00	0.27	0.01