

---

# Benefits of a Hospital-Based Peer Intervention Program for Violently Injured Youth

Daniel Shibru, MD, MPH, Elaine Zahnd, PhD, Marla Becker, MPH, Nic Bekaert, MSW, Deane Calhoun, MA, Gregory P Victorino, MD, FACS

---

- BACKGROUND:** Exposure to violence predisposes youths to future violent behavior. Breaking the cycle of violence in inner cities is the primary objective of hospital-based violence intervention and prevention programs. An evaluation was undertaken to determine if a hospital-based, peer intervention program, "Caught in the Crossfire," reduces the risk of criminal justice involvement, decreases hospitalizations from traumatic reinjury, diminishes death from intentional violent trauma, and is cost effective.
- STUDY DESIGN:** We designed a retrospective cohort study conducted between January 1998 and June 2003 at a university-based urban trauma center. The duration of followup was 18 months. Patients were 12 to 20 years of age and were hospitalized for intentional violent trauma. The "enrolled" group had a minimum of five interactions with an intervention specialist. The control group was selected from the hospital database by matching age, gender, race or ethnicity, type of injury, and year of admission. All patients came from socioeconomically disadvantaged areas.
- RESULTS:** The total sample size was 154 patients. Participation in the hospital-based peer intervention program lowered the risk of criminal justice involvement (relative risk = 0.67; 95% CI, 0.45, 0.99;  $p = 0.04$ ). There was no effect on risks of reinjury and death. Subsequent violent criminal behavior was reduced by 7% ( $p = 0.15$ ). Logistic regression analysis showed age had a confounding effect on the association between program participation and criminal justice involvement (relative risk = 0.71;  $p = 0.043$ ). When compared with juvenile detention center costs, the total cost reduction derived from the intervention program annually was \$750,000 to \$1.5 million.
- CONCLUSIONS:** This hospital-based peer intervention program reduces the risk of criminal justice system involvement, is more effective with younger patients, and is cost effective. Any effect on reinjury and death will require a larger sample size and longer followup. (*J Am Coll Surg* 2007;205:684–689. © 2007 by the American College of Surgeons)
- 

In 2001, the US Surgeon General warned of an epidemic in youth violence, stating that "the most urgent need is a national resolve to confront the problem of youth violence systematically, using research-based approaches."<sup>1</sup> Despite this attempt to focus national attention on youth violence, it continues to be a major public health concern in the US, where intentional violent trauma is the second leading cause of death among youths aged 15 to 24 years, account-

ing for 16% of all deaths in this age group.<sup>2</sup> The situation is far worse in some urban "hot-spots" such as the city of Oakland in Alameda County, CA, where intentional violent trauma from firearms is the leading cause of death for men aged 15 to 24 years.<sup>3</sup> In 2004, there were 53 deaths from intentional violent trauma recorded for this age group in Alameda County.<sup>4</sup>

Despite the rising violent injury rate among youths, effective intervention services remain rare. After hospitalization for their injuries, youths are discharged to the same conditions in the same violent environment from which the injury ensued, leading to spiraling retaliation, traumatic reinjury, death, and involvement in the criminal justice system. The violent environments to which youths are discharged are known to predispose them to future violent behavior and involvement.<sup>5</sup> Such exposure to violence disproportionately afflicts urban inner cities, where large

**Competing Interests Declared:** None.

Presented at the 134<sup>th</sup> Annual American Public Health Association Meeting and Exposition, Boston, MA, November 2006.

Received April 11, 2007; Accepted May 21, 2007.

From the University of California, San Francisco-East Bay Department of Surgery, Alameda County Medical Center (Shibru, Bekaert, Victorino), the Public Health Institute (Zahnd), and Youth ALIVE! (Becker, Calhoun), Oakland, CA.

Correspondence address: Gregory P Victorino, MD, FACS, Department of Surgery, UCSF-East Bay, 1411 E 31 St, Oakland, CA 94602.

numbers of young African-American men reside.<sup>6,7</sup> Two-thirds of the youth violence in Alameda County occurs in Oakland, home to large, low-income, inner-city neighborhoods. Although violence-related recidivism varies widely (6% to 44%), penetrating trauma from gunshots, stab wounds, and assaults remains a robust predictor of future violent injury.<sup>8-10</sup> A study from a major university-affiliated trauma center noted that although trauma center programs have improved triage, intervention, and outcomes for injured patients, the rate of gunshot patients did not change between 1995 and 2001.<sup>11</sup> So hospital-based intervention and prevention programs that could reduce reinjury or death and diminish criminal justice involvement, especially related to firearm violence, would benefit victims and society alike. But such programs are relatively rare, although their numbers are growing.<sup>7,12</sup>

Beginning in 1994, California's Alameda County Medical Center (Highland General Hospital, Oakland, CA) collaborated with Youth ALIVE!, a youth violence prevention nonprofit agency, to develop a unique hospital-based, peer intervention program called "Caught in the Crossfire." The goal of the program is to reduce retaliatory violence and subsequent traumatic reinjury or death and involvement in the criminal justice system among youths aged 12 to 20. This program is unique because it is staffed by youth violence "intervention specialists," who are recruited from the same Oakland neighborhoods that the victims come from and are earlier perpetrators and victims of youth violence. This distinguishing characteristic cannot be overstated, because the peer intervention specialists truly understand the background of Oakland's at-risk youths and are the driving force of the program. To our knowledge, this is the first injury prevention program to use peers as interventionalists.

Patients aged 12 to 20 years who suffer violence-related trauma come from well-defined, economically disadvantaged areas of Oakland and Alameda County. These vulnerable neighborhoods were easy to identify based on hospital admission records, police records, and coroner data. The program assists clients based on their needs and those of their families. This assistance may take the form of help obtaining state victim-of-violence restitution funds, help determining eligibility for assistance with medical costs, transportation to medical appointments or court hearings, help with job or school preparation and placement, help obtaining a driver's license and other identification necessary for job retention and high school retention, school transfers, graduation, GED and college educational assistance, referral to mental health counseling, and other needed services.

A preliminary evaluation of "Caught in the Crossfire" in 2003 followed 112 patients and matched controls for

6 months after initial hospitalization. It found that the program had a significant effect in reducing involvement in the criminal justice system, but the small sample size and short followup period did not permit the program's impact to be assessed after the youths had left the program.<sup>13</sup> So we undertook a second, expanded evaluation to determine if the program continued to reduce the criminal justice involvement over 18 months after the initial hospitalization, if it reduced the risk of traumatic reinjury and rehospitalization because of intentional violence, and if it reduced the risk of violence-related death. In addition, we assessed the cost effectiveness of the program by comparing program costs with the costs associated with incarceration in the county juvenile justice system.

## METHODS

### Study design

We conducted a retrospective, comparative double cohort study of patients, aged 12 to 20, admitted to Alameda County Medical Center's trauma center as a result of an intentional violent injury between January 1998 and June 2003. The catchment area for the trauma center encompasses 738 square miles, populated by 1.44 million people. Data on injury caused by intentional violence were collected anonymously from the trauma center's medical record database. Data on arrests, convictions, parole violations, and violent crime histories were obtained from the Oakland Police Department. Death records were retrieved from the Alameda County Coroner's Bureau. The study was approved by the appropriate institutional review boards and University of California Committee on Human Research.

### Intervention and control groups

Patients who participated in the intervention program were considered "enrolled" and were required to have a minimum of five interactions, two of which had to be in-person contacts with their assigned intervention specialist over the course of their participation in the program. The controls were selected from the hospital database by matching age, gender, race or ethnicity, type of injury (ie, gunshot wound, stab wound, or assault), and year of admission. Patients in the control group were also admitted to the trauma center for intentional violent trauma during the study period, but had not participated in the program, either because the intervention specialist was not able to contact them because of incorrect information, they were treated and released outside of business hours, they lived outside the program's catchment area for providing services, they were missed during admission by the injury prevention coordinator, or because they failed to appear for their initial appointment. Other control group patients may have been

**Table 1.** Demographics: Characteristics of Enrolled Patients and Controls

Demographics	Enrolled (n = 75)		Control (n = 79)	
	n	%	n	%
Male	61	81	64	81
Female	14	19	15	19
African American	44	59	48	60
Latino	26	35	25	32
Caucasian/other	2	2	3	4
Asian	3	4	3	4

unreachable because they left the hospital premises without any notice to avoid criminal prosecution for gang-related involvement, or they left incorrect contact information. Patients who declined services were not eligible for the study as enrolled subjects or controls. Only 2 patients declined services from January 1998 to June 2003. Followup review for both groups was conducted over a period of 18 months after the date of their initial hospitalization and injury to determine three outcomes: whether they had died, had been rehospitalized for another intentional violent injury, or had been involved or reinvolved with the criminal justice system.

### Data analysis

Results were analyzed comparing relative risk (RR) statistics between the 2 groups with 95% confidence intervals (CI). Corresponding p values were calculated with chi-square tests. By assessing the 3 outcomes over the 18-month period as binary variables (eg, rehospitalized violent injury versus no rehospitalized violent injury, dead versus alive, and any criminal justice involvement versus no criminal justice involvement), we were able to use logistic regression to evaluate the magnitude of association between exposure (ie, peer intervention program) and outcomes, after adjusting for age, race or ethnicity, and gender as possible confounders.<sup>14</sup> In addition, after establishing an association between program participation and outcomes (ie, criminal justice involvement, defined as arrest, conviction, or probation or parole violation for violent charges), we calculated attributable risk (risk difference) and number needed to treat (NNT), to determine cost effectiveness of the program when compared with the associated costs for Alameda County's juvenile justice incarceration. The NNT was calculated by taking the reciprocal of attributable risk ( $NNT = 1/\text{attributable risk}$ ).<sup>14</sup> The cost on an NNT basis of housing a juvenile in a detention center was then compared with the cost of the violence intervention program.

**Table 2.** Initial Injury Characteristics of All Patients

Type of injury	Enrolled (n = 75)		Control (n = 79)	
	n	%	n	%
Gunshot wound	46	61	42	53
Stab wound	4	5	5	6
Assault or other nonpenetrating	25	33	32	41

### RESULTS

The initial total sample size was 158 patients. Four intervention program participants were not included in the analysis because of missing record information. Seventy-five patients participated in the peer intervention group at the minimally required interaction level, and 79 patients served as nonenrolled matched controls. The intervention and control groups did not differ demographically ( $p = 0.85$ ) or in the type of initial injury ( $p = 0.70$ ; Tables 1, 2, respectively). Ages ranged from 14 to 20 years, with a median age of 17.5 years. Most patients were African-American or black men.

Risk of death and physical reinjury and rehospitalization from intentional violence were similar between the enrolled and control groups (Table 3). But fewer patients in the enrolled group were subsequently involved in the criminal justice system (RR = 0.67; 95% CI, 0.45, 0.99;  $p = 0.04$ ; Table 4). We examined subsequent violent criminal behaviors, such as burglary, assault, and murder during the 18-month followup period, using data provided by the Oakland Police Department Special Victims Unit. We found that after successful completion of the program, the risk of subsequent violent criminal behavior by the enrolled group was reduced by 7% ( $p = 0.15$ ) when compared with the control group.

Logistic regression analysis of age, gender, and ethnicity or race variables showed that only age had a confounding effect on the association between program participation and criminal justice involvement (RR = 0.71;  $p = 0.043$ ). This effect was evident for patients under the age of 17. In other words, when participants and controls were compared holding race or ethnicity and gender constant, the violence intervention program's effect on reducing criminal justice involvement appeared more evident in patients younger than 17 years. In the multivariate analysis, gender and race or ethnicity did not influence any outcomes ( $p = 0.49$  and 0.30, respectively).

After a significant association was established between program participation and subsequent criminal justice involvement, attributable risk was calculated to be 0.16, (ie, 16% of the risk reduction in criminal justice involvement among the participants can be attributed to the peer inter-

**Table 3.** Comparison of Clinical Outcomes Between Enrolled Patients and Controls

Outcomes	Enrolled (n = 75)		Control (n = 79)		Relative risk	95% CI	p Value
	n	%	n	%			
Reinjury	6	8	7	9	0.90	0.32, 2.56	0.97
Death	3	4	2	2	1.58	0.27, 9.19	0.60

vention program). So, to prevent a single adverse criminal outcome, the number needed to treat (NNT) was six patients. The cost of our program, which sees and treats 75 to 100 youths annually, is approximately \$3,500 per patient per year.

The annual cost for a juvenile detention center admission in Alameda County is \$80,000 per person.<sup>15</sup> Because the NNT is 6 patients to see a 16% risk reduction in involvement in the criminal justice system, the intervention program's annual cost amounts to \$60,000 less per patient than the cost of incarceration in the juvenile detention system. Assuming each juvenile who is rearrested and reconvicted spends 1 year in a detention center, the total cost reduction derived from the peer intervention program annually on an NNT basis is approximately \$750,000 to \$1.5 million.

## DISCUSSION

Our results indicated that our unique peer intervention injury prevention program continues to have a positive, protective effect in reducing the risk of subsequent criminal justice involvement for at-risk youths 6 months after completion of the 1-year program. These results demonstrated that the impact of the program goes beyond the initial 6 months of participation, as measured by the first evaluation study,<sup>13</sup> and asserts a positive impact 18 months after original injury or 6 months after the youths have left or completed the program. In addition, logistic regression analysis indicated the program's effectiveness in reducing the risk of involvement in the criminal justice system among patients under the age of 17. In addition, the cost savings derived from the peer intervention program were approximately \$750,000 to \$1.5 million when compared

with the incarceration costs of a juvenile for 1 year in the county juvenile detention centers. But the number of patients who required rehospitalization or died during the 18-month followup period was not sufficient to determine if there were clinically meaningful differences between the intervention and control groups for these 2 outcomes variables.

Despite the paucity of data assessing violence intervention program efficacy, recent trends in scientific evaluation and reporting in the literature are encouraging. Although hospital-based, violence-intervention programs are few, those that have been evaluated appear to affect social outcomes, such as reduction in violent crime recidivism.<sup>12,13,16,17</sup> Unlike our program, other intervention programs are not led by peers who have similar life experiences and socioeconomic background as the at-risk youths the program is trying to help. Additionally, previous studies that addressed the issues of youth violence were not focused on hospital-based violence intervention programs aimed at youths who are victims and perpetrators of intentional violence.<sup>18-20</sup> One hospital-based violence intervention program was evaluated recently using a prospective, randomized control study to measure violence recidivism, criminal justice involvement, and the program's cost effectiveness.<sup>16</sup> Patients admitted for injuries from intentional violence, who participated in the intensive substance abuse and psychosocial therapy services, engaged in fewer and less serious criminal activities than did injured youths who did not receive the intervention. There were no measures of traumatic reinjury and subsequent rehospitalization, and the researchers found no difference in the number of arrests between the two groups. But the control group had more arrests for violent crime and more severe penalties, resulting

**Table 4.** Comparison of Criminal Justice Outcomes Between Enrolled Patients and Controls

Outcomes	Enrolled (n = 75)		Control (n = 79)		Relative risk	95% CI	p Value
	n	%	n	%			
Parole violation	0	0	4	5	0.12	0.01, 2.15	0.12
Arrest	25	33	31	39	0.85	0.56, 1.29	0.40
Violent crime	7	9	13	16	0.56	0.25, 1.32	0.15
Conviction	13	17	21	27	0.65	0.35, 1.21	0.14
Any criminal event*	25	33	39	49	0.67	0.45, 0.99	0.04

\*Any criminal event only counts as a single event per person, even if a patient has had multiple arrests. The figures "39" and "25" are the sum of arrests and parole violations. Convictions and any violent crime without a corresponding arrest or conviction record from the police database are included here.

in longer convictions. As was true for our study, the cost of the intervention program was substantially lower than the cost of incarceration and hospitalization.<sup>16</sup> Another study evaluated a hospital-based intervention initiative that focused on changing attitudes about interpersonal conflict among at-risk youths and found it achieved a reduction in beliefs supporting aggression and reduced the likelihood of violence among at-risk youths.<sup>21</sup> The study did not discuss whether patients exhibited a similar reduction in violent behavior outcomes, as expressed by their changing attitudes toward aggression and likelihood of involvement in violent crimes.

These studies and ours all showed that youth violence intervention and prevention programs may reduce future difficulties with law enforcement. The one exception to this was a study that evaluated an emergency department-based youth violence prevention program using a randomized, prospective design; it found a reduction in physical reinjury but no difference in criminal justice involvement outcomes.<sup>12</sup> There was a promising reduction in the self-reported traumatic reinjury risk among those participating in the program, but self-reporting may have introduced recall bias. A more accurate measurement may be to document clinical outcomes through medical record review.

The retrospective evaluation of our peer intervention program has limitations that are inherent in observational retrospective studies.<sup>14</sup> Although our control patients were very similar to enrolled patients with respect to violent injury and demographic characteristics (Tables 1, 2), self-selection bias cannot be ruled out, given their nonparticipation in a program that is available to most youths ages 12 to 20 who are admitted for intentional violent injury. Those who were randomly selected as controls did not refuse the program but also did not participate in the program. They initially agreed to participate, but could not be contacted by the program after discharge from the hospital. So, although there may be self-selection bias among the controls, the direction of that bias is unclear, and the potential impact on study outcomes is unknown.

Our study was also limited by sample size, which, even with 154 patients, was too small to determine whether the peer intervention program decreased hospitalization from traumatic reinjuries or deaths. A power analysis indicated that we would need a total sample size of approximately 600 patients (300 subjects and 300 controls) to identify the clinically relevant outcomes of death and traumatic reinjury from intentional violence. Longer followup may also be needed to achieve these clinically meaningful end points.

The initial encounter in trauma centers between trauma surgeons and other health-care professionals with victims and perpetrators of youth violence presents real practical barriers in addressing the broader issues of youth violence

prevention and intervention. Because of the nature of a busy trauma hospital and understaffing during after-hours, when many youth violence-related traumas occur, brief screening and intervention for violence prevention gets little attention because of other pressing needs. An important way to address this difficulty may be through training health-care professionals in youth violence prevention so that they can screen these patients and refer them to existing programs. The American Medical Association and other organizations have emphasized training of health professionals about youth violence as critical in addressing the issue of violence intervention and prevention.<sup>22,23</sup> But there is still a lack of well-trained health professionals who understand youth violence prevention, are aware of the presence or lack of local resources, and have the knowledge to refer youths to local youth violence intervention programs.<sup>24</sup> As shown by our study, involvement of peers who have similar experiences as at-risk youths, enabling them to establish the necessary trust required for any program's success, is crucial. With an increased emphasis on youth violence prevention and intervention in health professional training, expanded funding of such programs, collaboration between trauma centers and local organizations like Youth ALIVE!, involvement of peers in the design and execution of programs and continued scientific evaluation of such programs, the goal of implementing effective hospital-based peer-directed youth violence intervention and prevention programs on a national scale is possible to attain.

In summary, this study showed that our unique hospital-based, peer-directed youth violence intervention program reduces the risk of future involvement in the criminal justice system and derives a cost savings of approximately \$750,000 to \$1.5 million when compared with the incarceration costs of a juvenile for 1 year in the county juvenile detention centers. Consequently, the need for increased awareness about youth violence and available intervention and prevention programs by health-care providers is critical if we are to adequately confront the problem of youth violence per the Surgeon General's warnings. Much larger studies and longer followup times are needed to determine the effects of such programs on reinjury and death among at-risk youths.

### Author Contributions

Study conception and design: Zahnd, Becker, Calhoun, Victorino  
Acquisition of data: Shibru, Zahnd, Bekaert  
Analysis and interpretation of data: Shibru, Zahnd, Becker  
Drafting of manuscript: Shibru, Zahnd  
Critical revision: Shibru, Zahnd, Becker, Calhoun, Victorino

---

**Acknowledgment:** We are indebted to the staff members of YouthALIVE! and to the Caught in the Crossfire peer inter-

vention specialists, whose work to address the escalating youth violence rate in our community is the centerpiece of this study. We are grateful to Pamela Derish, medical editor at UCSF Department of Surgery, for her critical appraisal of the article.

## REFERENCES

1. Youth violence: report of the Surgeon General. US Department of Health and Human Services. Available at: [www.surgeongeneral.gov/library/youthviolence/](http://www.surgeongeneral.gov/library/youthviolence/). Accessed June 26, 2007.
2. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control 2002 Data; Assault all injury cause, fatal injury causes, Age 1–24. Available at: [www.cdc.gov/ncipc/wisqars](http://www.cdc.gov/ncipc/wisqars). Accessed June 26, 2007.
3. Calhoun D, Dodge AC, Journal CS, Zhan E. The supply and demand for guns to juveniles: Oakland's gun tracing project. *J Urban Health* 2005;82:552–559.
4. Epidemiology and prevention for injury control. Available at: [http://www.applications.dhs.ca.gov/epicdata/content/sum\\_topfive.htm](http://www.applications.dhs.ca.gov/epicdata/content/sum_topfive.htm). California Department of Health Services. Accessed June 26, 2007.
5. Bingenheimer JB, Brennan RT, Earls FJ. Firearm violence exposure and serious violent behavior. *Science* 2005;308:1323–1326.
6. Bordere TC. 'Caught up' between hope and despair: Black teenage males experience with death in New Orleans. Dissertation Abstracts International, A: The Humanities and Social Sciences 2004;64(12).
7. Belcher JR, Deforge BR, Jani JS. Inner-city victims of violence and trauma care. The importance of trauma-center discharge and aftercare planning and violence prevention programs. *J Health Soc Policy* 2005;21:17–34.
8. Morrissey TB, Byrd CR, Deitch EA. The incidence of recurrent penetrating trauma in an urban trauma center. *J Trauma* 1991;31:1536–1538.
9. Sims DW, Bivins BA, Obeid FN, et al. Urban trauma: a chronic recurrent disease. *J Trauma* 1989;29:940–946; discussion 946–947.
10. Smith RS, Fry WR, Morabito DJ, Organ CH. Recidivism in an urban trauma center. *Arch Surg* 1992;127:668–670.
11. Cornwell EE, Chang DC, Phillips J, Campbell KA. Enhanced trauma program commitment at a level I trauma center: effect on the process and outcome of care. *Arch Surg* 2003;138:838–843.
12. Zun L, Downey L, Rosen J. The effectiveness of an ED-based violence prevention program. *Am J Emerg Med* 2006;24:8–13.
13. Becker MG, Hall JS, Ursic CM, Calhoun D. Caught in the crossfire: the effects of a peer-based intervention program for violently injured youth. *J Adolescent Health* 2004;34:177–183.
14. Hennekens CH, Buring JE. *Epidemiology in medicine*. Boston, MA: First Edition; 1987.
15. Anderson CL, Ho Y. Alameda County at the crossroads of juvenile justice reform: a national disgrace—or a national model? Center on Juvenile and Criminal Justice. Ella Baker Center for Human Rights/Books Not Bars Campaign. National Center for Youth Law: National Council on Crime and Delinquency Youth Law Center. April 2002.
16. Cooper C, Eslinger DM, Stolley PD. Hospital-based violence intervention programs work. *J Trauma* 2006;61:534–537; discussion 537–540.
17. De Vos E, Stone DA, Goetz MA, Dahlberg LL. Evaluation of a hospital-based youth violence intervention. *Am J Prev Med* 1996;12:101–108.
18. Scott KK, Tepas JJ 3<sup>rd</sup>, Frykberg E, et al. Turning point: rethinking violence—evaluation of program efficacy in reducing adolescent violent crime recidivism. *J Trauma* 2002;53:21–27.
19. Myers WC, Burton PR, Sanders PD, et al. Project back-on-track at 1 year: a delinquency treatment program for early-career juvenile offenders. *J Am Acad Child Adolesc Psychiatry* 2000;39:1127–1134.
20. Marcelle DR, Melzer-Lange MD. Project UJIMA: working together to make things right. *Wis Med J* 2001;100:22–25.
21. Chang DC, Cornwell EE 3<sup>rd</sup>, Sutton ER, et al. A multidisciplinary youth violence-prevention initiative: impact on attitudes. *J Am Coll Surg* 2005;201:721–723.
22. Knox LM, Lomonaco C, Elster A, American Medical Association. American Medical Association's youth violence prevention training and outreach guide. *Am J Prev Med* 2005;29:226–229.
23. Sidelinger DE, Guerrero AP, Rodriguez-Frau M, Mirabal-Colon B. Training healthcare professionals in youth violence prevention: an overview. *Am J Prev Med* 2005;29:200–205.
24. Carmona R. Health professional training in youth violence prevention: A commentary by the Surgeon General. *Am J Prev Med* 2005;29:2173–2174.