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THE DECLINE OF THE JUVENILE DEATH PENALTY: SCIENTIFIC EVIDENCE OF EVOLVING NORMS

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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 eighteen years of age—fat 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

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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 (2002) (Stevens, J., dissenting from denial of certiorari); *id.* (Ginsburg, J., dissenting from denial of certiorari) (joined by Justice Breyer).

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

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 two to eighteen.[6] In addition, the Court observed that, even in states where the death penalty was theoretically a permissible punishment 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 reliably sort out which juveniles were sufficiently morally culpable.[9] And it held that no national consensus barred the imposition of capital punishment on sixteen- or seventeen-year-old juveniles.[10]

The Supreme Court returned to the juvenile death penalty in January 2004 when it granted certiorari to review the Missouri Supreme Court's decision in *Simmons v. Roper*.[11] In *Simmons*, the Missouri Supreme Court relied on the logic of *Atkins* to hold that the execution of persons who committed homicide before reaching their eighteenth birthday is unconstitutional.[12] The Court cited the immaturity and consequent reduced culpability of juvenile offenders,[13] plus the special risk of wrongful execution for juvenile offenders, due in part to the risk of false confession.[14] In addition, the *Simmons* court concluded that, since *Stanford* was decided in 1989, a national consensus had emerged opposing the death penalty for juvenile offenders.[15] Evidence of this consensus was found in both the

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[4] *Id.* at 316.

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

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

[7] *Id.* at 316.

[8] 492 U.S. 361 (1989).

[9] *Id.* at 374-77.

[10] *Id.* at 370-71.

[11] 112 S.W.3d 397 (Mo. 2003), *cert. granted*, 72 U.S.L.W. 3487 (U.S. Jan. 26, 2004) (No. 03-633).

[12] *Id.* at 399-400.

[13] *Id.* at 412.

[14] *Id.* at 413.

[15] *Id.*

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.[16] On March 1, 2005, the U.S. Supreme Court voted 5-4 to affirm the Missouri Supreme Court's ruling in *Simmons*.[17] The Court's decision relied on social science evidence of the reduced culpability of juveniles and the declining use of the juvenile death penalty to ban the use of the death penalty for persons who commit capital homicide before reaching the age of eighteen.[18]

At the time of the *Simmons* decision, a growing body of research has addressed the issues of juveniles' lesser culpability and greater risk of wrongful execution.[19] In contrast, 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, and analyzes data on the patterns of decisions by judges and juries to illustrate the *Simmons* Court's conclusions on the consensus opposing the execution of minors.

The number of juvenile death sentences has declined sharply since 1994, when eighteen juveniles were sentenced to death.[20] In 2003, only two

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[16] *See id.* at 408-10.

[17] Roper v. Simmons, No. 03-633, 2005 WL 464890, at *18 (U.S. Mar. 1, 2005).

[18] *Id.* at *11, **16-17

[19] *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 eighteen, and may not be completed until age twenty-one or later); Jeffrey Fagan, Atkins, *Adolescence and the Maturity Heuristic: Rationales for a Categorical Exemption for Juveniles 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); Elizabeth S. 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); David S. Tanenhaus & Steven A. Drizin, *"Owing to the Extreme Youth of the Accused": The Changing Legal Response to Juvenile Homicide*, 92 J. CRIM. L. & CRIMINOLOGY 641, 671-89 (2003) (on the special risk of false confessions for adolescents).

[20] *See* Victor L. Streib, *The Juvenile Death Penalty Today: Death Sentences and Executions for Juvenile Crimes, January 1, 1973—December 31, 2004*, at 9 tbl.3, *available at* http://www.law.onu.edu/faculty/streib/documents/JuvDeathDec2004.pdf (updated Jan. 21, 2005) [hereinafter Streib, *December*]; *see also* 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 (updated July 1, 2004) [hereinafter Streib, *June*]; 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/JuvDeathApr

juveniles were sentenced to death, and one of these was a re-sentence following a reversal of a previous sentence; in 2004, two juveniles were sentenced to death.[21] Adult death sentences have declined at a slower pace during this time, from a recent peak of 320 in 1996 to 143 in 2003.[22]

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.[23]

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 juvenile offenders and the rate at which juvenile offenders are

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302004.pdf (updated May 4, 2004) [hereinafter Streib, *April*].

[21] *Id.* at 9 tbl.3, 21, 23. In 2004, two juveniles were sentenced to death. *See id.* at 9 tbl.3, 21, 23, 28. 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 Parts III and IV. 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 (last visited Jan. 14, 2005). 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 United States have declined from 110 burglaries per 1,000 households in 1973 to 27.7 in 2002. *See* BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, NATIONAL CRIME VICTIMIZATION SURVEY PROPERTY CRIME TRENDS, 1973-2002, *available at* http://www.ojp.usdoj.gov/bjs/glance/tables/proptrdtab.htm (last visited Jan. 14, 2005). Within this twenty year period when burglary rates declined more than seventy-five percent, one-year increases in the burglary rate were measured in four of the twenty years. *Id.*

[22] Death Penalty Information Center, *Death Sentences By Year, 1973 - 2003*, *available at* www.deathpenaltyinfo.org/article.php?scid=9&did=873 (last visited Jan. 14, 2005). The figure for 2003 represents the projected number of death sentences for that year. *Id.*

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

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 eighteen.

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 "[t]he Amendment must draw its meaning from the evolving standards of decency that mark the progress of a maturing society."[24] 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*,[25] 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."[26] *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.[27] 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 fifteen years since the *Stanford* decision, no state has lowered its age threshold for the juvenile death penalty from eighteen years of age to seventeen or sixteen, although *Stanford* set the lower boundary for a death sentence at sixteen.[28] Instead, during this period, six states prohibited capital punishment for juveniles by

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[24] *See, e.g.*, Atkins v. Virginia, 536 U.S. 304, 311-12 (2002); Trop v. Dulles, 356 U.S. 86, 101 (1958) (plurality).

[25] 433 U.S. 584 (1977).

[26] *Id.* at 592.

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

[28] *See* Stanford v. Kentucky, 492 U.S. 361 (1989).

statute: Kansas (1994),[29] New York (1995),[30] Montana (1999),[31] Indiana (2002),[32] South Dakota (2004),[33] and Wyoming (2004).[34] In addition, the Washington Supreme Court's 1993 *Furman* decision interpreted Washington's death-penalty statute as excluding the death penalty for persons under eighteen.[35] Including the eleven states that had legislatively prohibited the juvenile death penalty prior to the *Stanford* decision, eighteen of the thirty-eight states that permit the death penalty now expressly bar its use for offenders under the age of eighteen.[36] Thirteen jurisdictions bar the death penalty altogether.[37]

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.[38] 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,[39] 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 eighteen.

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*,[40] the Court explained:

> [T]he jury . . . is a significant and reliable objective index of contemporary values

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[29] *See* KAN. STAT. ANN. § 21-4622 (1995).

[30] *See* N.Y. PENAL LAW § 125.27 (2004).

[31] *See* MONT. CODE ANN. § 45-5-102 (2004).

[32] *See* IND. CODE ANN. § 35-50-2-3 (2004).

[33] *See* S.D. CODIFIED LAWS § 23A-27A-42 (2004).

[34] *See* WYO. STAT. ANN. § 6-2-101(b) (2004).

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

[36] *See* Streib, *December*, *supra* note 20, at 7 tbl.2. The eleven 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.* Missouri is included in the eighteen states barring the death penalty for juveniles.

[37] *See id.*

[38] *See* Atkins v. Virginia, 536 U.S. 340, 315 (2002).

[39] *See infra* Tables 6 and 7 and Figures 4a and 4b.

[40] 433 U.S. 584 (1977).

> 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.[41]

Accordingly, in support of its holding that the death penalty is an excessive punishment for the crime of rape of an adult woman,[42] 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.[43]

In *Enmund v. Florida*,[44] the Court employed a similar 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.[45] 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.[46]

Similarly, in *Thompson v. Oklahoma*,[47] a plurality of the Court relied on evidence that, between 1982 and 1986, only five of 1861 persons under sixteen 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 sixteen.[48] 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*.[49]

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 eighteen when they committed their crimes.

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

[42] *See id.* at 592.

[43] *See id.* at 597.

[44] 458 U.S. 782 (1982).

[45] *See id.* at 801.

[46] *Id.* at 794 (quoting *Coker*, 433 U.S. at 596 (in turn quoting *Gregg*, 428 U.S. at 181)) (citations omitted).

[47] 487 U.S. 815 (1988).

[48] *Id.* at 832-33, 833 n.39.

[49] Atkins v. Virginia, 536 U.S. 304, 316 (2002).

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 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."[50] 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."[51]

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 across the states that permit juvenile death sentences 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, to isolate accurately 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,

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[50] *Thompson*, 487 U.S. at 853 (O'Connor, J., concurring in the judgment).

[51] *Id.*

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.[52]

Moreover, as discussed further below,[53] 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 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.

D. SOCIAL AND LEGAL CONTEXTS: INNOCENCE AND THE DECLINE IN JUVENILE DEATH SENTENCES

The decline in juvenile death sentences since 1999 is situated in a wider social and historical context of a "crisis of confidence" in the death penalty in America.[54] Several challenges to the legitimacy and accuracy of the death penalty emerged within a relatively narrow and recent timeframe that eroded public confidence in the death penalty.[55] The challenges converged on revelations of high rates of substantive errors in the use of the death penalty, errors that led to reversals in many cases and over 100 exonerations that in turn raised the awful specter of wrongful execution. Accordingly, we expanded our analyses to consider whether these challenges may have given pause to judges and juries in capital cases, and further suppressed the rate of juvenile death sentences per juvenile homicide arrest.

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[52] Enmund v. Florida, 458 U.S. 782, 796 (1982).

[53] *See infra* Part V.

[54] *See, e.g.*, Joseph L. Hoffmann, *Protecting the Innocent: The Massachusetts Governor's Council Report*, 95 J. CRIM. L. & CRIMINOLOGY 561 (2005).

[55] *See, e.g.*, The Gallup Organization, *Question: Do Your Favor or Oppose the Death Penalty for Persons Convicted of... Murder* (Sept. 11, 1988) (78.94%); The Gallup Organization, *Question: Do Your Favor or Oppose the Death Penalty for Persons Convicted of... Murder* (June 23, 2000) (65.63%).

The decline in the use of the death penalty for both adults and juveniles took place in the same narrow timeframe in which these challenges entered the nation's legal and political landscape. In this Symposium, Professor Samuel Gross and his colleagues identify 205 exonerations for murder in the United States from 1989 through 2003, including seventy-four for persons serving death sentences.[56] Gross and his colleagues show that the rate of exonerations averaged twelve per year from 1989-94,[57] then rose sharply beginning in the late 1990s, from thirteen in 1998 to forty-three in 2001 and forty-four in 2003.[58] The trends in exonerations mirror the trends juvenile death sentences. Juvenile death sentences declined slowly after 1994, and then declined sharply beginning in 1999, from fifteen in 1999 to seven in 2000 and eventually to one new death sentence in 2003.[59]

The increase in exonerations through the 1990s paralleled the recurring and dramatic revelations of innocent men on death row both in Illinois and nationally in that decade. Illinois led the nation in total exonerations from 1989 through 2003 with fifty-four, followed by New York with thirty-five, Texas with twenty-eight, and California with twenty-seven.[60] The Illinois exonerations first captured national attention in the late 1990s. In 1996, the exonerations from death row of the "Ford Heights

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[56] Samuel R. Gross et al., *Exonerations in the United States, 1989 Through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523 (2005) [hereinafter Gross et al., *Exonerations*]. The data used in these analyses were obtained from an earlier version of this paper. Samuel Gross et al., Exonerations in the United States 1989 through 2003, app. at 27-31 (Apr. 19, 2004), *available at* http://www.law.umich.edu/NewsAndInfo/exonerations-in-us.pdf (on file with authors) [hereinafter Gross et al., Exonerations early draft]. The results reported in Section V.B.2. *infra* are based on this version of the Gross et al. article, in which the authors discussed 328 exonerations. In the Symposium publication, the authors updated their research and modified their findings, reporting 340 exonerations. The additional twelve cases included six murder exonerations, of which one was a capital case, and one non-capital homicide case where the defendant was a minor. New cases were found in five death penalty states, of which two were juvenile death penalty states. No states added cases that had no exonerations in the previous version. Accordingly, these small differences will not statistically alter the pattern of results reported in Table 15 *infra*.

[57] Gross et al., *Exonerations*, *supra* note 56, at 4 fig.1.

[58] *Id.* at 4 fig.1 & 3 n.10. Although the discovery of exculpatory DNA evidence accounted for fewer than half of the 340 exonerations reported by Gross and colleagues, DNA became linked in the popular imagination to the question of innocence. *See* BRIAN FORST, ERRORS OF JUSTICE: NATURE, SOURCES, AND REMEDIES, 201-04 (2004). *See generally* JIM DWYER ET AL., ACTUAL INNOCENCE: WHEN JUSTICE GOES WRONG AND HOW TO MAKE IT RIGHT (2003).

[59] New juvenile death sentences are distinguished from juveniles re-sentenced to death following appellate review and reversal. *See infra* Part III.B.

[60] Gross et al., *Exonerations*, *supra* note 56, at 17 tbl.2.

Four" grabbed national headlines.[61] The Chicago Tribune's 1999 series "The failure of the death penalty in Illinois"[62] concluded that the recurring problem of exonerations in capital cases was intrinsic to capital prosecution in the state. Later in 1999, the exoneration of Anthony Porter within forty-eight hours of his scheduled execution dramatically highlighted the urgency of these exonerations and the risks of error.[63] By January 2003, when then-Governor George H. Ryan commuted the sentences of Illinois's death row and placed a moratorium on the death penalty in the state, seventeen of the 289 persons sentenced to death in Illinois had already been exonerated by appellate review, an error rate of 5.9%.[64]

The Illinois revelations were followed closely by the release in June 2000 of a study by Professor James Liebman and colleagues at Columbia University showing that two in three death sentences from 1973 through 1995 were reversed at one or more stages or appellate review.[65] The study was widely reported in the national media,[66] and was cited in several state

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[61] *See* Rob Warden, *Illinois Death Penalty Reform: How it Happened, What it Promises*, 95 J. CRIM. L. & CRIMINOLOGY 381 (2005). *See generally* DAVID L. PROTESS & ROBERT WARDEN, A PROMISE OF JUSTICE (1998) (documenting the media reactions to the exonerations of the four death row inmates).

[62] Ken Armstrong & Steve Mills, *The Failure of the Death Penalty in Illinois* (series), CHI. TRIB., Nov. 14-18, 1999, at 1.

[63] Andrew Bluth, *Illinois Man Is Finally Cleared in 2 Murders: An Armed Robbery Conviction Lingers from a Murder Case.*, N.Y. TIMES, Mar. 12, 1990, at A20; Sharon Cohen, *Last-Minute Exonerations Fuel Death-Penalty Debate Justice: Wrongful Convictions Shift Focus from Morality to Legitimacy*, L.A. TIMES, Aug. 15, 1999, at A1; Daniel H. Lehmann, *Cleared of '82 Murders*, CHI. SUN-TIMES, Mar. 12, 1999, at 8.

[64] Warden, *supra* note 61.

[65] James Liebman, Jeffrey Fagan, Valerie West, & Jonathan Lloyd, *Capital Attrition: Error Rates in Capital Cases, 1973 – 1995*, 78 TEX. L. REV. 1839 (2000) [hereinafter Liebman et al., *Capital Attrition*] (showing that 68% of all death sentences since *Furman v. Georgia* were reversed either on direct appeal, state direct appeal, or federal habeas review; most (82%) of those reversed were re-sentenced to non-capital punishments, 7% were exonerated, and the remainder were re-sentenced to death); *see also* FORST, *supra* note 58, at 200-02 (noting that the errors in these cases were the result of misidentification of witnesses, prosecutorial or police misconduct, incompetent defense counsel, prejudicial instructions by judges, and biased jury selection procedures); James Liebman, Jeffrey Fagan, & Valerie West, *A Broken System, Part I: Error Rates in Capital Cases, 1973-1995* (2000), *available at* http://www2.law.columbia.edu/instructionalservices/liebman/ [hereinafter Liebman et al., *A Broken System, Part I*]; 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* http://www2.law.columbia.edu/brokensystem2/report.pdf [hereinafter Liebman et al., *A Broken System, Part II*].

[66] *See, e.g.*, David Broder, *Broken Justice*, WASH. POST, June 19, 2000, at B.07:

> In the annals of politics, there have been few pieces of social research which have decisively affected the course of policy debate. Michael Harrington's "The Other America" opened the eyes of the nation—and of Presidents Kennedy and Johnson—to the extent of poverty in this nation.

commissions that have examined substantive problems in the administration of the death penalty.[67] The discovery of widespread unreliability in death sentences ignited arguments that the "reasonable doubt" standard of proof in capital cases should be replaced by a "beyond any doubt" standard.[68]

Daniel Patrick Moynihan's essay on "The Negro Family" alerted President Nixon and his successors to the plight of female-headed welfare families.

Now, there may be a third. James S. Liebman's just-published report, "A Broken System: Error Rates in Capital Cases 1973-1995," transforms the debate on the death penalty as much as those earlier works did the understanding of poverty and welfare in America.

Id.; *see also* Jonathan Alter, *The Death Penalty on Trial: Special Report—DNA and Other Evidence Freed 87 People From Death Row; Now Ricky McGinn is Roiling Campaign 2000; Why America's Rethinking Capital Punishment*, NEWSWEEK, June 12, 2000, at 24, 26–34 (noting changes in political rhetoric concerning the death penalty); Alan Berlow, *The Broken Machinery of Death*, THE AM. PROSPECT, July 30, 2001, at 16; David Gergen, *Death by Incompetence*, U.S. NEWS & WORLD REP., June 26, 2000, at 76; James Liebman, *The Condemned, and The Mistakes*, N.Y. TIMES, July 12, 2000 at A20; *Murder One*, THE ECONOMIST, June 17, 2000, at 33:

> America has been convulsed by a debate about the death penalty. . . . Most of the arguments have either been ideological or framed in terms of emotive individual cases . . . . Hence the importance, this week, of the first real data. It comes from the first comprehensive study of all the 5,760 capital cases heard in America from 1973 to 1995.

Id. This research was cited as a model for contemporary scholarship of relevance to the legal profession and to the reform of legal institutions by the President of the American Association of Law Schools in the Association's quarterly publication. *See* Elliott Milstein, *Coming Soon to A Law School Near You: A Colloquium on How You Can Help Promote Access to Equal Justice*, THE ASS'N OF AM. LAW SCHOOLS NEWSL. (Washington, D.C.), Aug. 2000, at 1, *available at* http://www.aals.org/pmaug00.html.

See also David Broder, *A Broken System*, WASH. POST, June 18, 2000, at B7 (Editorial); Fox Butterfield, *Death Sentences Being Overturned in 2 of 3 Appeals*, N.Y. TIMES, June 12, 2000, at A1; *Deadly Mistakes*, N.Y. TIMES, June 13, 2000, at A26 (Editorial); David Gergen, *Death by Incompetence*, U.S. NEWS & WORLD REP., June 26, 2000, at 76; Henry Weinstein, *Death Penalty Overturned in Most Cases*, L.A. TIMES, June 12, 2000, at A1; *Good Morning America: Study Finds U.S. Capital Punishment System Flawed* (ABC News broadcast, June 12, 2000); *The Early Show: New Study of the Death Penalty Finds that a Majority of the Cases are Overturned on Appeal* (CBS News broadcast, June 12, 2000); *Today: Professor James Liebman, Columbia University, Discusses Death Penalty* (NBC broadcast, June 12, 2000); *Morning Edition: Recent Study Showing High Number of Death Penalty Cases Have Been Reversed Because of Critical Mistakes* (NPR broadcast, June 12, 2000); *All Things Considered: Studies Show the Death Penalty System is Fraught with Error* (NPR broadcast, June 12, 2000); *The News Hour with Jim Lehrer: Death Penalty Debate* (PBS broadcast, June 13, 2000).

[67] State death penalty study commissions in Arizona, California, Connecticut, Illinois, New Jersey, North Carolina, Maryland, Nebraska, Nevada, Pennsylvania, and Virginia have cited the Columbia study as one impetus to examine the state's system of capital punishment. For discussion and links to each of the state study commission reports, see Human Rights Watch, *The Death Penalty in the United States of America, at* http://www.hrw.org/campaigns/deathpenalty/statestudies.htm (last visited Jan. 14, 2005).

[68] FORST, *supra* note 58; Liebman et al., *A Broken System, Part II*, *supra* note 65.

Coming closely on the heels of the revelations of actual innocence and the exonerations of inmates on death row in Illinois, and in the shadow of the growing number of exonerations nationally that surpassed 100 in 2002, the Liebman et al. study intensified the debate on the accuracy of the death penalty and further raised doubts about the reliability of capital sentences.

Many of the issues in capital punishment revealed by the exonerations in Illinois and elsewhere, and by the Liebman et al. study, have particular salience for adolescents facing the death penalty, and may underlie the declining use of the death penalty for adolescents who are convicted of capital murders committed before the age of eighteen. Juveniles accounted for thirty-three of the 340 exonerations reported by Professor Gross and colleagues, including twenty-three for murder. Fourteen of the thirty-three were exonerated following revelation of false confessions, a far higher rate (42%) compared to their older counterparts (13%).[69] The special vulnerability of adolescents to false confessions reflects their developmental and functional immaturity and the likelihood of their diminished culpability.[70]

The tension between the culpability and immaturity of juvenile murderers was highlighted in recent cases in Florida involving Lionel Tate, and in Michigan involving Nathaniel Abraham.[71] In each case, public

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[69] Gross et al., *Exonerations*, *supra* note 56, at 545.

[70] Steven A. Drizin & Richard A. Leo, *The Problem of False Confessions in a Post-DNA World*, 82 N.C. L. REV. 892, 963 (2004); *see, e.g.*, Beckman, *supra* note 19 (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 eighteen, and may not be completed until age twenty-one or later); Fagan, *supra* note 19 (discussing evidence of juveniles' immaturity and the risk of false confessions, and the risk of error in attempts to assess individual juveniles' culpability); Scott & Steinberg, *supra* note 19 (on the diminished culpability of adolescents owing to their deficits in psycho-social maturity, and the need for law to accommodate these facts); Tanenhaus & Drizin, *supra* note 19, at 671-89 (on the special risk of false confessions for adolescents). Questions about the diminished culpability of juveniles reached the U.S. Supreme Court in a rare published dissent by Justices Stevens, Breyer and Ginsburg in August 2002, in a petition for certiorari in a juvenile death penalty case that was denied. *See* Patterson v. Texas, 536 U.S. 984 (2002) (Stevens, Ginsburg, Breyer, J.J., dissenting); *see also* Adam Liptak, *3 Justices Call for Reviewing Death Sentences for Juveniles*, N.Y. TIMES, Aug. 30, 2002 at A1.

[71] *See, e.g.*, Keith Bradsher, *Michigan Boy Who Killed at 11 is Convicted of Murder as Adult*, N.Y. TIMES, Nov. 17, 1999, at A1; Michael Browning, *Boy, 14, Gets Life in TV Wrestling Death: Killing of 6-Yr.-Old Playmate Wasn't Just Horseplay, Florida Judge Says*, CHI. SUN-TIMES, Mar. 10, 2001, at 1 (noting that the death occurred while Tate was "allegedly demonstrating wrestling techniques on her"); Dana Canedy, *At 14, a Life Sentence: Boy Killed Girl in 'Wrestling' Murder*, DALLAS MORNING NEWS, Mar. 10, 2001, at 1A. The case of thirteen-year-old Nathaniel serves as another example of the tendency on the part of prosecutors to respond to the deeds rather than the needs of juvenile defendants. Despite the fact that Nathaniel "was officially assessed as functioning at the level of a six-

debates about the severity of their crimes were contextualized in analyses of their immaturity and the belief of the courts that these juveniles were amenable to change. Whether this contextualist view of culpability enters the deliberations of jurors, whether simply to rule out death or to more cautiously calibrate the reliability of a conviction when the defendant is an adolescent, the special considerations of the culpability of adolescents and the heightened risks of error may be factors that contribute to the recent decline in juvenile death sentences. The *Atkins* majority worried about the potential for execution of innocents, or at the least, of those less culpable.[72] The same may now be true about jurors in juvenile death penalty cases.

Accordingly, we extend the analyses in this article to examine whether the accumulation of innocence has influenced the rate of juvenile death sentences. We include measures of exonerations in multivariate models to estimate the contributions of innocence to the declining patterns of juvenile death sentences and evidence of the evolving social and legal norms on the juvenile death penalty.

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

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year-old, both intellectually and emotionally," prosecutors, pursuant to a state statute, Mich. Comp. Laws Ann. 712A.2d (West 2000), charged him as an adult for first degree murder on the basis that he was capable of forming the requisite intent. Deanna M. Maher, *Michigan Juveniles Are Denied Equal Defenses Before the Law: The State of Michigan's Reaction to Juvenile Defendants*, 78 U. DET. MERCY L. REV. 259, 260 (2001). At thirteen years of age, Nathaniel was the youngest person to be tried for first degree murder in the United States. Christina DeJong & Eve Schwitzer Merrill, *Getting "Tough on Crime": Juvenile Waiver and the Court*, 27 OHIO N.U. L. REV. 175, 175 (2001). Although Nathaniel was eventually found guilty by a Detroit jury of second degree murder, the judge presiding over the case exercised the discretion allotted to him under Michigan law to sentence Nathaniel to a juvenile detention center rather than a prison. Maher, *supra*, at 261. The judge was able to exercise this discretion because Nathaniel was under the age of fourteen when he committed the alleged offense. For an analysis of how trial court judges adjusted the sentences of these defendants to accommodate their immaturity and prospects for rehabilitation, see Fagan, *supra* note 19.

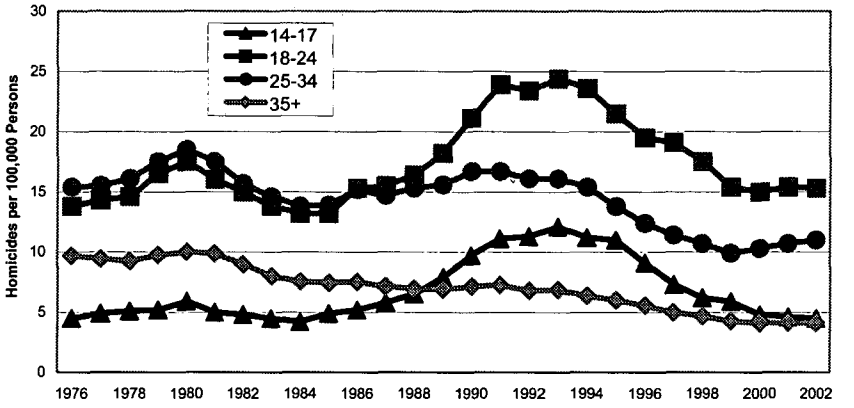
[72] Atkins v. Virginia, 536 U.S. 304, 320 n.25 (2002).

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.[73] 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 fourteen to seventeen peaked in 1993 and has declined steadily since that year.[74] 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.

[73] *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 thirty years, with peaks in 1974 (9.8), 1980 (10.2) and 1991 (9.8), followed in each instance by declines of varying durations. *See* JAMES ALLEN FOX & MARIANNE W. ZAWITZ, U.S. DEP'T OF JUSTICE, HOMICIDE TRENDS IN THE UNITED STATES, *available at* http://www.ojp.usdoj.gov/bjs/homicide/homtrnd.htm (last visited Feb. 11, 2005). In addition to reaching a record high nationally in 1991, the homicide rate reached record levels in fourteen 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).

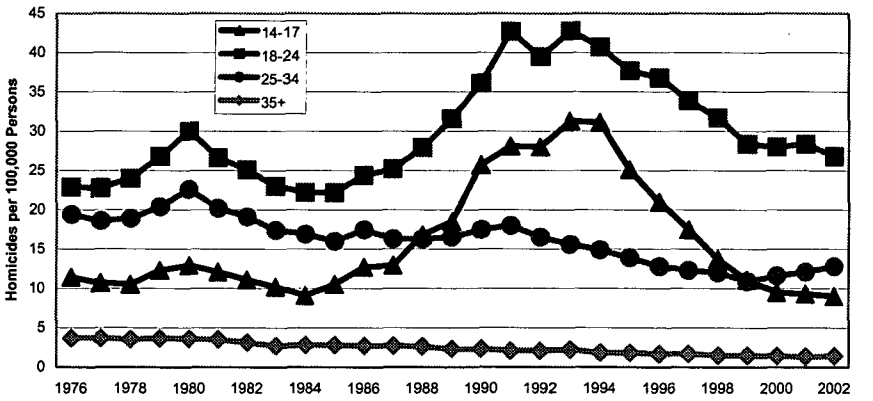
[74] *See also, e.g.*, Philip J. Cook & John H. Laub, *After the Epidemic: Recent Trends in Youth Violence*, 29 CRIME AND JUST. 1 (2002).

Figure 1a. Homicide Victimization Rates per 100,000 Persons by Age, U.S., 1976-2002



Source: FBI, SUPPLEMENTARY HOMICIDE REPORTS, 1976-2002

Figure 1b. Homicide Offending Rates per 100,000 Persons by Age, U.S., 1976-2002



Source: FBI, SUPPLEMENTARY HOMICIDE REPORTS, 1976-2002

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.[75]

Following a set 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 eighteen to twenty-four—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 rate of 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 Table 4. 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.[76] Second, death sentences

[75] 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.

[76] *See generally* MICHAEL FINKELSTEIN & BRUCE LEVIN, STATISTICS FOR LAWYERS (2d

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, had that sentence overturned upon review at some point later in time (often, years later), and then, 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.[77] 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.[78] 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 the behavior of criminal justice agencies. 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,[79] and the Uniform Crime Reports[80] 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.[81] Table 1 provides an overview of data domains and sources.

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ed. 2001).

[77] *See* Liebman et al., *A Broken System, Part II, supra* note 65.

[78] *See id.*

[79] *See* TRACEY SNELL & THOMAS J. BONZCAR, U.S. DEP'T OF JUSTICE, CAPITAL PUNISHMENT 2002 (2003), *available at* www.ojp.usdoj.gov/bis/abstract/cp02.htm. Data are publicly available at National Archive of Criminal Justice Data, Institute for Social Research, University of Michigan, *at* www.icpsr.umich.edu/cgi-bin/archive.prl?study=3958 (last visited Jan. 11, 2005).

[80] FED. BUREAU OF INVESTIGATION, U.S. DEPARTMENT OF JUSTICE, UNIFORM CRIME REPORTS: CRIME IN THE UNITED STATES, various years, *at* 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, *at* http://www.icpsr.umich.edu/NACJD/ucr.html (last visited Jan. 11, 2005).

[81] Streib, *December*, *supra* note 20, at 5.

Table 2 shows the variables computed from these data that were used in the analyses in Sections IV and V.

Table 1

Data Domains and Sources

Domain	***Source***
Juvenile Death Sentences	*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 (last visited Jan. 11, 2005). 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.
Adult Death Sentences	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 (last visited Jan. 11, 2005).[2]
Homicide Victimization Patterns and Character-istics	U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, Compressed Mortality Files. 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 1988-1992 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 (last visited Jan 11, 2005).[3]
Juvenile and Adult Homicide Arrests	Annual homicide arrests are taken from The Uniform Crime Reporting Program Data [United States]: 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. Due to non-reporting issues and difference in age categories used in these two data

	sources, counts of juvenile homicide arrests include all arrests of persons under the age of eighteen. Adult homicides arrests are for all ages over seventeen.[4]
Punishment Trends	Data are taken from an annual series of reports and data on state and federal prison populations from the Bureau of Justice Statistics.[5] 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, *available at* http://www.ojp.usdoj.gov/bjs/ dtdata.htm#prisoners (last visited Jan 11, 2005). Data from 1999-2001 are taken from Bureau of Justice Statistics, U.S. Dep't of Justice, Sourcebook of Criminal Justice Statistics.
Drug Arrests	Crime data are from the FBI Uniform Crime Reports, Fed. Bureau of Investigation, U.S. Dep't of Justice, Uniform Crime Reports for the United States: Crime in the United States, 1973-2001.[6]
Social and Economic Character-istics	*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 (last visited Jan. 11, 2005). *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 at http://factfinder.census.gov (last visited Jan 11, 2005). Years 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 at http://factfinder.census.gov (last visited Jan. 11, 2005).

	Additional data were collected from previous research, and data supplied from other published research projects.[7]
Political Contexts	Indices of the political pressure on state trial court and appellate judges from judicial selection techniques were developed by Liebman et al.[8] 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.[9]
Innocence Cases	Counts of the number of exonerations by state and year were computed from data compiled by Samuel Gross et al., Exonerations early draft, *supra* note 56, at app. at 27-31.

[1] Streib, *June*, *supra* note 20, at 5; *see also* Strieb, *December* and *April*, *supra* note 20.

[2] THOMAS P. BONCZAR & TRACY L SNELL, BUREAU OF JUSTICE STATISTICS, CAPITAL PUNISHMENT, 2002 (2003), *available at* http://www.ojp.usdoj.gov/bjs/abstract/cp02.htm. 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, *available at* http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=3958.

[3] 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.

[4] FED. BUREAU OF INVESTIGATION, U.S. DEP'T OF JUSTICE, UNIFORM CRIME REPORTING PROGRAM DATA [UNITED STATES]: SUPPLEMENTARY HOMICIDE REPORTS 1976-2001 (ICPSR Study 3108, 3448, and 3722); BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, THE SOURCEBOOK OF CRIMINAL JUSTICE STATISTICS 1988–2002 (2002). Data for Kansas were largely missing and are taken from Kansa Bureau of Investigation and are available at http://www.accesskansas.org/kbi (last visited Jan. 11, 2005); Florida data were also missing and are taken from the Florida Department of Law Enforcement publications available at http://www.fdle.state.fl.us/ (last visited Jan. 11, 2005).

[5] *See, e.g.*, PAIGE HARRISON & ALLEN J. BECK, U.S. DEP'T OF JUSTICE, PRISONERS IN 2002 (2003), *available at* http://www.ojp.usdoj.gov/bjs/pub/pdf/p02.pdf.

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

[7] *See, e.g.*, H. Naci Mocan & R. Kay Gittings, *Getting Off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, XLVI J.L. ECON. 453 (2003). Professor Mocan graciously provided his data, including economic and population characteristics and measures of punishment and other criminal justice case processing indicia.

[8] *See* Liebman et al., *Broken System, Part I*, *supra* note 65; Liebman et al., *Broken System, Part II*, *supra* note 65.

[9] *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).

Table 2

Variables and Measures[1]

Variable	***Measure***
Juveniles Sentenced to Death	Counts of persons under the age of eighteen sentenced to death by state and year.
Time	The fourteen years in the study period taken as a linear trend from the beginning to the end of the study.
Time Squared	A quadratic 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 eighteen.
Population 15 and Above (logged)	The natural log of the population that is age fifteen 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 twenty-five.
Black/ White Victimization Ratio	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.[2]
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 eighteen arrested for homicide in a state year.
Homicide Residual	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 regressed, using ordinary least squares, on the percentage of the population under twenty-five, 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 fifteen and above.[2]
Innocence	The number of exonerations in each state-year. The two- and three-year averages of exonerations in each state. The two- and three-year averages of exonerations nationally.

[1] All predictors were lagged by two years.
[2] For a fuller discussion of this variable, *see* Liebman et al., *Broken System, Part I*, *supra* note 65; Liebman et al., *Broken System, Part II*, *supra* note 65.
[3] Model statistics available from authors.

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.[82] Because juvenile death sentences since *Stanford* are 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[83]—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.[84] The Poisson distribution is a discrete distribution which takes on the values $y = 0, 1, 2, 3, \ldots$. 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

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

[83] *See* Streib, *December*, *supra* note 20, at 5.

[84] *See, e.g.*, WILLIAM GREENE, ECONOMETRIC ANALYSIS (5th ed. 2000); PETER KENNEDY, A GUIDE TO ECONOMETRICS (1995).

distribution more closely resembles a normal distribution.

Poisson distributions typically assume that events are inevitable, and that they follow some known distribution or frequency pattern. In most circumstances, 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.

Accordingly, the Poisson distribution may not accurately predict the occurrence of a discrete event when these events are rare within an observational period. 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.[85] 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 334 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 the jurisdiction simply may choose not to use this sentencing option, regardless of the characteristics of the pool of juvenile homicide defendants or the

[85] 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); Christopher J. Zorn, *An Analytic and Empirical Examination of Zero-Inflated and Hurdle Poisson Specifications*, 26 SOCIOLOGICAL METHODS AND RESEARCH 368 (1998).

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. In a distribution with so many zeros, once the hurdle is crossed so that a non-zero count is generated, the rate of occurrence of the events of interest, such as juvenile death sentences, are likely to be quite low.

This is the rationale for two forms of Poisson regression: Poisson models, which model the factors that predict the event being observed, and Zero-Inflated Poisson (ZIP) models, [86] which also model these predictors but accommodate distributions with a large number of zero observations.[87] 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. [88]

In a Zero-Inflated Poisson model, 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:

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

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

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

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[86] GREENE, supra note 84, at 22; Diane Lambert, *Zero-Inflated Poisson Regression, with an Application to Defects in Manufacturing*, 343 TECHNOMETRICS 1 (1992).

[87] *See, e.g.*, GREENE, *supra* note 84, at 22; JEFFREY M. WOOLRIDGE, ECONOMETRIC ANALYSIS OF CROSS-SECTIONAL AND PANEL DATA (2003); Zorn, *supra* note 85, at 369-70.

[88] *See generally* Zorn, *supra* note 85.

distributions (Poisson, in this case) can be anticipated.[89] Vuong's statistic is $V = \sqrt{n}\ \bar{m} / s_m$, where m_i is the log of the ratio of the predicted probabilities from the extended model and the Poisson model $\log (P_e / P)_i$. 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.[90] Values close to zero in absolute value favor neither model.[91]

In the analyses in Section V, 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.[92]

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 importantly, with different distributional properties.[93]

IV. TRENDS AND PATTERNS IN JUVENILE DEATH SENTENCES

Table 3 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 their courts did not impose 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 re-sentencings) in each year in each state while that state had a valid juvenile death sentence statute. There were 262 state-year observations with no juveniles sentenced to death. When states did sentence juveniles to death, most sentenced only

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

[90] *See* J. SCOTT LONG, REGRESSION MODELS FOR CATEGORICAL AND LIMITED DEPENDENT VARIABLES (1997).

[91] *See id.*

[92] *See* Yin Bin Cheung, *Zero-Inflated Models for Regression Analysis of Count Data: A Study of Growth and Development*, 21 STAT. IN MED. 1461, 1462-67 (2002).

[93] *See* Zorn, *supra* note 85.

one juvenile to death in a year (fifty-two); and rarely were there more than two. Although death sentences were more frequent for persons ages eighteen to twenty-four, 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 eighteen state-years with more than ten persons ages eighteen to twenty-four sentenced to death.

Table 3

Capital Sentencing History and Age Eligibility by State 1990-2003

	Minimum Age Eligible for Capital Sentencing 2003		
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: Simmons v. Roper, 112 S.W.3d 397 (2003); American Bar Assoc., Juvenile Death Penalty Resources & Information, *at* http://www.abanet.org/crimjust/juvjus/resources.html#context; Streib, *June*, *supra* note 20.

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

Table 4 shows that 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 4 shows that fifty-seven young persons were sentenced to death in states with a minimum age of sixteen, and fifty-five were sentenced to death in states with a minimum age of seventeen. The peak year for juveniles sentenced to death was 1994, when fifteen juvenile offenders were newly sentenced to death. Following a more recent peak of fourteen 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%. The number declined again to three in 2002, and one in 2003. Table 4 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 4. 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: Streib, *June*, *supra* note 20.

* Data include first death sentences that originated during the study period. Data include death sentences for two defendants fifteen years of age, the first in 1990 in Alabama, the second in 1991 in Florida. The current minimum death penalty age is seventeen in Florida and sixteen 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 eighteen to twenty-four—and persons age twenty-five and older. Table 5 compares the number of persons sentenced to death in each of these three age groups from 1990 to 2002.[94] For example, the number of juveniles sentenced to death declined from fourteen in 1999 to three in 2002, a drop of 79%. In the eighteen to twenty-four age bracket, the number of persons sentenced to death declined from eighty-nine to forty-three in the same time period, a decline of 52%; among persons twenty-five and older, the number of persons sentenced to death declined from 161 to 97 during this period, a drop of 40%.

Table 5

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: SNELL & BONZCAR, *supra* note 79; Streib, *December*, *supra* note 20.

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 fifteen (in 1994) to three (in

[94] Table 5 excludes juveniles sentenced to death in 2003, since comparable data are not available for adults during that year.

2002), a decline of 82%. For persons ages eighteen to twenty-four, 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 twenty-five 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.

Figure 2a. Death Sentences By Year and Age, States with the Death Penalty for Juveniles, 1990-2003

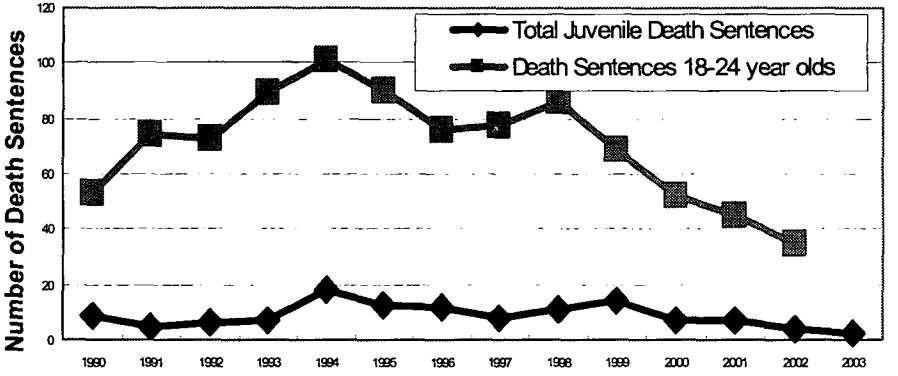
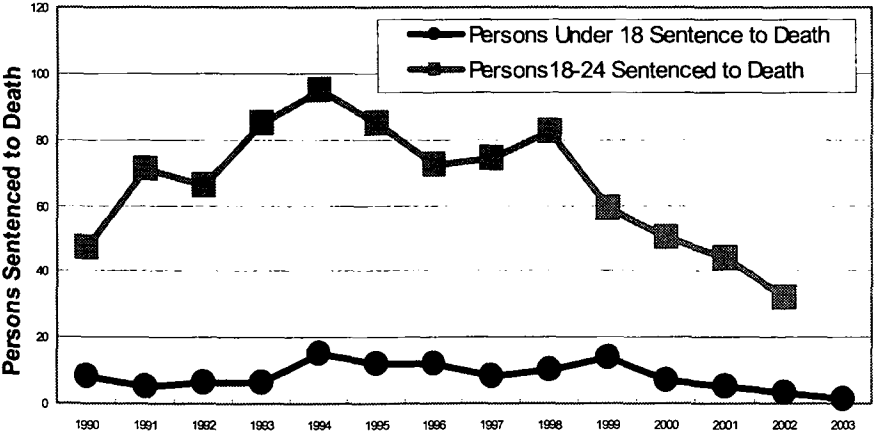


Figure 2b. Persons Sentenced to Death By Year and Age, States with the Death Penalty for Juveniles, 1990-2002



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 2a shows the changes over time in the total number of death sentences imposed per year, comparing juvenile defendants with defendants eighteen to twenty-four years of age. Figure 2b shows the changes over time in the total number of persons sentenced to death per year (excluding re-sentencings), comparing the same age groups.[95]

[95] 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 6 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 thirteen 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 6. 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 sixteen-year-olds rose from 12 per 100,000 in 1985 to 36 per 100,000 in 1995; the rate for seventeen-year-olds rose from 20 per 100,000 in 1985 to 51 per 100,000 in 1995. *See* Blumstein, *supra* note 73, at 20-24. 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 infra* note 104 regarding the limitations of juvenile homicide arrest data in the UCR.

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 7 and Figures 3a and 3b show that the concentration of juvenile death sentences in these three states correlates positively with their overall death sentencing patterns.[96] Texas ranks first in juvenile death sentences, first in death sentences for young adults ages eighteen to twenty-four, 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[97] 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 eighteen to twenty-four 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).

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., U.S. DEP'T OF JUSTICE, STATE RESPONSES TO SERIOUS AND VIOLENT JUVENILE CRIME 1-2 (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); 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.); FRANKLIN E. ZIMRING, AMERICAN YOUTH VIOLENCE (1999) (discussing trends toward greater use of adult criminal sanctions for juvenile offenders).

[96] 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).

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

Table 7

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: SNELL & BONZCAR, *supra* note 79; Streib, *June*, *supra* note 20.

*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 were able to sentence a juvenile to death.

Figure 3a. Persons Sentenced to Death by Age and State, in Active Juvenile Death Sentencing States, 1990-2002

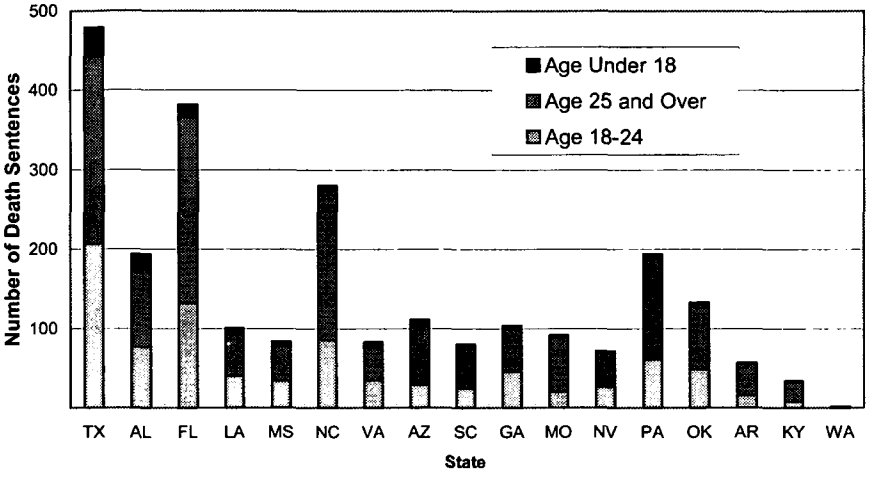
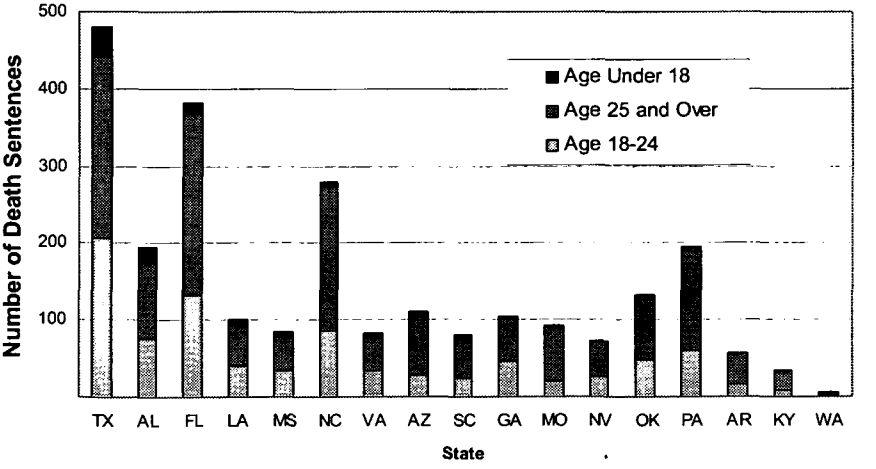


Figure 3b. Death Sentences by Age and State, in Active Juvenile Death Sentencing States, 1990-2002



As Table 7 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 also generally ranked lowest in number of adults sentenced to death. Nevertheless, there are three states—Delaware, Idaho, and Indiana—that had no juvenile death sentences during the study period but had between fifteen and twenty-nine adult death sentences per state. Accordingly, there appear to be quite different norms influencing death sentencing patterns for juveniles and adults in several states. [98]

Table 8 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 4a 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.[99]

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[98] 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 STUD. 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* Parts IV.C and V.

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

Table 8

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 Juvenile Death Penalty 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

SNELL & BONZCAR, *supra* note 79; Streib, *June*, *supra* note 20

Figure 4a. Juveniles Sentenced to Death in High States Compared to Other States, 1990-2002

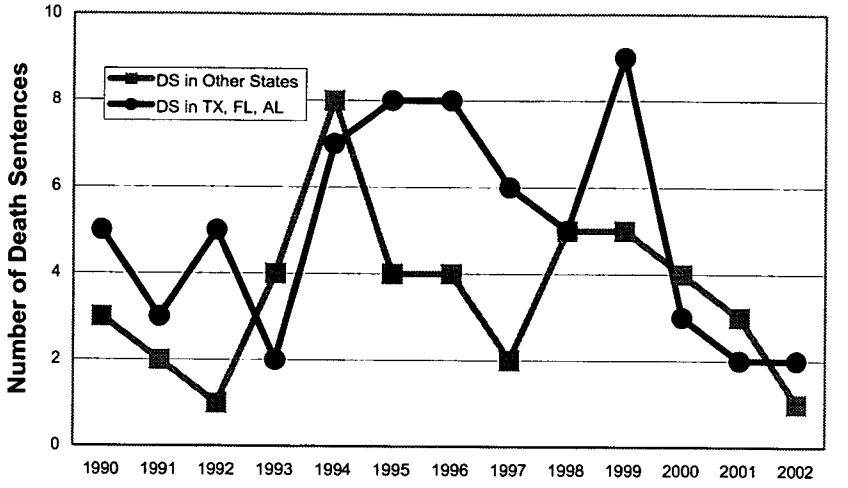
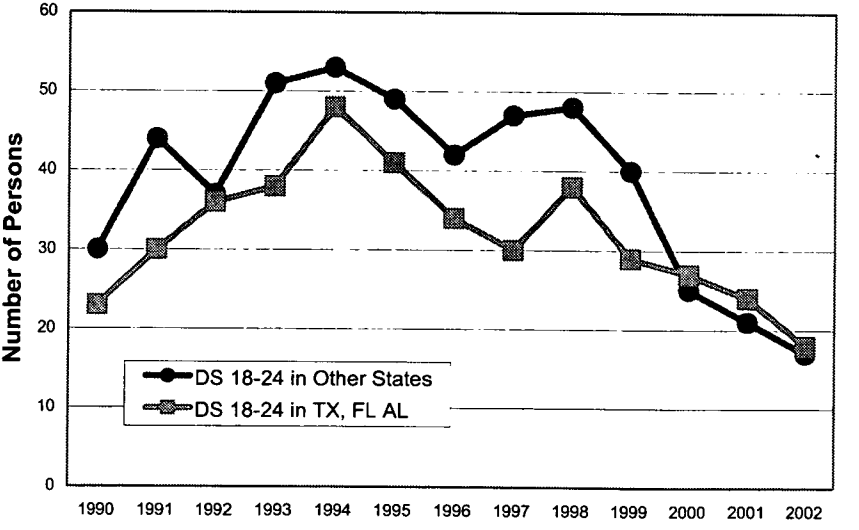


Figure 4b. Persons Ages 18-24 Sentenced to Death in High States vs. Other States, 1990-2002



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 4b shows the trends in death sentencing of defendants eighteen to twenty-four 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 eighteen to twenty-four, however, is not as steep as the decline for juveniles. Accordingly, comparing Figures 4a and 4b 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.[100] In subsequent multivariate analyses,[101] we introduce controls for juvenile homicide arrests and populations below age eighteen 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 9 shows the number of persons sentenced to death per 1,000

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

[101] *See infra* section V.

homicide victimizations in the U.S. from 1990-2002 for persons under eighteen, persons ages eighteen to twenty-four, and persons twenty-five 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.[102])

The data in Table 9 show that all three age-specific distributions reflect a curvilinear pattern of increases followed by declines. However, the decline is greater for persons below eighteen 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%. Since 1999, the rate declined from 1.67 per 1,000 juvenile homicide arrests to 0.35 in 2002, a decline of 79.0%.

Both of these substantial declines for juvenile homicide offenders were far greater than the declines for adults. The number of homicide offenders ages eighteen to twenty-four 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.[103] Among persons twenty-five 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

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[102] From 1985 to 1995, in cases where the age of the offender is known, about one in four of the victims of homicide offenders ages thirteen to seventeen were within the same age group. Three-fourths of the victims of juvenile homicide offenders were eighteen years of age or older, and most of those were age twenty-five and older. *See* Philip J. Cook & John H. Laub, *The Unprecedented Epidemic in Youth Violence*, 24 CRIME & JUSTICE 27, 48-50 & 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% of juvenile homicide offenders kill persons who also are juveniles, while 74.5% kill persons who are over age seventeen. 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.

[103] 2002 is the last year when accurate age-specific homicide arrest data are available nationally.

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.

Table 9

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: BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, CAPITAL PUNISHMENT 2001 (2002); FED. BUREAU OF INVESTIGATION, *supra* note 80; Streib, *April*, *supra* note 20.

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 9, the ratio of persons eighteen to twenty-four 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 twenty-five 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.

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 5 and Table 10, 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.[104]

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[104] We use all juvenile homicide arrests for persons below eighteen years of age, rather than specific counts of homicide arrests for sixteen- and seventeen-year old homicide offenders. (Specific counts of persons sixteen and seventeen 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 sixteen- and seventeen-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. The data for 1975-97 are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=9028. Beginning in 1998, the data for each year are maintained in separate files. The data for 1998 are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=2906. The data for 1999 are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=3162. The data for 2000 are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=33448. For 2001, the data are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=3722, and for 2002, the data are available at http://www.icpsr.umich.edu/cgi-bin/bob/archive?study=3999. 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 nine of the fourteen 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 one to fourteen 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

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.[105] 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 ten cases from 1990 to 1999 in Texas, Florida and Alabama, the three states with the highest number and percentage of juvenile death sentences.[106] The lag ranged from seven to thirty-eight months across these cases; the average time lag was 21.9 months, and the median time lag was twenty-four months. Accordingly, we use a time lag of twenty-four months in estimating the duration from arrest to sentencing.

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death in some states but not others.

To account for missing data, we then turned to the SOURCEBOOK OF CRIMINAL JUSTICE STATISTICS, *available at* www.albany.edu/sourcebook (last visited July 7, 2004). The *Sourcebook* integrates data from over 100 sources of criminal justice information in the United States. The *Sourcebook* reports the total number of persons under the age of eighteen 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 eighteen from the SHR and the *Sourcebook.* Since we use all juvenile homicide arrests, including arrests of those under sixteen 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 sixteen-and seventeen-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, *supra* note 73, at 20-24.

In the political ecology of states and courts that sentence juvenile homicide offenders, it is reasonable to assume that death sentences for eligible juvenile offenders (ages sixteen and seventeen) would be influenced by total patterns of juvenile homicide, especially those that receive political attention and popular interest. These totals will include juvenile homicide offenders under sixteen, whose actions may well be generalized politically and culturally to the broader pool of juvenile homicide offenders.

[105] *See* Liebman et al., *A Broken System, Part I, supra* note 65.

[106] We reviewed ten 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 twenty-six months, and averaged 15.8 months. In Alabama, the average length of time between arrest and death sentence was twenty-six months, with a range of fifteen to thirty-eight months. In Texas, the lag time from arrest to sentence was 23.4 months, with a range of eleven to thirty-eight months. Data and citations are available from the authors.

Figure 5. Persons Sentenced to Death Per 100 Homicide Arrests Lagged by Two Years, 1990-2003

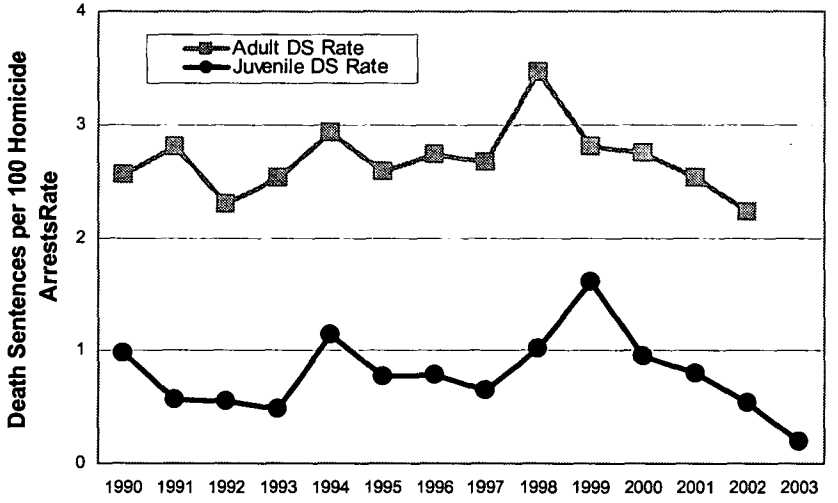


Table 10. Juveniles and Adults Sentenced to Death per 100 Homicide Arrests Lagged Two Years, 1990-2003

	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	--	--	--

Sources: FED. BUREAU OF INVESTIGATION, *supra* note 80; SNELL & BONZCAR, supra note 79; Streib, *June*, *supra* note 20.

Table 10 and Figure 5 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 6a 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 6a 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 2002 rate of 1.07, for a drop of 33.5%. Again, the rate of decline for juvenile death sentences per homicide arrests 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 6b 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.

Figure 6a. Persons Sentenced to Death Per 100 Homicide Arrests Lagged Two Years, Texas, Alabama and Florida, 1990-2002

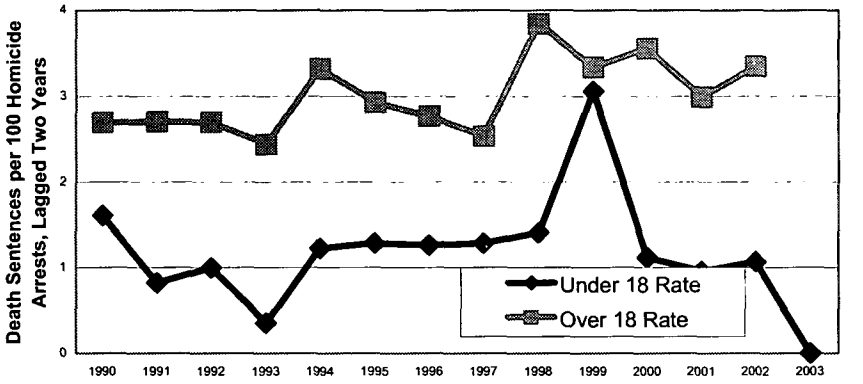
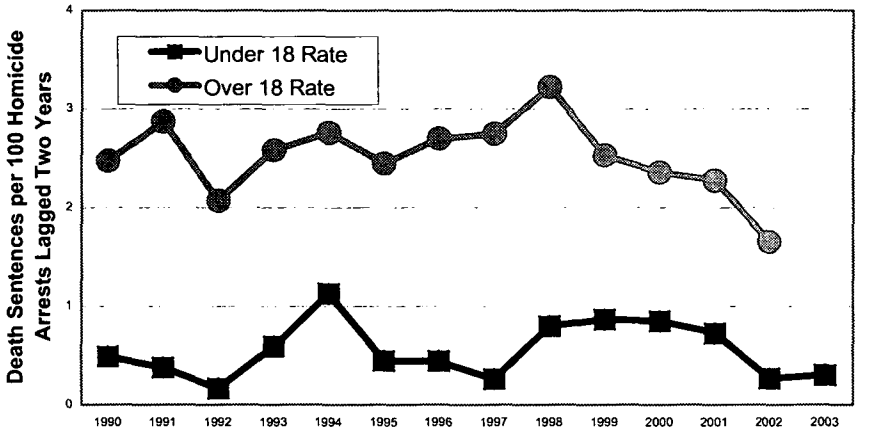


Figure 6b. Persons Sentenced to Death Per 100 Homicide Arrests Lagged Two Years, Medium and Low Juvenile Death Sentencing States, 1990-2002



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 eighteen to twenty-four) and juveniles; the presence of other social and political factors that would alter the political ecology and legal context of charging and death sentencing.[107] The growing prevalence of exonerations in capital cases[108] and the high rate of reversals of capital sentences in state appellate courts[109] may also contribute to the reluctance of juries to impose death sentences. The contribution of these factors may signal a loss of faith in the capacity to reliably and accurately implement capital sentences, but not a normative shift away from the use of the penalty on juvenile offenders.

Accordingly, we tested whether changes in the social, political, and normative cultures of the United States 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.

A. MODEL ESTIMATION

1. Model Specifications

In the models that follow, the dependent variable is juveniles

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[107] *See, e.g.*, Liebman et al., *A Broken System, Part II*, *supra* note 65 (discussing social and political factors that influence error rates in capital sentences).

[108] For a listing of exonerations of persons who received death sentences since 1989, see Gross et al., Exonerations early draft, *supra* note 54, at app. at 27-31.

[109] *See, e.g.*, Liebman et al., *A Broken System, Part I*, *supra* note 65; Liebman et al., *A Broken System, Part II*, *supra* note 65.

sentenced to death; we did not include re-sentences for the 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).[110] In the zero-inflated Poisson (ZIP) model, we specify an inflation factor that adjusts for the excessive number of zeros in the dataset. Most of the zeros are located in states with medium and low total death sentencing rates.[111] 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.[112] We include a dummy (binary) variable for the most recent four-year period of sustained decline in juvenile death sentences (2000-2003) 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

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

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

[112] 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 supra* Figures 3a and 3b.

model.[113] We lag the count of juvenile homicide arrests by two years,[114] 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.[115] 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. 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.[116] 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 eighteen to twenty-four 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 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,[117] we estimated regression

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[113] 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, *supra* note 84.

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

[115] BRUCE K. ARMSTRONG ET AL., PRINCIPLES OF EXPOSURE MEASUREMENT IN EPIDEMIOLOGY (1992).

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

[117] Murder and social structural variables are endogenous, and determining causal direction often is difficult. *See, e.g.*, Lauren J. Krivo & Ruth D. Peterson, *The Structural Context of Homicide: Accounting for Racial Differences in Process*, 65 AM. SOC. REV. 547 (2000); Kenneth C. Land et al., *Structural Covariates of Homicide Rates: Are There Any Invariances Across Time and Social Space?*, 95 AM. J. SOC. 922, 922-32 (1990). *See*

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,[118] 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.[119] Finally, we include the percentage of the total population that is below age eighteen 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 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 A.

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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 65. 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.

[118] *See* Blume et al., *supra* note 98; Liebman et al., *A Broken System, Part II*, *supra* note 65.

[119] *See* Liebman et al., *A Broken System, Part II*, *supra* note 65.

2. Testing for the Effects of Exonerations

To test for the influence of exonerations on the decline in juvenile death sentences, we extended the first set of Poisson models to include measures of the prevalence of exonerations both within each state and in the broader national context. We computed two- and three-year averages for the years preceding each year in the time series for each state. This was done for two reasons. First, we assume that the effects of exonerations would not be limited to only those that might have occurred in the preceding year. The residual perceptual effects of salient events such as exonerations may last for two or three years; beyond that time interval, the effects of exonerations would be too distal to presume an effect, or would be confounded with other intervening effects. Second, we computed averages because of the sparseness of the data, and the burden of an excessive number of zeros that might skew the parameter estimates in the Poisson regression models.[120]

Accordingly, to measure the effects of within-state exonerations, we computed each state's average number of exonerations for both two-and three-year intervals preceding each year in the study. To measure the effects of the broader national context in which exonerations take place, we computed the national average of exonerations in all death penalty states for the preceding two-and three-year intervals for each year in the study. We also computed the total number of prior exonerations, both within each state and nationally, for each year in the series. For the national exoneration data, we computed total exonerations plus two- and three-year averages in the preceding years, in three different ways: (1) all exonerations in all death penalty states, (2) all exonerations in juvenile death penalty states only, and (3) capital exonerations in all death penalty states.

We then computed an interaction term that combined the within-state and national exoneration effects to estimate the combined effects of the two sources of exonerations. The interaction term is the most important of the predictors in the model, providing a measure of the multiplicative effects of the state or national measures and capturing two independent sources of the potential effects of exonerations on juror or judge decision making. We tested these models using just the more conservative hurdle Poisson

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[120] There were fifty-one state-year data points with one or more exonerations in capital cases in the juvenile death penalty states since 1989, only 12.3% of the 334 state-year data points. Because a Poisson distribution with a parameter λ is a linear function of a set of explanatory variables ($\ln \lambda$), an excessive number of zeros in a predictor would exert a downward bias on the estimation of that predictor and potentially inflate the parameter estimates of other predictors in the linear model. *See* PETER KENNEDY, A GUIDE TO ECONOMETRICS 245 (3d ed. 1994).

specification.

B. RESULTS

1. Identifying the Decline in Juvenile Death Sentences

The results of the models using the linear interaction term are shown in Table 11. The first three columns in Table 11 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 at both the $p < .05$ and $p < .10$ levels.[121]

In the full model in Table 11, 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 (ages eighteen to twenty-four) death sentence rate, the murder rate, the residual of the murder rate,[122] 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 11. 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.[123]

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 eighteen to twenty-four), the murder rate, and the youth population.

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[121] 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.

[122] 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 115 and accompanying text.

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

Table 11. Zero-Inflated and Hurdle 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 are: Arizona, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Nevada, Oklahoma, Pennsylvania, South Carolina, South Dakota (through 2003), Virginia, and Washington (through 1992). § 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., *A Broken System, Part I, supra* note 65; Liebman et al, *A Broken System, Part II, supra* note 65; and punitiveness index, *id.*

The third column in Table 11 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 sentences since 1990.[124] 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 11 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 11 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 12 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.

[124] *See* Streib, *December*, *supra* note 20.

Table 12. Zero-Inflated and Hurdle 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 are: Arizona, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Nevada, Oklahoma, Pennsylvania, South Carolina, South Dakota (through 2003), Virginia, and Washington (through 1992). § 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., *A Broken System, Part I, supra* note 65; Liebman et al., *A Broken System, Part II, supra* note 65; and punitiveness index, *id.*

Table 13

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[§]					
Kentucky					
Missouri[†]					
Mississippi					
New Hampshire					
Oklahoma					
Pennsylvania					
South Carolina					
South Dakota*					
Utah					
Virginia					
Wyoming*					
Total	7	5	3	1	16

[§] Indiana banned the death penalty for juveniles by statute in 2002.

* 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: Streib, *June*, *supra* note 20.

The pattern of results is identical. The coefficients for the interaction of $TIME^2$ * Post-1999 are smaller compared to the coefficients in Table 11, 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).

Overall, the results in Tables 11 and 12 provide consistent evidence under a variety of measurement and model specification conditions of a significant downward trend in juvenile death sentences in the United States, 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 13 shows that seventy-two of the eighty 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 7 and 8 show the predicted values for juvenile death sentences per juvenile homicide arrest that were generated from the full models (with all states) in Tables 11 and 12. On a second axis, we show the juvenile homicide arrest count, lagged by two years as it is in the multivariate models.[125]

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[125] 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 data point. At the other end of the series, the 2001 juvenile homicide arrest count is shown with the 2003 JDS data point.

Figure 7. Juvenile Death Sentences per Year, Adjusted for Predictors including Linear Trend, by Juvenile Homicide Arrests (Lagged 2 Years), 1990-2003

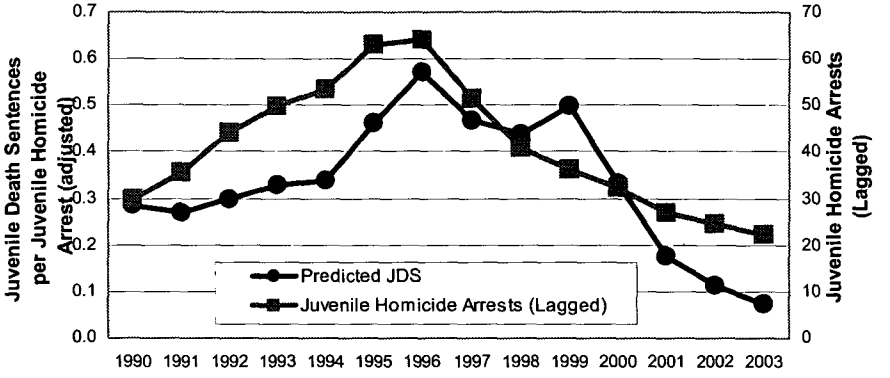

Figure 8. Juvenile Death Sentences per Year, Adjusted for Predictors including Quadratic Time Trend, by Juvenile Homicide Arrests (Lagged 2 Years), 1990-2003

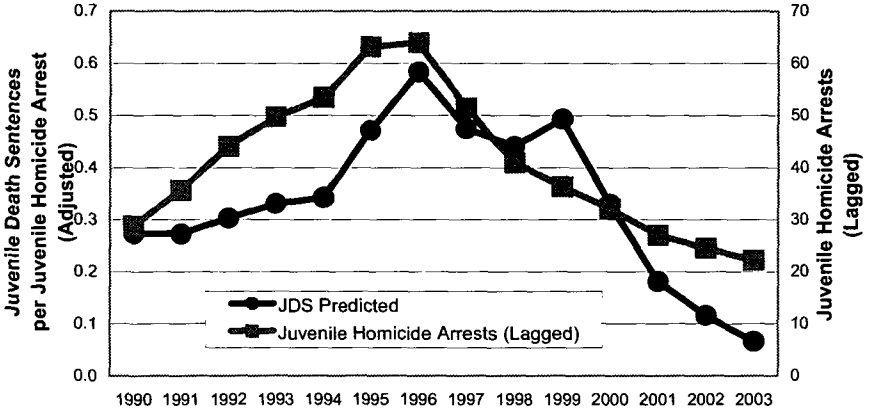

Figure 9 uses the linear Time interaction term to compute the predicted juvenile death sentence rates; Figure 7 uses the more restrictive adjustment based on the quadratic ($Time^2$) interaction. The figures are nearly identical. They show that the peak adjusted rate of juvenile death sentences per juvenile 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. Finally, in Figures 9 and 10, 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.[126] 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 9 and 10 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.

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

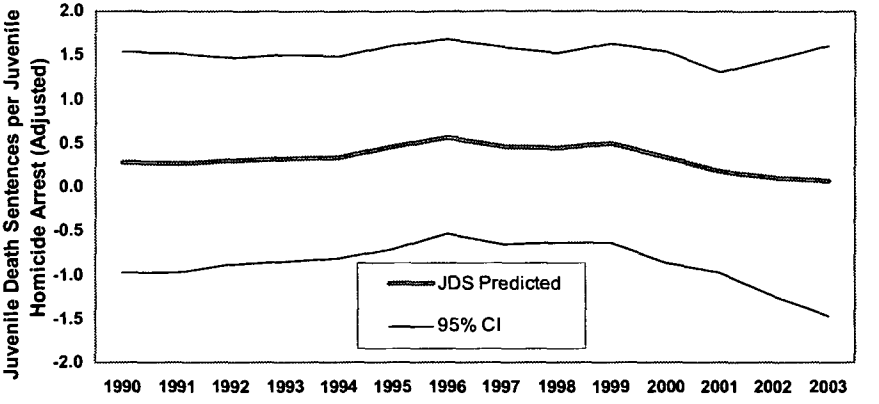
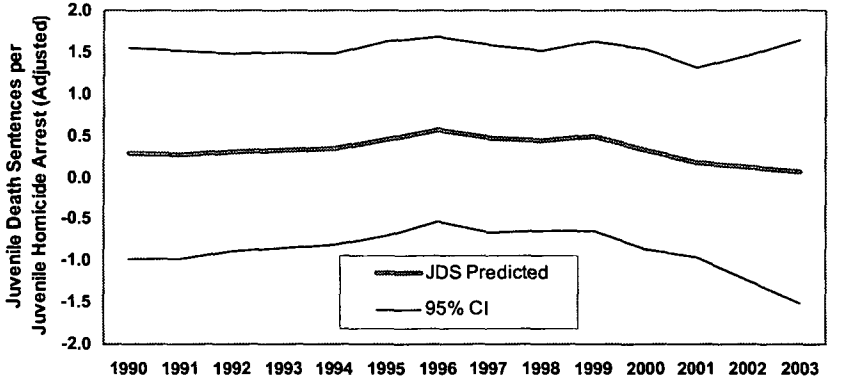


Figure 10. Juvenile Death Sentences Per Juvenile Homicide Arrest by Year with 95% Confidence Intervals, Adjusted for Quadratic Time Trend and Other Predictors, 1990-2003



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 fourteen juvenile death sentences in 1999 to seven (2000), five (2001), three (2002) and one (2003) (see Table 13). 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.

2. The Effects of Exoneration on Juvenile Death Sentences

We estimated a set of models that included several measures of both within-state and national patterns of exonerations. These measures were added to the models shown in Table 12. These models, estimated with quadratic time trends and using a hurdle Poisson specification, were the more stringent test of the decline in juvenile death sentences. Here, we show the results in a slightly different form. In Table 14, we show the complete results of one regression model to illustrate the model form and its results. In Table 15, we summarize the results of the full set of models, showing only the probabilities associated with the regression coefficient for each innocence measure. As in the previous models, all models again were estimated with the full range of state covariates and controls for murder rates, adults death sentences, and population.

Table 14 shows that recent capital exonerations exert a statistically significant downward influence on the number of juvenile death sentences since 1989. The interaction of the two sources of exonerations combines to significantly lower the number of juvenile death sentences. The effect is significant ($p=.054$), and the exponentiated regression coefficient ($\exp\{\beta\}=.654$) suggests that juvenile death sentences are 35% less likely to occur in the presence of a recent capital exoneration either within the state or nationally. Table 14 also retains the important finding that juvenile death sentences had significantly declined since 1999, with the same controls for murder and arrest rates as well as adult death sentences and social and political factors. In addition to the substantive importance of the exoneration finding in Table 14, it also shows that these effects are evident after controlling for the secular trend of declining juvenile death sentences.

As before, we generated predicted values for juvenile death sentences that are adjusted for the explanatory variables in the regression model, this

time including both the two-year within-state and three-year national averages of capital exonerations. In Figures 11 and 12, we show the predicted rates of juvenile death sentences per juvenile homicide arrest, adjusted for all the predictors in Table 14. The results are essentially unchanged. Figures 11 shows the predicted values for juvenile death sentences per juvenile homicide arrest. On a second axis, we show the juvenile homicide arrest count, lagged by two years as it is in the multivariate models. Figure 11 uses the restrictive prediction based on the quadratic ($Time^2$) interaction. Figure 12 shows the predicted rates of juvenile death sentences together with 95% confidence intervals (CIs).

Table 14. Poisson Regression of Exonerations on Juvenile Death Sentences, Controlling for Time Trends, Murder Rates, Juvenile Homicide Arrests, and State Covariates

					95% CI	
	B	*SE*	*z*	*p(z)*	*Lower*	*Upper*
Time	-.373	.291	-1.28	.200	-.94	.20
$Time^2$	.032	.024	1.35	.178	-.025	.08
DS Persons 18-24	.120	.197	.61	.543	-.276	.51
Post 1999	3.467	1.730	2.00	.045	.08	6.86
Post99*$Time^2$	-.034	.014	-2.42	.015	-.06	-.01
Murder Rate (log)	1.243	.768	1.62	.105	-.26	2.75
Murder Residual	-.020	.089	-.22	.823	-.19	.15
Population > 18	-.161	.225	-.72	.474	-.60	.28
Exonerations						
National 3yr Average	.072	.180	.40	.689	-.28	.42
State 2yr Average	2.659	1.151	2.31	.021	.40	4.92
Interaction	**-.424**	**.220**	**-1.93**	**.054**	**-.86**	**.01**
State Covariates						
B/W Homicide Ratio	-.076	.051	-1.46	.145	-.18	.03
% Black Population	.021	2.496	0.01	.993	-4.87	4.91
% Urban	.005	.013	0.35	.725	-.02	.03
Political Pressure	-.037	.088	-0.42	.673	-.21	.14
Punitiveness	.152	.055	2.78	.005	.04	.26
Constant	-6.054	3.464	-1.75	.081	-12.84	.74

Chi square = 48.08, p = .000
Log likelihood = -170.82075
Pseudo R^2 = .123

Figure 11. Juvenile Death Sentences, Adjusted for State and National Exonerations with Quadratic Time Trend, and Juvenile Homicide Arrests (Lagged 2 Years), 1990-2003

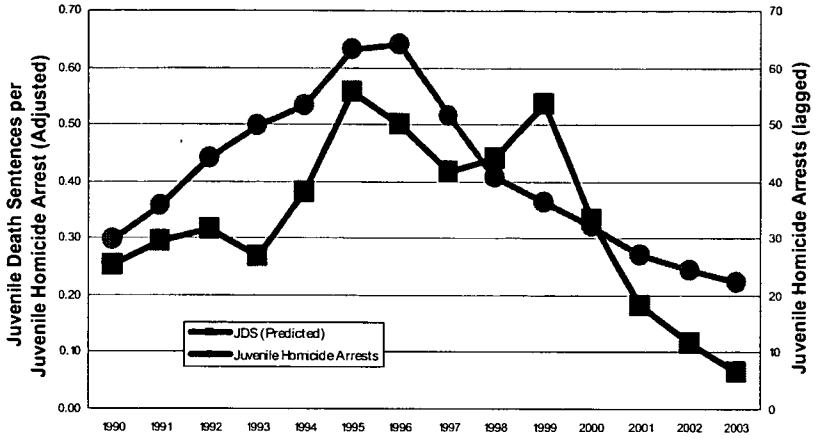
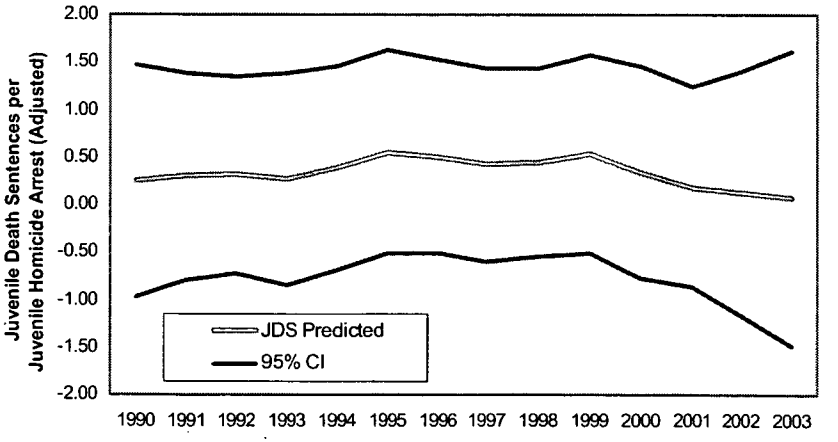


Figure 12. Juvenile Death Sentences per Juvenile Homicide Arrest with 95% Confidence Intervals, Adjusted for State and National Exonerations with Quadratic Time Trend and Other Predictors, 1990-2003



Figures 11 and 12 are nearly identical to Figures 8 and 10, and lead to identical conclusions. 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. As before, the graphs also show a widening gap between the predicted values for juvenile death sentences and juvenile homicide arrests beginning in 2000.

Accordingly, the addition of exoneration data seems to add little to the explanation and prediction of the declining pattern juvenile death sentences following *Stanford*. Although exonerations make unique contributions to the pattern of juvenile death sentences, the contribution is small and has little effect on the functional form of the relationship between the adjusted rate of juvenile death sentences and juvenile homicide arrests.

These results shown in Table 14 and Figures 11 and 12 were obtained for one specific iteration of a broader pattern of analyses of the effects of exonerations. We conducted similar analyses, varying two parameters. First, we included alternate measures of state and national exoneration: prior-year exonerations, and averages for the preceding two- and three-year intervals. We also varied the source of exonerations (all death penalty states for national exoneration data versus only juvenile death penalty states). To assess the robustness of the finding that recent capital exonerations seem to influence the number and rate of juvenile death sentences. Regression models similar in form to the models shown in Table 14 were conducted for all possible combinations of these constructions of the exoneration measure. A total of forty-five regressions were completed. Table 15 reports the results of the significance test for the interaction term for models with alternate specifications of within-state and national exonerations.

Table 15. Effects of Within-State and Nationwide Exonerations on Juvenile Death Sentences

	All Exonerations in All Death Penalty States	All Exonerations in JDP States Only	Capital Exonerations in All DP States
National and State Totals (Death Penalty Exonerations)			
Nat'l prior year total * State prior year total	***.096****	**.020****	.168
Nat'l 2 year avg. * State prior year total	**.048**	.225	.570
Nat'l 3 year avg. * State prior year total	**.018**	**.013****	***.087****
National and State Totals (All Exonerations)			
Nat'l prior year total * State prior year total	.912	.759	n/a
Nat'l 2 year avg. * State prior year total	.954	.974	n/a
Nat'l 3 year avg. * State prior year total	.971	.911	n/a
National By State 2 Year Averages (Death Penalty Exonerations)			
Nat'l prior year total * State 2 year average	.139	.111	.218
Nat'l 2 year avg. * State 2 year average	.124	***.070****	.255
Nat'l 3year avg. * State 2 year average	***.066****	.079	***.054****
National By State 2 Year Averages (All Exonerations)			
Nat'l prior year total * State 2 year average	.902	.872	n/a
Nat'l 2 year avg. * State 2 year average	.972	.530	n/a
Nat'l 3 year avg. * State 2 year average	.982	.895	n/a
National By State 3 Year Averages (Death Penalty Exonerations)			
Nat'l prior year total * State 3 year average	.393	.275	.455
Nat'l 2 year avg. * State 3 year average	.376	.188	.911
Nat'l 3 year avg. * State 3 year average	.240	.322	.183
National By State 3 Year Averages (All Exonerations)			
Nat'l prior year total * State 3 year average	.885	.627	n/a
Nat'l 2 year avg. * State 3 year average	.751	.279	n/a
Nat'l 3 year avg. * State 3 year average	.696	.610	n/a

* p(z) for interaction term in Poisson regression < .10

** p(z) for interaction term in Poisson regression < .05

Nine of the forty-five tests (20%) were statistically significant. The overall pattern is inconsistent; the significant results are concentrated in one set of models where the within-state measure of exonerations is the total number of prior capital exonerations for each year in the time series. This group is the set of models reported in the first three rows of Table 15. The pattern is the same when national totals are computed for only juvenile death penalty states and when all death penalty states are considered. When we examine the state two-year averages, three of the six tests are significant, again only for within-state capital exonerations. We obtained significant results when the national measure included either all exonerations or just capital exonerations. Significant results were obtained here the national data included all death penalty states or just juvenile death penalty states, and when the national indicia included either all exonerations or capital exonerations only.[127]

The pattern in Table 15 suggests that exonerations do contribute to the declining trend in juvenile death sentences, but under specific and limited conditions. Two such conditions are evident from Table 15: the total number of capital exonerations within the state, or the average number of exonerations over the previous two years within the state. The rising trend in total exonerations across the nation seems to influence juvenile death sentences conditionally on the presence of these within-state trends. Even when these effects are present, Figures 11 and 12 remind us that capital exonerations have little measurable influence on the overall pattern of declining juvenile death sentences. What is more likely is that the decline in juvenile death sentences and the rise in exonerations are two faces of a larger temporal trend in capital punishment that points to its decreasing use in the face of strong evidence of the unreliability of death sentences. That is, beyond the influence of exonerations, there appears to be a normative shift away from sentencing juvenile offenders to death.

VI. CONCLUSION

In 2003, the Missouri Supreme Court ruled in *Simmons v. Roper* that the execution of offenders under the age of eighteen 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

[127] The model in this group that combines National 3 year average * State 2 year average, for Capital Exonerations in All Death Penalty States is the model shown in detail in Table 14.

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 United States since 1990. The data show that the number of juveniles sentenced to death (excluding re-sentencings) has declined sharply since *Stanford*, from a peak of fifteen in 1994, and a more recent peak of fourteen in 1999, to one in 2003. (Total death sentences, including re-sentencings, 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 eighteen to twenty-four and for adults twenty-five 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.

We also examined the effects of the growing number of innocence cases on the declining rates of juvenile death sentences. We find evidence

that the combined effects of recent capital innocence cases both within juvenile death sentencing states and across the nation exerted a downward pressure on juvenile death sentences, controlling for murder rates and juvenile homicide arrest rates. Although capital innocence cases may have contributed to the reluctance of juries to impose death sentences on juveniles, the accumulation of innocence cases is contemporaneous with the trend that we observed for juvenile death sentences. Both trends are a function of time: the increase in innocence cases and the decline of juvenile death sentences. Both contribute reciprocally to the evolving social and legal norms opposing the use of the death penalty for juveniles.

There is compelling evidence, even in the states that theoretically permit the use of the juvenile death penalty, of 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

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
Exonerations				
National 3 Year Average	3.00	7.00	4.69	1.33
State 2 Year Average	.00	2.00	.092	.21
Interaction	.00	14.00	.47	1.23

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