Hidden Homicide Increases in the USA, 1999–2005

Guoqing Hu, Daniel Webster, and Susan P. Baker

ABSTRACT Prior to 1999, dramatic fluctuations in homicide rates were driven by changes in the rates of firearm homicide among men aged 15–24. Since 2000, the overall homicide rate has appeared stable, masking any changes in population subgroups. We analyzed recent trends in homicide rates by weapon, age, race, gender, state, and urbanization to determine whether the risk of victimization increased substantially during 1999–2005 for demographic subgroups. The analysis of WISQARS™ data and Wonder data from Centers for Disease Control and Prevention revealed no trend in the homicide rate nationally between 1999 and 2005; this obscured large increases in firearm homicide rates among black men aged 25–44 and among white men aged 25–34. Between 1999 and 2005, for ages 25–44 combined, the increase for black men was 31% compared with 12% for white men. Significant increases among men aged 25–44 occurred in Alabama, California, Michigan, Minnesota, Nebraska, Nevada, New Jersey, Ohio, Pennsylvania, Texas, and Washington. The firearm homicide rate increased the most in large central metropolitan areas (+32%) and large fringe metropolitan areas (+30%) for men aged 25–44. We conclude that the recent, unrecognized increases in firearm homicide among men aged 25–44, especially black men, in large metropolitan areas merit the attention of policymakers.

KEYWORDS Homicide, Firearm, Trend, United States

INTRODUCTION

Homicide is an important cause of death in the USA and the leading cause for black men aged 15 to 34.¹ Two thirds of victims are killed with firearms.² Prior to 1999, there were large swings in the firearm homicide rate that were concentrated in urban areas among young black men, including a striking increase beginning in the late 1980s and a substantial decrease after 1993.^{3–5}

Possible reasons for the fluctuations in the homicide rate have been described by Blumstein et al.³ They pointed to a number of factors likely to have contributed to the marked decrease in homicide that began in the early 1990s: changes in drug markets, increased drug arrests, reduced carrying of guns following prior increases

Hu is with the Department of Epidemiology and Health Statistics, School of Public Health, Central South University, Changsha, Hunan, China; Hu and Baker are with the Center for Injury Research and Policy, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA; Webster is with the Center for the Prevention of Youth Violence and Center for Gun Policy and Research, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA.

Correspondence: Susan P. Baker, Center for Injury Research and Policy, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, 624 North Broadway, Baltimore, Maryland 21205, USA. (E-mail: sbaker@jhsph.edu)

in weapons arrests, and improved economic conditions. More recently, Nevin has provided compelling evidence to indicate that dramatic reductions in childhood lead poisoning during the late 1960s and the 1970s in US cities may have contributed to the steep reduction in murders and other violent crimes in the 1990s.⁶

Little attention has been given in the literature to the homicide rate since 1999, which the Bureau of Justice Statistics characterizes as “stable”.⁷ The flatness of the total homicide rate, however, which increased by only 1% between 1999 and 2005,⁸ may have obscured important changes in specific components of the population. The primary objectives of our research were to describe the epidemiological characteristics of homicide rates, especially firearm homicide rates, from 1999 to 2005, and determine whether there were notable trends during these years in firearm homicide rates of specific population subgroups characterized by age, gender, race, and geography.

MATERIALS AND METHODS

Data for this study came from WISQARS™ (Web-based Injury Statistics Query and Reporting System).⁸ WISQARS™ mortality reports provide tables with the numbers of injury-related deaths and the mortality rates per 100,000 of the population according to cause (mechanism) and intent of injury by sex, age group, race, and state for the years 1981 through 2005. These mortality data come from annual data files of the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), and are derived from Multiple Cause of Death data.⁹ Although the International Classification of Diseases (ICD)-10 coding system used for 1999 data onward is different in many respects from the ICD-9 coding used for 1998 and earlier data, preliminary studies showed that the revision does not substantially affect mortality patterns for homicide.^{9,10} Therefore, we used data from WISQARS™ without adjustment for the coding change. Mortality data by urbanization level were available from 1999 onward from CDC’s Wonder system.¹¹ The NCHS Urban–Rural Classification scheme divides the 3,141 US counties and county equivalents into six categories, four metropolitan (large central, large fringe, medium, and small) and two nonmetropolitan (micropolitan and noncore).¹² To analyze the urban–rural difference, we combined the two nonmetropolitan categories. The unemployment rate came from the Research and Analysis Unit of the Indiana Department of Workforce Development.¹³

Analysis

To identify trends since 1999, we first graphed homicide rates of 1981–2005 by weapon and gender. Then, age-specific mortality rates for male firearm homicide in 1999 and 2005 were determined. Because men aged 25–44 were the only group with obvious and significant increases in the 7-year period, subsequent analyses focused on this group. We examined whites and blacks separately due to the white–black disparity in male firearm homicide rates.² To explore geographic variations, we plotted the trends during 1981–2005 in firearm homicide for men aged 25–44 by region. Further, we fitted simple linear regression between mortality rates and year for each state and the District of Columbia, to identify states with significant changes in rates of men aged 25–44 in the recent 7 years. Linear regression coefficients were used to measure the significance of the linear trend; $p < 0.05$ was selected as the statistically significant level.

RESULTS

Between 1981 and 2005, nonfirearm homicide rates declined gradually for both men and women, except for peaks reflecting the terrorist attacks on September 11, 2001 (Figure 1). Among women, firearm homicide rates paralleled their nonfirearm rates. Men experienced three periods of rapid change in their rates of firearm homicide, which fell sharply from 1981 until 1985, then increased sharply until 1991, and then declined rapidly between 1993 and 1999.

Between 1999 and 2005, the overall homicide rate remained between 6.0 and 6.1 of 100,000 except for 2001, when it was 7.1 (regression coefficient=−0.03, $p=0.728$). During the same period, there was a slight increase in the firearm homicide rate of men (regression coefficient=0.11, $p=0.006$; Figure 1). There was no appreciable change in the generally downward trend for nonfirearm homicide or for female homicide during 1999–2005 (regression coefficients were, respectively, −0.10, −0.06, and −0.02, $p>0.05$). Subsequent analyses therefore focused on firearm homicide among men. First, male age-specific rates were compared for the years 1999 and 2005 (Figure 2). For most age groups, there was virtually no change during this period, but the rate increased for the age groups 20–24, 25–29, 30–34, 35–39, and 40–44.

Differences between black and white men in firearm homicide trends of the 5-year age groups from 15 to 44 were examined (Table 1). For whites, the age groups of 25–34 showed significant increases in firearm homicide rates ($p<0.05$); for blacks, significant increases occurred in ages 25–44 ($p<0.05$). For ages 25–44 combined, the increase in rates between 1999 and 2005 was 12% for white men (from 4.9 to 5.5 of 100,000) and 31% for black men (from 39.6 to 51.7).

The increases in firearm homicide during 1999–2005 did not occur uniformly across the USA. Most states did not change significantly, but 11 states experienced

FIGURE 1. Trends in homicide by weapon and gender (USA, 1981–2005).

FIGURE 2. Age-specific mortality for firearm homicide (USA, male, 1999 vs. 2005).

large increases in the firearm homicide rate for men aged 25–44 ($p<0.05$): Alabama, California, Michigan, Minnesota, Nebraska, Nevada, New Jersey, Ohio, Pennsylvania, Texas, and Washington (Table 2). These figures are for blacks and whites combined.

Regional trends differed between whites and blacks (Figure 3a and b). From 1981 onward, rates for whites were generally lowest in the Midwest, where rates for blacks were highest. After 1999, marked increases in rates for both races occurred in the West (annual percent changes in rates were 6.6% for whites, $p=0.001$, and 9.6% for blacks, $p=0.006$). The West was the only region where white rates increased significantly; among blacks, significant increases occurred in the Northeast, South, and West.

TABLE 1 Firearm homicide mortality rate per 100,000 population by race and age group (US, male, 1999–2005)

Race	Age	1999	2000	2001	2002	2003	2004	2005	<i>b</i> ^a	<i>p</i> value
White	15–19	6.9	6.5	6.2	6.7	6.4	6.3	7.0	0.004	0.957
	20–24	9.1	9.0	10.4	9.9	10.7	9.3	9.3	0.054	0.711
	25–29	7.2	6.7	8.2	8.1	8.3	8.3	8.4	0.246	0.029
	30–34	5.2	5.1	5.4	5.3	5.7	5.9	6.3	0.186	0.002
	35–39	4.3	4.1	4.9	4.5	4.4	4.7	4.2	0.014	0.815
	40–44	3.6	3.7	3.7	4.0	3.4	3.5	3.9	0.007	0.877
Black	15–19	56.4	51.7	52.8	48.5	53.2	49.8	54.9	−0.282	0.633
	20–24	101.0	105.2	106.1	105.7	102.4	94.2	101.9	−0.821	0.355
	25–29	74.4	78.7	83.2	90.0	93.1	89.4	90.2	2.811	0.010
	30–34	44.0	48.1	51.3	56.4	56.6	55.3	64.4	2.889	0.002
	35–39	27.3	31.7	31.4	35.8	33.9	34.7	35.8	1.214	0.014
	40–44	20.5	21.6	20.3	22.8	24.3	23.5	26.2	0.889	0.006

^aLinear regression coefficient

TABLE 2 Eleven states with significant increases in firearm homicide (US, rates for males, ages 25–44, per 100,000 population, 1999–2005)

State	1999	2000	2001	2002	2003	2004	2005	<i>b</i> ^a	<i>p</i> value
Alabama	14.9	17.6	18.6	18.4	18.2	17.7	21.2	0.668	0.039
California	8.3	9.6	10.7	12.3	12.2	12.1	13.2	0.757	0.002
Michigan	14.8	14.9	14.9	15.0	15.3	16.6	16.4	0.307	0.010
Minnesota	2.5	2.5	2.4	2.2	2.9	4.0	3.6	0.243	0.041
Nebraska	2.9	3.6	3.6	3.7	4.4	4.2	5.1	0.307	0.002
Nevada	10.3	9.1	12.5	12.4	12.6	14.1	12.6	0.607	0.037
New Jersey	5.6	6.0	6.4	7.3	8.8	9.0	12.1	0.996	0.001
Ohio	6.0	5.5	7.6	8.4	7.2	8.7	10.3	0.675	0.008
Pennsylvania	8.9	10.1	9.6	11.0	11.2	12.9	13.6	0.761	0.001
Texas	9.4	9.7	10.3	10.2	10.6	11.6	11.7	0.393	<0.001
Washington	3.8	3.4	4.0	4.2	4.8	4.7	4.7	0.218	0.008

^aLinear regression coefficient

Analysis in relation to urbanization (Figure 4) revealed that between 1999 and 2005, the largest increases in firearm homicide in males aged 25–44 occurred in large central metropolitan areas (regression coefficient=0.71, *p*=0.002), large fringe metropolitan areas (regression coefficient=0.29, *p*<0.001), and medium metropolitan areas (regression coefficient=0.21, *p*=0.020). Increases elsewhere were not significant (*p*>0.05). In large central metropolitan areas, the annual percent increase in rates was 6% for blacks and 4% for whites.

DISCUSSION

Although overall US homicide rates have not changed dramatically in recent years, there have been substantial increases in firearm homicide rates among black men aged 25–44 and white men aged 25–34, particularly in large metropolitan areas. Unlike other age groups, these age groups have also experienced significant increases in homicide offending, as well as victimization, since 1999.⁸

This increase is of special interest for several reasons. First, unlike an earlier increase in the late 1980s, the increase since 1999 went largely unrecognized because of the lack of an increase in the homicide rate for the entire US population. Second, the age groups with the largest increase were not the same as the group (ages 20–24) with the highest rate, which may have contributed to the failure to take note of the trend.

The reasons that men in the 25–44-year age group, particularly blacks and those in large metropolitan areas, had a large increase in their rate of firearm homicide from 1999 to 2005 are not obvious. Many in this demographic subgroup were 15 to 24 years old between 1985 and 1991 when black men aged 15–24 in large cities experienced exponential growth in firearm homicide rates. The fact that the same cohort has been involved in two recent upswings in firearm homicide rates raises questions about whether there is something about the conditions during which this group came of age that may make them much more susceptible to involvement in lethal violence.

One factor that may be important in explaining varying trends in homicide rates between demographic subgroups is childhood exposure to lead. Elevated maternal and early-childhood blood lead levels can impair cognitive functions that are key to

FIGURE 3. Firearm homicide by region for men aged 25–44 (USA, 1981–2005).

controlling behaviors relevant to the risk of violence (e.g., impulse control, reasoning).¹⁴ Although the evidence to support the hypothesized effect of lead poisoning on homicide rates is based on observational research, the body of

FIGURE 4. Firearm homicide by urbanization, men aged 25–44 (USA, 1999–2005).

evidence satisfies most of the key criteria for establishing causal effects. These include: strong associations across place, time, and subgroup; many replications spanning data from many decades, countries, and cultures; biological plausibility; and control of potential confounders.⁶ The largest recent increases in firearm homicide rates were among black men in their 30s and among men living in the center of large cities. This cohort experienced the highest rates of early-childhood exposure to lead in recent decades⁶ and also experienced unusually high homicide rates during their adolescent years. The lead–homicide theory is also consistent with the continued decline in homicide rates among those under age 20. Individuals in that younger age group, who were born after the mid-1980s, experienced substantially lower levels of lead exposure during their early childhood compared with prior cohorts.⁶ More research is needed to better understand the role of changes in harmful exposure to lead on homicide rates in urban areas.

Many offenders who engage in serious violence beyond their early adult years have exhibited problems with aggressive and antisocial behavior throughout their lives, beginning in childhood. These so-called life course-persistent offenders often have neurological deficits – sometimes the result of pre- and postnatal exposure to toxins such as lead – and many grew up in “criminogenic” social environments.¹⁵ This confluence of risk factors for life course-persistent offending may have been more common for inner city youth born in the 1960s and 1970s who were exposed to high levels of lead during preschool years and who experienced during their adolescence and young adult years high unemployment, the emergence of a highly volatile crack cocaine market, and an escalating war on drugs by law enforcement as well as ever-increasing rates of incarceration.¹⁶

Increased incarceration may have contributed to a decline in homicide rates in the short term,¹⁷ but offending rates are high among those being released from

prison. The increasing number of prisoners within this age group who have been recently released may have contributed to the recent upswing in homicides among those ages 25–44. About half of all prisoners who are released are convicted of another crime within 3 years of their release,¹⁸ and most are released into urban neighborhoods that have high levels of social and economic disadvantage.^{19,20} Persons released from prison during 1999–2002 accounted for an estimated 35% of violent crimes in 2002.⁶ Both the absolute number and the proportion of prison inmates and prisoners released in their 30s and 40s in the USA have been increasing.⁶ Efforts to reverse the increase in homicide among men aged 25 to 44 must address the multiple challenges (e.g., substance abuse, mental illness, poor education, unemployment) that persons released from prison face when trying to stay free from crime and violence.

Blumstein et al.³ have pointed to the improving economy during the latest downturn in homicide rates, so we compared the US unemployment rates in 1993–2005 with the trend of firearm homicide rates among the rate of black men aged 25–44 (Figure 5). Both trends declined from 1993 to 1999/2000 at similar rates, and then both increased until 2003 before declining slightly. Although these results suggest an association between unemployment and male firearm homicide rates in ages 25–39, analyses of homicide and unemployment rates between 1950 and 1985²¹ and between 1971 and 1997²² did not find an association between unemployment and murder rates. Furthermore, Nevin's analyses of homicide trends across nine countries including the USA showed that unemployment explained little of the temporal changes after controlling for the effects of early-childhood lead exposure (lagged by approximately 20 years).⁶

FIGURE 5. US unemployment rate and firearm homicide rate, black men aged 25–44, 1993–2005.

CONCLUSION

Although overall homicide rates in the USA have been stable in recent years, rates of firearm homicide have increased significantly among black men aged 25–44 and white men aged 25–34. The rate of increase was twice as high among blacks as whites and has been greatest in large central metropolitan areas and large fringe metropolitan areas. There is some evidence to suggest that levels of early childhood exposure to lead and prisoner reentry trends – both very relevant to the health and safety of residents of low-income urban communities – may partly explain some of these age-specific trends. Further research is needed to explicate the causal factors at play.

ACKNOWLEDGMENT

This research was supported by the National Center for Injury Research and Prevention, Centers for Disease Control and Prevention (Grant CCR302486), through a grant to the Johns Hopkins Center for Injury Research and Policy.

REFERENCES

1. Heron MP, Smith BL. *Deaths: leading causes for 2003*. National vital statistics reports; vol 55 no 10. Hyattsville, MD: National Center for Health Statistics. 2007. http://www.cdc.gov/nchs/data/nvsr/nvsr55/nvsr55_10.pdf. Accessed on: March 1, 2008.
2. Baker SP, O'Neill B, Ginsburg MJ, Li G. *The Injury Fact Book*. 2nd edn. New York: Oxford University Press; 1992.
3. Blumstein A, Rivara FP, Rosenfeld R. The rise and decline of homicide—and why. *Annu Rev Public Health*. 2000;21:505–541.
4. Fingerhut LA, Ingram DD, Feldman JJ. Homicide rates among US teenagers and young adults: differences by mechanism, level of urbanization, race, and sex, 1987 through 1995. *JAMA*. 1998;280(5):423–427.
5. Centers for Disease Control and Prevention (CDC). Homicides among 15–19-year-old males—United States, 1963–1991. *MMWR Morb Mortal Wkly Rep*. 1994;43(40):725–727.
6. Nevin R. Understanding international crime trends: the legacy of preschool lead exposure. *Environ Res*. 2007;104(3):315–336.
7. Fox JA, Zawitz MW. *Homicide Trends in the United States: age trends*. Washington, DC: Bureau of Justice Statistics, US Department of Justice; July 2007. <http://www.ojp.usdoj.gov/bjs/homicide/teens.htm>. Accessed on: March 1, 2008.
8. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. *Web-based Injury Statistics Query and Reporting System (WISQARS) [online]*; 2008. www.cdc.gov/ncipc/wisqars. Accessed on: March 1, 2008.
9. Hoyert DL, Arias E, Smith B, Murphy SL, Kochanek KD. *Deaths: final data for 1999*. *Natl Vital Stat Rep*. 2001;49(8):1–113. http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_08.pdf. Accessed on: March 1, 2008.
10. Anderson RN, Minino AM, Hoyert DL, Rosenberg HM. Comparability of cause of death between ICD-9 and ICD-10: preliminary estimates. *Natl Vital Stat Rep*. 2001;49(2):1–32. http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf. Accessed on: March 1, 2008.
11. Centers for Disease Control and Prevention. *CDC WONDER: compressed mortality, 1979–1998 Request*. <http://wonder.cdc.gov/cmfi-icd9.html>. Accessed on: March 1, 2008.
12. Deborah D, Ingram SF. 2006 NCHS Urban–Rural Classification Scheme for Counties. http://www.cdc.gov/nchs/r&d/rdc_urbanrural.htm. Accessed on: March 1, 2008.
13. Research and Analysis Unit, Indiana Dept. of Workforce Development. *Historical Labor Force/Unemployment Data for United States*. <http://www.nidataplus.com/lfeus1.htm#annl>. Accessed on: March 1, 2008.

14. Lidsky T, Schneider J. Lead neurotoxicity in children: basic mechanisms and clinical correlates. *Brain*. 2003;126(Pt 1):5–19.
15. Moffitt TE. Adolescence-limited and life-course-persistent antisocial behavior: a developmental taxonomy. *Psychol Rev*. 1993;100(4):674–701.
16. Langan PA, Levine DJ. *Recidivism of Prisoners Released in 1994. Bureau of Justice Special Report*. Washington, DC: US Department of Justice; 2002.
17. Levitt SD. Understanding why crime fell in the 1990s: four factors that explain the decline and six that do not. *J Econ Perspect*. 2004;18:163–190.
18. Langan PA, Levine DJ. *Recidivism of Prisoners Released in 1994. Bureau of Justice Special Report*. Washington, DC: US Department of Justice; 2002.
19. Visher C, Courtney SME. *Cleveland Prisoners' Experience Returning Home*. Washington, DC: Urban Institute; 2006.
20. Travis J, Keegan S, Cadora E. *A Portrait of Prisoner Reentry in New Jersey*. Washington, DC: The Urban Institute, Justice Policy Center; 2003.
21. Yang B, Lester D. Suicide, homicide and unemployment. *Appl Econ Lett*. 1995;2(8):278–279.
22. Raphael S, Winter-Ebmer R. Identifying the effect of unemployment on crime. *J Law Econ*. 2001;44(1):259–283.