

Healthy People 2010 Objectives for Unintentional Injury and Violence Among Adolescents

Trends from the National Youth Risk Behavior Survey, 1999–2009

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Background: In 2000, the USDHHS released *Healthy People 2010* (HP2010), a series of disease prevention and health promotion objectives for the nation. Thirty-nine of these objectives were dedicated to injury prevention and six of these objectives related to adolescents, who were tracked through CDC's National Youth Risk Behavior Survey (YRBS).

Purpose: This paper uses national YRBS data from 1999 to 2009 to analyze overall and subgroup trends and determine progress toward targets for the following HP2010 objectives: seatbelt use (HP2010 objective 15-19); motorcycle helmet use (15-21); riding with a driver who had been drinking alcohol (26-6); physical fighting (15-38); weapon carrying on school property (15-39); and suicide attempts requiring medical attention (18-2).

Methods: The CDC conducted the national YRBS biennially from 1999 to 2009 and used similar three-stage cluster-sample designs to obtain representative samples of high school students in the U.S. This study was conducted in 2010 and used linear and quadratic time variables simultaneously in logistic regression models while controlling for gender, race/ethnicity, and grade to test for secular trends over time.

Results: Only two objectives met their HP2010 targets: riding with a driver who had been drinking alcohol (26-6) and physical fighting (15-38). Progress was seen for four additional objectives and within some subgroups.

Conclusions: Substantial policy and practice changes must occur if the recently released *Healthy People 2020* targets are to be met. School-, community-, and state-level policies and programs may be effective tools to prevent injuries and victimizations.

(Am J Prev Med 2011;41(6):551–558) Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine

Background

Violence and unintentional injuries have a substantial impact on the health of adolescents. In 2007, as during the past several decades, unintentional injuries were disproportionately responsible for

deaths among adolescents. Unintentional injuries, such as motor vehicle crashes, falls, and sports-related injuries, were the leading cause of death among adolescents aged 14–18 years. Of the unintentional injury fatalities experienced by adolescents, nearly three quarters (71%) were related to motor vehicle crashes. Homicide was the second leading cause of death for adolescents aged 14–18 years, responsible for 16% of deaths, followed by suicide, at 11%.¹

In 2005, the estimated lifetime medical treatment and lost-productivity costs of adolescent (aged 14–18 years) deaths from unintentional injury and violence totaled

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0749-3797/\$36.00

doi: 10.1016/j.amepre.2011.08.011

\$10.3 billion.¹ Nonfatal injuries among young people also are prevalent. In 2009, more than 2.8 million adolescents aged 14–18 years made visits to emergency departments for nonfatal injuries.¹ The estimated lifetime medical and lost-productivity costs of unintentional and violence-related injuries requiring hospitalization or treatment in an emergency department for adolescents aged 14–18 years was \$19.6 billion in 2005.¹ In addition to economic impacts, injuries and violence also have substantial health implications beyond morbidity and mortality. For example, exposure to violence in the home or community is highly correlated with asthma diagnoses,² decreased childhood lung capacity,³ engagement in risky sexual behaviors,⁴ and smoking.⁵

Thirty-nine of the *Healthy People 2010* (HP2010)⁶ disease prevention and health promotion objectives were dedicated to injury prevention. Six of these objectives included adolescents and were tracked by CDC's national Youth Risk Behavior Survey (YRBS): seatbelt use (HP2010 objective 15-19); motorcycle helmet use (15-21); riding with a driver who had been drinking alcohol (26-6); physical fighting (15-38); weapon carrying on school property (15-39); and suicide attempts requiring medical attention (18-2). One additional objective, bicycle helmet use (15-23), was developmental and did not have a baseline or target; however, because it is measured by the YRBS it was included in the current analysis. The current paper uses data from the national YRBS to assess linear and nonlinear trends in unintentional injury and violence-related behaviors targeted by HP2010 and to examine the extent to which the targets were met for each of these objectives.

Methods

Study Design

The National YRBS has been implemented biennially since 1991 by CDC to monitor priority health-risk behaviors among youth. Each national school-based YRBS conducted by CDC in 1999, 2001, 2003, 2005, 2007, and 2009 used similar three-stage cluster-sample designs to obtain a nationally representative sample of high school students. The target population consisted of all public and private school students in grades 9–12 in the 50 states and the District of Columbia. Details of the sample design for each survey have been described previously.^{7,8}

Participation in the survey was anonymous and voluntary and local parental permission procedures were used. Students recorded their responses directly on a self-administered computer-scannable questionnaire with approximately 98 items. The IRB at the CDC approved the YRBS.

Variables

Table 1 displays the HP2010 objectives, corresponding YRBS question, 2010 goals, and the prevalence at baseline (1999) and in 2009.

The dichotomous outcome variables assessed for unintentional injury were:

- sometimes, most of the time, or always wear a seatbelt when riding in a car driven by someone else (versus never or rarely wear a seatbelt);
- sometimes, most of the time, or always wear a motorcycle helmet during the 12 months before the survey (versus never or rarely wear a motorcycle helmet);
- rode one or more times with a driver who had been drinking alcohol during the 30 days before the survey; and
- sometimes, most of the time, or always wear a bicycle helmet during the 12 months before the survey (versus never or rarely wear a bicycle helmet).

Bicycle helmet use was calculated among those students who had ridden a bicycle during the 12 months before the survey, and motorcycle helmet use was calculated among those students who had ridden a motorcycle during the 12 months before the survey.

The dichotomous outcome variables assessed for violence were:

- in a physical fight one or more times during the 12 months before the survey;
- carried a weapon on school property on at least 1 day during the 30 days before the survey; and
- made a suicide attempt during the 12 months before the survey that had to be treated by a doctor or nurse.

Statistical Analyses

Secular trend analysis was performed in 2010 and used to understand the pattern of these behaviors across the decade. Time was treated as a continuous variable with linear and nonlinear (quadratic) components. A linear trend indicates a significant, constant increase or decrease over time. A quadratic trend indicates a significant but nonlinear change over time. Trends that include significant quadratic and linear components demonstrate nonlinear variation in addition to an overall increase or decrease over time. Linear and quadratic time variables were created by using orthogonal coefficients that reflected biennial spacing of the surveys. The use of motorcycle helmets was not assessed in 2003, so the coefficients for that analysis were adjusted appropriately. Demographic variables added to the logistic regression models included gender; race/ethnicity (black, Hispanic, white); and grade in school (9th, 10th, 11th, and 12th).

Trends in the prevalence of each HP2010 objective were examined for all high school students and for subgroups of students. Linear and quadratic time variables were entered simultaneously into logistic regression models while controlling for gender, race/ethnicity, and grade. Data were weighted to adjust for nonresponse and oversampling of black and Hispanic students. Analyses were performed using the SUDAAN software package (version 10.0.0). Significance was set at $p < 0.05$ for all analyses.

Results

From 1999 to 2009, national YRBS school response rates ranged from 75% to 81%, student response rates ranged from 66% to 72%, and overall response rates ranged from 63% to 71%. Results of the trend analyses are shown in Figure 1 and Appendixes A and B (available online at www.ajpmonline.org) and are summarized briefly below. Although significant increases and

Table 1. Summary of HP2010 unintentional injury and violence objectives, goals, and YRBS prevalence (%), 1999–2009

HP2010 objective	Description	YRBS question	YRBS response of interest	1999 prevalence	HP2010 goal	2009 prevalence
Behaviors that contribute to unintentional injury						
15-19	Increase use of safety belts	How often do you wear a seatbelt when riding in a car driven by someone else?	Students who sometimes, most of the time, or always wear a seatbelt when riding in a car driven by someone else	83.6	92.0	90.3
15-21	Increase the proportion of motorcyclists using helmets	When you rode a motorcycle during the past 12 months, how often did you wear a helmet?	Among students who rode a motorcycle during the 12 months before the survey, those who sometimes, most of the time, or always wore a helmet	62.0	79.0	68.1
15-23	Increase use of bicycle helmets	When you rode a bicycle during the past 12 months, how often did you wear a helmet?	Among students who rode a bicycle during the 12 months before the survey, those who sometimes, most of the time, or always wore a helmet	14.7	— ^a	15.3
26-6	Reduce the proportion of adolescents who report that they rode, during the previous 30 days, with a driver who had been drinking alcohol	During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?	Students who rode in a car or other vehicle driven by someone who had been drinking alcohol one or more times during the 30 days before the survey	33.1	30.0	28.3
Behaviors that contribute to violence						
15-38	Reduce physical fighting among adolescents	During the past 12 months, how many times were you in a physical fight?	Students who were in a physical fight one or more times during the 12 months before the survey	35.7	32.0	31.5
15-39	Reduce weapon carrying by adolescents on school property	During the past 30 days, on how many days did you carry a weapon such as a gun, knife, or club on school property?	Students who carried a weapon on school property on at least 1 day during the 30 days before the survey	6.9	4.9	5.6
18-2	Reduce the prevalence of suicide attempts by adolescents that require medical attention	If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?	Students whose suicide attempt resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse during the 12 months before the survey	2.6	1.0	1.9

^aObjective 15-23 was a developmental objective without baseline measurement.
HP, Healthy People; YRBS, Youth Risk Behavior Survey

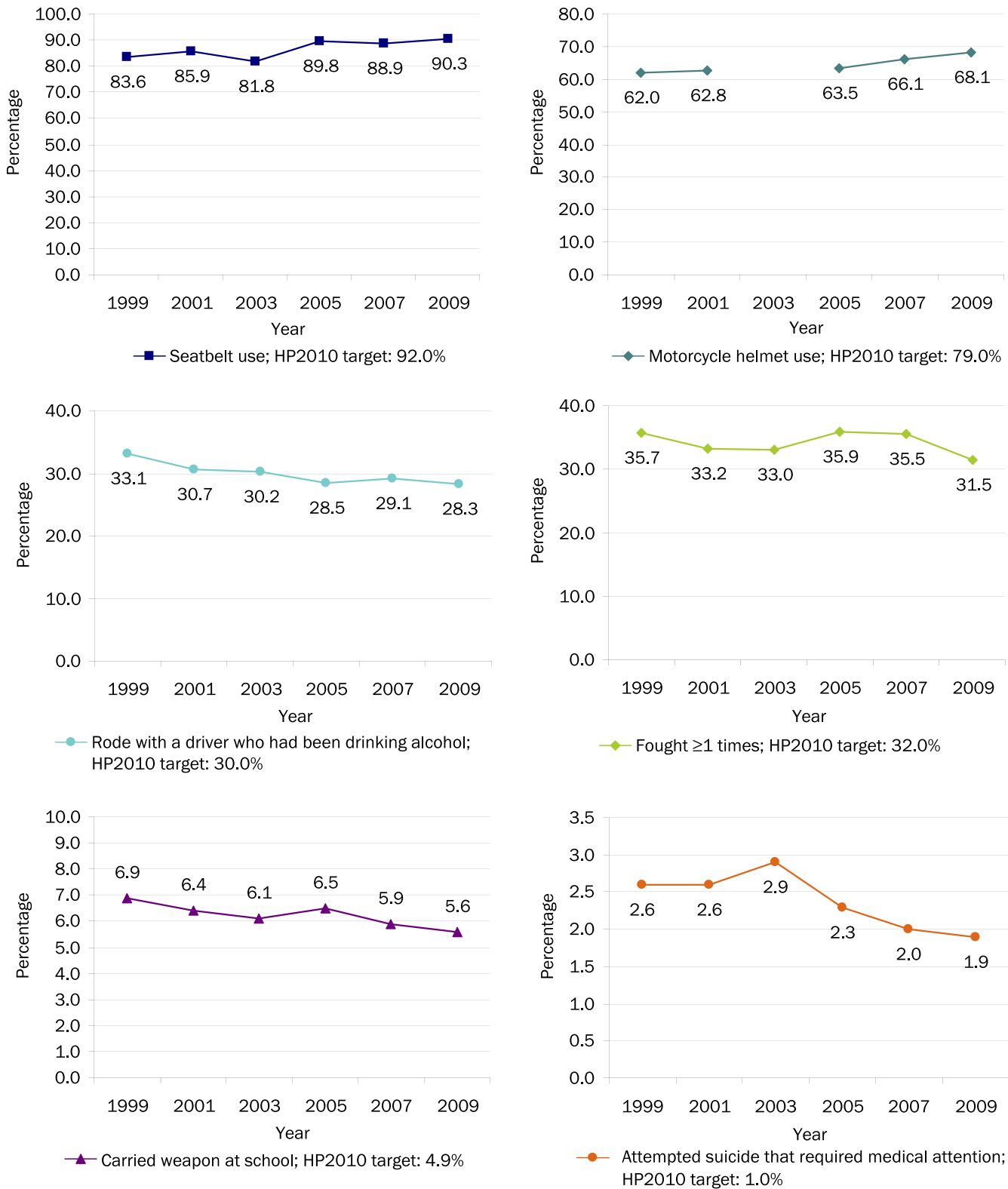


Figure 1. Healthy People 2010 objectives and prevalence of unintentional injury- and violence-related health risk behaviors, 1999-2009

decreases were seen toward the HP2010 injury goals for all six objectives measured by the YRBS, only reducing riding in a vehicle with a driver who had been drinking alcohol and reducing physical fighting met the HP2010 targets (Table 1).

Healthy People 2010 Individual Objectives

Seatbelt use (Objective 15-9). The prevalence of sometimes, most of the time, or always wearing a seatbelt increased by 6.7 points overall, from 83.6% to 90.3%. Significant linear increases were detected overall and among every subgroup of gender, race/ethnicity, and grade. Quadratic trends also were detected among Hispanic and 11th-grade students; the prevalence remained stable during 1999 to 2003 and increased from 2003 to 2009.

Motorcycle helmet use (Objective 15-21). Among students who had ridden a motorcycle during the 12 months before the survey, the prevalence of sometimes, most of the time, or always wearing a motorcycle helmet increased by 6.1 points overall, from 62.0% to 68.1%. Significant linear increases were detected overall and among male, white, 11th-grade, and 12th-grade students. A quadratic trend also was detected among female students; the prevalence of motorcycle helmet use in female students did not change during 1999 to 2005 and increased from 2005 to 2009.

Riding in a vehicle with a driver who had been drinking alcohol (Objective 26-6). The prevalence of riding one or more times during the 30 days before the survey in a vehicle with a driver who had been drinking alcohol decreased by 4.8 points overall, from 33.1% to 28.3%. Significant linear decreases were detected overall and among male, female, Hispanic, white, 9th-grade, 10th-grade, and 12th-grade students. Quadratic trends also were detected among male and black students. Among male students, the prevalence decreased during 1999 to 2005 and then remained stable from 2005 to 2009. Among black students, the prevalence decreased during 1999 to 2005 and then increased from 2005 to 2009.

Bicycle helmet use (Objective 15-23). Among students who had ridden a bicycle during the 12 months before the survey, sometimes, most of the time, or always wearing a bicycle helmet had a baseline prevalence of 14.7% (95% CI=11.4%, 18.7%) and a final prevalence of 15.3% (95% CI=12.4%, 18.8%) (data not shown). For the overall population, no trend was detected; however, a linear increase was detected among 12th-grade students ($p=0.003$), whose bicycle helmet use increased from 9.3% (95% CI=5.5%, 15.3%) to 17.9% (95% CI=14.3%, 22.3%).

Physical fighting (Objective 15-38). The prevalence of being in a physical fight one or more times during the 12 months before the survey decreased by 4.2 points overall, from 35.7% to 31.5%. Significant linear decreases were detected overall and among male, white, and 12th-grade students.

Weapon carrying (Objective 15-39). The prevalence of carrying a weapon on school property on at least 1 day during the 30 days before the survey decreased by 1.3 points overall, from 6.9% to 5.6%. Significant linear decreases were detected overall and among male, 9th-grade, and 11th-grade students.

Suicide attempts (Objective 18-2). The prevalence of suicide attempts during the 12 months before the survey that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse decreased by 0.7 points overall, from 2.6% to 1.9%. Significant linear decreases were detected overall and among male, female, and 9th-grade students. Quadratic trends also were detected among Hispanic students; the prevalence increased during 1999–2003 and then decreased from 2003 to 2009.

Conclusion

These findings indicate that substantial work remains to be done to reduce unintentional and violent injuries among youth and meet Healthy People objectives. Of the six objectives examined in the current paper, only two were achieved: reducing riding in a vehicle with a driver who had been drinking alcohol and reducing physical fighting among adolescents. Similarly, adults reported a 30% decline in annual episodes of alcohol-impaired driving from 1999 to 2010,⁹ and the decrease in physical fighting among youth parallels U.S. Department of Justice data indicating a 27.2% reduction from 2000 to 2009 in youth (aged <18 years) arrest rates for aggravated assaults.¹⁰ However, the remaining four objectives did not achieve their targets. To reduce injuries among youth, sustained and coordinated policy and programmatic efforts must occur at national, federal, state, and local levels.

Success in reducing the prevalence of unintentional injuries has relied in large part on state laws. For example, two laws specifically targeting underage alcohol use, the law setting the minimum legal drinking age at 21 years and the ≤ 0.02 g/dL blood alcohol concentration limit (“zero tolerance”) law, have contributed to reductions in alcohol-related crashes involving drivers aged <21 years in recent decades.¹¹ These laws exist in every state. To further reduce alcohol-impaired driving among adolescents, communities should consider enhancing enforcement of these laws.^{11,12} Additionally, because adult drinking may act as role modeling for youth,^{13,14} laws and policies that affect the entire

population, such as reducing outlet density (the number of establishments selling alcohol relative to the population density) and alcohol taxation,¹² may be effective for reducing alcohol consumption and alcohol-impaired driving among adolescents.

Likewise, states that have primary enforcement seatbelt laws, which allow a police officer to stop and ticket a motorist solely for not wearing a seatbelt, coupled with high-visibility enforcement have demonstrated effectiveness in increasing seatbelt use.^{15,16} In communities where teen seatbelt use is particularly low, policies that tie school parking privileges to student seatbelt use also may be effective.¹⁷

Finally, state universal helmet laws for motorcyclists, which require every rider to wear a helmet regardless of age, reduce fatalities and serious head injuries among young motorcyclists. However, of the 47 states with helmet laws, 27 have opted for "partial" helmet laws that exclude riders over a certain age (e.g., 21 or 18 years).¹⁸ Because these "partial" helmet laws are difficult to enforce, helmet use rates among adolescents in states with a partial helmet law are similar to rates in the three states with no law¹⁹ and fatality rates²⁰ and traumatic brain injury rates among crash survivors²¹ are substantially higher. Adoption and enforcement of universal helmet laws that require every motorcycle rider to wear a helmet would improve protection for adolescent motorcycle riders.^{19,21}

While there are no state-level laws with evidence of effectiveness in preventing or reducing youth violence, there are evidence-based practices and policies that are promising. For example, the Safe Schools/Healthy Students (SS/HS) Initiative, an ongoing national grant program, was launched in 1999 to fund school districts to implement evidence-based practices to prevent violence and promote mental health among adolescents. Since its inception, the SS/HS Initiative has awarded funds to more than 276 school districts to prevent violence and substance abuse among youth in schools and communities. School districts participating in this program reported fewer students involved in violent incidents, decreases in levels of experiencing and witnessing violence, and improvements in overall school safety and violence prevention (www.ed.gov/programs/dvpsafeschools/index.html).

Universal school-based violence prevention programs, such as some of those implemented through the SS/HS Initiative, are effective in reducing adolescent aggressive and violent behavior,²² including physical fighting.²³ A coordinated approach pairing the aforementioned policy changes with sustained funding for these types of programs is needed to decrease substantially the burden of injuries among children and adolescents. The SS/HS Initiative provided access to many students to mental health and violence prevention programs and services not otherwise accessible. In addition, during the 10-year period covered in this analysis, large-scale movements to improve school climate and school con-

nectedness²⁴—factors protective of involvement in violent and self-injurious behaviors^{25,26}—have been implemented. In addition, this time period also witnessed notable declines in adolescent alcohol use and drug use⁸—risk behaviors highly correlated with violence and suicide.²⁷⁻²⁹

Three promising program strategies exist for prevention of youth suicide. First, gatekeeper training programs may provide school personnel with the knowledge, attitudes, and skills to identify students at risk for suicide and, if appropriate, to refer them to a mental health professional. Evidence indicates that these programs increase staff knowledge and skills³⁰ and suggests that these programs supplement interventions intended to modify students' help-seeking behavior in order to affect suicide ideation among youth.³¹ Second, school-based training programs teach students problem-solving and coping skills. These have been shown to decrease risk factors, such as depression, and increase protective factors, such as perceived family support, associated with suicide attempts.³² Finally, school-based screening programs can be used to identify students at high risk for suicide; however, these programs are labor-intensive, require a strong referral system and network, and need to be repeated frequently.³⁰ More research is needed to examine the effectiveness of all of these strategies in reducing suicide-related behaviors.

On a larger scale, there are some policy-related strategies for reducing other youth violence. These strategies include housing vouchers, which permit selected residents to lease a unit in census tracts with poverty rates of $\leq 10\%$ and have some evidence of decreasing violent and property crimes among female youth, relative to a control group.³³ However, more research is needed to examine the long-term effects of this type of policy and to explore why these effects were noted for female but not male adolescents.

Business improvement districts are another promising policy approach to reduce violent behavior. Business improvement districts typically feature special assessments on commercial properties to supplement sanitation, public safety, place marketing, and planning efforts to supplement those provided by public agencies. Data suggest reductions in robbery and other violent crimes in these districts compared to nonbusiness improvement districts in the same urban area.³⁴ However, it is unclear if this approach is effective in specifically reducing youth crime and less-severe violence.

One limitation of this study is the self-reported nature of all responses. Although the extent of under-reporting and over-reporting of behaviors cannot be determined, the YRBS has been shown to have good test-retest reliability.³⁵ Additionally, these questions were asked with the same language every cycle, so one would expect that the under-reporting and over-reporting would not vary much from survey year to survey year. Another limitation

is that the trend data apply only to youth who attend school and are not representative of all people in this age group. In 2007, approximately 4% of people in the U.S. aged 16–17 years were not enrolled in a high school program and had not completed high school.³⁶

Third, various strategies may have contributed to the declines in injury- and violence-related behaviors; however, in the current study, no measure was made of exposure to the prevention programs or policies, or state laws, and therefore no conclusions can be drawn regarding how or if the programs may have affected the national rates. Finally, HP2010 objectives and goals may be more insightful if the responses were not strictly dichotomized.

This analysis highlights the need for more widespread adoption of policies with evidence of effectiveness and additional research examining the viability and effectiveness of promising policy and practices to prevent youth injury at federal, state, and community levels. Additionally, widespread policy and practice change must occur to decrease injuries among youth and achieve the recently released *Healthy People 2020* (www.healthypeople.gov) objectives (AH-7, AH-10, AH-11, MHMD-2, IVP-34, IVP-35, IVP-36). Further exploration of promising programs for unintentional injuries and, conversely, evidence-based laws or policies for violence could bolster prevention efforts at the population level.

This paper is dedicated to the memory of coauthor Dr. Merle E. Hamburger for his dedication and contributions to the field of public health and particularly to the prevention of youth violence. He is greatly missed.

Disclaimer: The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the CDC.

No financial disclosures were reported by the authors of this paper.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.amepre.2011.08.011](https://doi.org/10.1016/j.amepre.2011.08.011).

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