

Lesbian, Gay, Bisexual, and Transgender Hate Crimes and Suicidality Among a Population-Based Sample of Sexual-Minority Adolescents in Boston

Dustin T. Duncan, ScD, and Mark L. Hatzenbuehler, PhD

Suicide is the second-leading cause of death among all youths worldwide and is the third-leading cause of death among all youths in the United States,¹ making the topic of adolescent suicidality a global public health and medical priority.² One of the most consistent findings in psychiatric epidemiology is the existence of marked sexual orientation disparities in adolescent suicidality (e.g., suicidal ideation and suicide attempts).³ Lesbian, gay, bisexual, and transgender (LGBT, or sexual minority) adolescents are more likely to contemplate,⁴⁻⁶ plan,⁷ and attempt^{4,5,8} suicide than their heterosexual peers, and these disparities have been documented across multiple countries.^{4,5,8}

Despite the increased attention devoted to eliminating sexual orientation disparities in adolescent suicide, a 2011 report from the Institute of Medicine on LGBT health disparities noted the dearth of research into determinants of adverse health outcomes, including suicidality, within this population.⁹ To date, research has focused predominantly on individual (e.g., hopelessness, depressed mood),^{5,8,10-13} peer (e.g., recent suicide attempts by a peer, peer victimization),^{5,8,14,15} family (e.g., family rejection, family abuse),^{5,8,13,16-18} and school (e.g., presence of gay-straight alliances in schools, school safety)^{14,18,19} factors that are associated with suicidality among sexual-minority adolescents, which mirrors research on adolescent suicidality more broadly.²⁰ This research has offered key insights into determinants of suicide risk, but sexual orientation-related disparities in suicidality remain after control for these established risk factors.^{4,5,8} The persistence of these disparities indicates the importance of considering additional risk factors, including at the social-ecological level, which we define as influences that occur above individuals, peers, families, and schools, including neighborhoods as well as institutional practices and policies

Objectives. We examined whether past-year suicidality among sexual-minority adolescents was more common in neighborhoods with a higher prevalence of hate crimes targeting lesbian, gay, bisexual, and transgender (LGBT) individuals.

Methods. Participants' data came from a racially/ethnically diverse population-based sample of 9th- through 12th-grade public school students in Boston, Massachusetts (n = 1292). Of these, 108 (8.36%) reported a minority sexual orientation. We obtained data on LGBT hate crimes involving assaults or assaults with battery between 2005 and 2008 from the Boston Police Department and linked the data to the adolescent's residential address.

Results. Sexual-minority youths residing in neighborhoods with higher rates of LGBT assault hate crimes were significantly more likely to report suicidal ideation ($P = .013$) and suicide attempts ($P = .006$), than were those residing in neighborhoods with lower LGBT assault hate crime rates. We observed no relationships between overall neighborhood-level violent and property crimes and suicidality among sexual-minority adolescents ($P > .05$), providing evidence for specificity of the results to LGBT assault hate crimes.

Conclusions. Neighborhood context (i.e., LGBT hate crimes) may contribute to sexual-orientation disparities in adolescent suicidality, highlighting potential targets for community-level suicide-prevention programs. (*Am J Public Health*. 2014;104:272-278. doi:10.2105/AJPH.2013.301424)

(e.g., state policies that ban same-sex marriage).^{21,22}

Decades of research in medical sociology and social epidemiology have provided substantial evidence for the role that broad social-ecological factors play in shaping population health,^{23,24} and *Healthy People 2020* recognizes that such factors may be implicated in LGBT health.²⁵ Yet there is a paucity of research into the social-ecological risk factors for suicide among sexual-minority adolescents. In one of the few studies to address this topic, Hatzenbuehler²⁶ created an ecological measure of the social environment surrounding lesbian, gay, and bisexual youths living in counties across the state of Oregon. Compared with lesbian, gay, and bisexual youths living in counties with supportive environments, the risk of attempting suicide was 20% higher among sexual-minority youths in less-supportive environments,²⁶ suggesting that

ecological measures can reveal previously unrecognized social determinants of suicide risk among sexual-minority adolescents. However, additional research on other social-ecological factors that may influence suicide risk within this population is warranted.

Therefore, in the current study, we used a novel measure of the social environment: neighborhood-level hate crimes targeting LGBT persons. Hate crimes refer to "unlawful, violent, destructive or threatening conduct in which the perpetrator is motivated by prejudice toward the victim's putative social group."^{27(p480)} Evidence demonstrates that many sexual minorities experience hate crimes²⁸; data from the Federal Bureau of Investigation demonstrated that 17.4% of the 88 463 hate crimes between the years of 1995 and 2008 targeted sexual minorities,²⁹ a rate that was more than 8 times what would be expected when one considers the relatively low

percentage of sexual minorities in the general population.³⁰

The objective of the present study was to examine whether suicidal ideation and suicide attempts among sexual-minority adolescents are more common in neighborhoods with a higher prevalence of hate crimes targeting LGBT individuals. Although there is limited research on the relationship between neighborhood-level LGBT hate crimes and suicidality among sexual-minority populations, existing research suggests strong associations between neighborhood-level exposure to violence and suicide in general (i.e., non-LGBT) populations.^{31,32} On the basis of this literature, we hypothesized higher rates of suicidal ideation and attempts among sexual minority adolescents residing in neighborhoods with more LGBT hate crimes. To test this hypothesis, we obtained LGBT hate crimes data from the Boston Police Department Community Disorders Unit and linked this information to individual-level data on suicidality (i.e., ideation and attempts) and sexual orientation from a population-based sample of Boston, Massachusetts, adolescents. This study therefore capitalizes on a rare opportunity to examine a potentially salient social-ecological risk factor for suicidality among sexual-minority adolescents.

METHODS

The sample consisted of high-school students (9th- through 12th-grade) in the Boston Public Schools system who took the Boston Youth Survey (BYS) in 2008 and provided their complete residential address.³³⁻³⁵ Similar to the percentage of those schools included in the BYS survey, approximately 74% of Boston Public School students in the 2007-2008 academic year were eligible for free or reduced-price meals and were a racial/ethnic minority (i.e., Black or Hispanic). Schools that served adults, students transitioning back to school after incarceration, suspended students, and students with severe disabilities were ineligible. Of the 32 eligible public high schools in Boston, 22 participated in the 2008 BYS. Participating and nonparticipating eligible schools did not have statistically significant differences in key school characteristics (e.g., racial/ethnic composition of students, drop-out rates, standardized test scores, student mobility rate). We obtained

a list of unique classrooms within each participating school, stratified by grade, to generate the classroom-level sample. Classrooms were then randomly selected for survey administration. Of the 2725 students enrolled in the classrooms selected for participation, 1878 (response rate = 68.9%) completed a survey. Approximately 86% of nonparticipants were absent from school on the day of survey administration. We obtained and geocoded complete address information to the nearest intersection from 68.8% of the Boston students who took the BYS instrument, which we refer to as the “geospatial sample” (n = 1292). Table 1 shows the socio-demographic characteristics of the study sample. Further information on sampling is described elsewhere.³³⁻³⁵

Study Measures

Sexual orientation. The sexual orientation item in the BYS questionnaire, which has been validated and used among adolescents in several other studies,^{36,37} asked respondents to identify 1 of 6 categories that best described

themselves: (1) completely heterosexual, (2) mostly heterosexual, (3) bisexual, (4) mostly homosexual, (5) completely homosexual (i.e., gay or lesbian), or (6) not sure. Among the geospatial sample, 1170 youths (90.56%) indicated that they were heterosexual, 35 (2.71%) were mostly heterosexual, 37 (2.86%) were bisexual, 2 (0.15%) were mostly homosexual, 16 (1.24%) were gay or lesbian, and 18 (1.39%) were unsure of their sexual orientation. We excluded 14 respondents (1.08%) who did not answer the sexual orientation item from analyses. Because of the small number of nonheterosexual respondents in each category, we combined the sexual-minority group (n = 108), which consisted of individuals who were mostly heterosexual, bisexual, mostly homosexual, gay or lesbian, or unsure. We included the “unsure” group to increase statistical power, consistent with other studies with small sample sizes of sexual-minority adolescents.^{4,38,39} When we removed this group from the analyses, the direction of the results remained unchanged. There were no

TABLE 1—Sample Characteristics and Suicidality: 2008 Boston Youth Survey Geospatial Data Set, Boston, MA

Characteristic	Sexual Minority (n = 102), % or Mean (SD)	Heterosexual (n = 1071), % or Mean (SD)	t Value or χ^2 Statistic	P
Age, y	16.25 (1.27)	16.32 (1.27)	t = -0.54	.59
Gender			$\chi^2 = 23.51$	< .001
Male	21.57	46.54		
Female	78.43	53.46		
Race/ethnicity			$\chi^2 = 6.95$.139
White, non-Hispanic	11.88	9.94		
Black, non-Hispanic	31.68	44.07		
Hispanic	38.61	31.93		
Asian	6.93	7.17		
Other	10.89	6.88		
Nativity status			$\chi^2 = 0.78$.377
US-born	77.45	73.42		
Foreign-born	22.55	26.58		
Suicide ideation			$\chi^2 = 48.36$	< .001
Yes	32.35	9.43		
No	67.65	90.57		
Suicide attempt			$\chi^2 = 53.47$	< .001
Yes	16.67	2.43		
No	83.33	97.57		

Note. Descriptive statistics presented are for youths who answered both suicide outcomes (n = 1173).

sexual-orientation differences between respondents who provided their complete intersection residential address and those who did not ($\chi^2 = 0.2853$; $P = .593$), suggesting no geographic selection bias by sexual orientation.

Suicide ideation and attempts. Respondents were asked whether they had considered suicide (“Have you seriously considered attempting suicide?”) and attempted suicide (“Have you actually attempted suicide?”) within the 12 months preceding survey administration. Response options were “yes” and “no” for both questions. The items on suicidal ideation and suicide attempts were adapted from the 2005 Youth Risk Behavior Surveillance System questionnaire. The suicide thoughts ($\kappa = 83.8$) and attempt ($\kappa = 76.4$) variables have demonstrated excellent test–retest reliability.⁴⁰

Lesbian, gay, bisexual, and transgender hate-crime incidents. Geocoding, the process of matching addresses to geographic coordinates, is the first step when one is conducting a geographical information system project.⁴¹ We geocoded the street location address for de-identified hate-crime incidents related to minority sexual orientation and nonconforming gender identity (i.e., transgender individuals) from the Boston Police Department Community Disorders Unit. Consistent with the criminology literature,^{42–45} we obtained multiple years of data on hate crimes (January 2005–December 2008) to (1) increase statistical power, because of the (relatively) small numbers of hate crimes in each year, and (2) create a more stable measure of this construct in case any individual year reflected random variation in LGBT hate crimes.

After cleaning the addresses (e.g., standardizing to the US Postal Service format), we geocoded the hate-crime street location address data by using the Google Maps geocoder. The address data includes street information and in some cases cross-street in addition to other geographic information, namely the neighborhood (e.g., Roxbury, Brighton, South Boston, Dorchester). We checked the geocoded location for every LGBT hate crime incident for spatial accuracy in Google Maps and Bing Maps, remedying the geocoded location, if necessary.

There were 210 incidents of LGBT hate crimes and 208 were correctly geocoded (99.05%). The hate-crime data also included key characteristics of all reported LGBT hate

crimes in Boston from 2005 to 2008, including police district where the crime was reported, date of incident, race of the perpetrator of the crime, victim bias (e.g., lesbian, gay, transgender), and LGBT hate crime type (i.e., threat, harassment, assault and battery, assault and battery by means of a dangerous weapon). Of the victims, 204 were gays or lesbians and 3 were transgender individuals (1 victim’s bias was not reported). No hate crimes among bisexuals were reported during this period. Of the 4 types of LGBT hate crimes, 22.12% were threats, 30.77% were harassment, 25.48% were assault and battery, and 21.63% were assault and battery by means of a dangerous weapon. We conducted analyses only for the geocoded assault-based LGBT hate crimes ($n = 98$) because (1) sexual orientation hate crimes are more likely to be violent and to involve weapons than other types of hate crimes, including hate crimes that are race-related,^{46,47} and (2) assaults (with and without weapons) represent the most acute and physically violent forms of LGBT hate crimes.

We divided neighborhood LGBT assault hate crimes reported from 2005 to 2008 by the total population (based on census block group data from the 2010 US Census),⁴⁸ whereby values across block groups were weighted proportionately by each block group’s area within the defined buffer. We reported LGBT assault hate crimes per 100 000 population (hate crime rate formula: [crime incidents/total population] \times 100 000). We calculated the crime rates for each adolescent based on 400- and 800-meter street network buffers (which are approximately one quarter mile and one half mile, respectively).

Statistical Analysis

We dropped adolescents missing information on sexual orientation or either of the suicide items ($n = 119$) from the geospatial analytic sample (final analytic sample, $n = 1173$). We used descriptive statistics to characterize the sample and to examine group differences in suicidal ideation and suicide attempt, comparing sexual-minority ($n = 102$) and heterosexual ($n = 1071$) adolescents. Because of the small sample size of sexual-minority adolescents, a multivariate regression-based approach was inappropriate for this study, as odds ratios may be inflated in

the case of small sample sizes.^{49,50} Moreover, because preliminary analyses indicated no spatial dependence in adolescent suicidality (Global Moran $IP > .05$), and minimal within-school clustering of the outcome variables (intraclass correlation coefficient, suicidal ideation = 0.04; suicide attempt = 0.05) among sexual minorities, we deemed spatial and multilevel models unnecessary. Thus, we computed nonparametric Wilcoxon-Mann-Whitney test and corresponding P values to assess differences in suicidality among sexual minorities by neighborhood-level LGBT assault hate crime rate. Nonparametric tests were appropriate because the hate crime rates were not normally distributed. To show the direction of association, we present means of LGBT hate crime rates by suicidality.

Finally, we ran 2 tests to examine specificity of the study results. First, we examined associations between suicidality and neighborhood-level LGBT hate crime rates for heterosexual adolescents. Second, we assessed associations between suicidality and neighborhood-level overall crimes (i.e., crimes unrelated to LGBT hate crimes) among sexual-minority adolescents. We examined both overall crime rates from the year 2007 ($n = 31\,254$) as well as specific types of crime, including violent and property crimes. Documenting that LGBT assault hate crimes were associated with suicidal thoughts and suicide attempts among sexual minority adolescents, but not heterosexual adolescents would provide evidence for specificity of the study results. Furthermore, showing that rates of suicidal ideation and attempts among sexual minority adolescents were greater in neighborhoods with higher LGBT assault hate crimes, but not in neighborhoods with higher violent and property crimes, would provide additional evidence for specificity of the results. We performed data analysis with SAS version 9.3 (SAS Institute, Cary, NC). All P values were 2-sided with an α level of .05.

RESULTS

Almost one third of sexual-minority adolescents reported suicidal ideation in the past year (Table 1), compared with 9.43% of their heterosexual peers ($\chi^2 = 48.36$; $P < .001$). In a similar way, nearly 17% of the sexual-minority

adolescents reported a past-12-month suicide attempt, compared with only 2.43% of heterosexual adolescents ($\chi^2 = 53.47; P < .001$).

Sexual-minority adolescents who reported suicidal ideation and suicide attempts were more likely to reside in neighborhoods with higher LGBT assault hate crime rates (Table 2). Specifically, sexual-minority adolescents who endorsed suicidal ideation resided in neighborhoods that had a higher rate of assault-based LGBT hate crimes (21.22 vs 12.26 per 100 000; $P = .013$); this was significant for the 800-meter buffer. Moreover, sexual-minority adolescents reporting a suicide attempt resided in neighborhoods that had a higher rate of LGBT assault hate crimes (33.61 vs 13.18 per 100 000; $P = .006$); this was significant for the 400-meter buffer.

We found no statistically significant associations between LGBT assault hate crimes and

either suicidal ideation or suicide attempts among heterosexual adolescents (both $P > .05$; Table 3), indicating that the relationships between LGBT assault hate crimes and suicide outcomes are specific to sexual-minority adolescents. Moreover, we detected no associations for non-LGBT crimes and suicidality among the sexual-minority adolescents (all $P > .05$; Table 4), indicating that the results are specific to LGBT assault hate crimes.

DISCUSSION

Although multiple studies have identified individual, peer, family, and school factors that are associated with suicidal ideation and suicide attempts among sexual-minority adolescents,^{5,8,10-12,14,16-19} few have utilized ecological measures to examine broader social environmental determinants. The current study addresses this gap in the literature. We

TABLE 2—Mean Residential Neighborhood LGBT Hate Crime Assault Rate by Suicide Ideation and Attempt for Sexual Minority Adolescents: 2008 Boston Youth Survey Geospatial Data Set, Boston, MA

Variable	LGBT Hate Crime Assault Rate ^a	<i>P</i> ^b
Suicide ideation		
400-m buffer		.321
No	14.90	
Yes	20.12	
800-m buffer		.013
No	12.26	
Yes	21.22	
Suicide attempt		
400-m buffer		.006
No	13.18	
Yes	33.61	
800-m buffer		.094
No	13.99	
Yes	21.02	

Note. LGBT = lesbian, gay, bisexual, and transgender. The sample size was n = 102.
^aLGBT assault hate crime rates expressed as per 100 000 population.
^bTwo-sided *P* values based on the Wilcoxon two-sample test are reported.

TABLE 3—Mean Residential Neighborhood LGBT Hate Crime Assault Rate by Suicide Ideation and Attempt for Heterosexual Adolescents: 2008 Boston Youth Survey Geospatial Data Set, Boston, MA

Variable	LGBT Hate Crime Assault Rate ^a	<i>P</i> ^b
Suicide ideation		
400-m buffer		.262
No	13.67	
Yes	15.41	
800-m buffer		.229
No	13.16	
Yes	16.68	
Suicide attempt		
400-m buffer		.715
No	13.89	
Yes	11.32	
800-m buffer		.963
No	13.52	
Yes	12.29	

Note. LGBT = lesbian, gay, bisexual, and transgender. The sample size was n = 1071.
^aLGBT assault hate crime rates expressed as per 100 000 population.
^bTwo-sided *P* values based on the Wilcoxon two-sample test are reported.

TABLE 4—Mean Residential Neighborhood Overall, Violent, and Property Crime Rate by Suicide Ideation and Attempt for Sexual Minority Adolescents: 2008 Boston Youth Survey Geospatial Data Set, Boston, MA

Variable	Crime Rate ^a	<i>P</i> ^b
Suicide ideation		
Overall crime, 400-m buffer		.786
No	5723.45	
Yes	5807.77	
Overall crime, 800-m buffer		.705
No	5554.80	
Yes	5613.33	
Violent crime, 400-m buffer		.622
No	1794.58	
Yes	1680.35	
Violent crime, 800-m buffer		.748
No	1658.21	
Yes	1583.62	
Property crime, 400-m buffer		.331
No	3928.87	
Yes	4127.41	
Property crime, 800-m buffer		.356
No	3896.58	
Yes	4030.72	
Suicide attempt		
Overall crime, 400-m buffer		.556
No	5685.93	
Yes	6074.72	
Overall crime, 800-m buffer		.464
No	5531.57	
Yes	5784.57	
Violent crime, 400-m buffer		.16
No	1703.99	
Yes	2025.78	
Violent crime, 800-m buffer		.312
No	1604.13	
Yes	1781.86	
Property crime, 400-m buffer		.805
No	3981.94	
Yes	4048.94	
Property crime, 800-m buffer		.587
No	3927.43	
Yes	4002.71	

Note. The sample size was n = 102.
^aOverall, violent, and property crime rates expressed as per 100 000 population.
^bTwo-sided *P* values based on the Wilcoxon two-sample test are reported.

linked ecological data on neighborhood-level LGBT assault hate crimes obtained from police records to individual-level data on sexual orientation and suicidality from a population-based sample of adolescents. Among sexual-minority adolescents, suicidal ideation and suicide attempts were significantly more likely to occur in neighborhoods with a greater prevalence of LGBT assault hate crimes. Results also indicated that larger spatial scales were more strongly associated with suicidal ideation, whereas smaller spatial scales were more strongly associated with suicide attempts. Although additional research is needed to understand why neighborhood spatial scale is differentially associated with suicidality, these findings suggest that closer proximity to LGBT assault hate crimes increases risk for more extreme forms of suicidality.

Despite the large sample size of heterosexual respondents ($n = 1071$) and, hence, greater statistical power, we found no associations between LGBT assault hate crimes and suicide ideation or attempts among the heterosexual sample, providing evidence for result specificity. In addition, suicidal ideation and attempts among sexual-minority respondents were not more likely to occur in neighborhoods with greater overall violent and property crimes, suggesting that the results were specific to LGBT assault hate crimes. The lack of associations between neighborhood-level overall crime and suicidality among sexual minorities could be attributed to type II error, rather than a true null result. However, the number of overall violent and property crimes ($n = 31\,254$) was much larger than the number of LGBT assault hate crimes ($n = 98$). Thus, we have far greater statistical power to detect associations between suicidality and overall crime than between suicidality and LGBT assault hate crimes among sexual-minority adolescents. Despite this increase in power, we found no associations between overall crimes and sexual-minority suicidality.

To our best knowledge, only 1 study²⁶ has utilized ecological measures of the social environment to examine sociocontextual determinants of suicidality among sexual-minority adolescents. That study specifically found that the risk of attempting suicide was 20% higher among lesbian, gay, and bisexual youths in counties with less-supportive environments

(e.g., fewer same-sex couples, fewer school policies that protected sexual-minority students), compared with lesbian, gay, and bisexual youths living in counties with supportive environments.²⁶ The results of the current study continue and expand these previous results by demonstrating that LGBT assault hate crimes are an additional sociocontextual risk factor for suicide ideation and attempts among sexual minority adolescents. These results are consistent with recent literature documenting the influence of sociocontextual-level factors (e.g., same-sex marriage policies) on sexual orientation disparities in mental health,^{21,22} as well as with social-ecological theories,^{51,52} which posit that social environments shape adverse health outcomes.

These results raise important directions for future research, including identifying mechanisms through which LGBT assault hate crimes contribute to elevations in suicidality among sexual-minority adolescents. Social cognitive and learning theories posit that individuals learn behaviors and norms that are passively observed in the environment, independent of actual reinforcement.⁵³ This research suggests that sexual-minority adolescents who reside in neighborhoods with greater LGBT assault hate crimes may learn that the victimization of sexual minority persons is socially sanctioned, sending an implicit message about the acceptability of homosexuality in their community. This hypothesis awaits empirical examination. In addition to identifying mechanisms, future studies should also explore factors that buffer sexual-minority youths against the adverse health consequences of exposure to neighborhood LGBT assault hate crimes, including protective school climates (e.g., gay-straight alliances).

Study Limitations and Strengths

The BYS is a sample of public high-school students in Boston, who are urban, disproportionately low-income, and from racial/ethnic minority groups. Thus, results may not be generalizable to other locations or to the broader population of sexual-minority adolescents, including transgender adolescents, who were not included in the 2008 BYS. The small sample size of sexual-minority adolescents in the BYS sample precluded the ability to stratify analyses by gender or sexual orientation categories (e.g., bisexuals). Therefore, we are unable to

determine whether specific subgroups are especially vulnerable to the effects of living in neighborhoods with higher LGBT assault hate crimes. The measures of suicidal ideation and attempts, although well-validated,⁴⁰ were each assessed with a single item, which may inflate the prevalence of suicide attempts.⁵⁴ Replication of these results with more detailed assessments of suicidality is therefore warranted. Although we documented that sexual minority adolescent suicidality was not associated with overall neighborhood crime rates, there is the possibility for confounding attributable to other factors that were unmeasured in this study, such as neighborhood poverty and non-LGBT hate crimes. Finally, this analysis was cross-sectional. Prospective studies that examine changes in suicidality as a function of changes in neighborhood-level LGBT hate crimes are needed.

Additional study limitations concern the data on LGBT hate crimes. Hate crimes are underreported to police departments.²⁷ Underreporting reduces statistical power, and may also underestimate the relation between LGBT assault hate crimes and suicidality. As a consequence, our results provide conservative estimates of the association between LGBT hate crimes and rates of suicidality among sexual-minority adolescents. In addition, because the specific incident location (i.e., exact street address location) was not often available in the police records, we relied on geocoded street-level information for most LGBT hate crimes, which can result in misclassification. Location misclassification is likely to be minimal, however, because all hate crime incidents happened within the city of Boston, which generally has a dense street network with small block sizes.

The current study also has a number of noteworthy strengths. First, many studies of sexual-minority health utilize convenience samples that can introduce sampling biases.^{55,56} By contrast, data in the current study come from a population-based sample of adolescents. Second, crime data are often aggregated to an administrative unit (e.g., census tract or police district), which may not be a meaningful neighborhood definition for adolescents.⁵⁷ The current study addressed this limitation through geocoding the hate-crime data to the location in which it occurred. Third, the ecological hate-crimes data overcome same-source bias, which can create

a spurious association when both the exposure and the outcome are self-reported.⁵⁸ Utilizing an ecological measure of LGBT assault hate crimes substantially minimized the likelihood that the outcome was confounded with the exposure, thereby increasing internal validity of the study.

Conclusions and Implications

This study makes several important contributions to the literature on social determinants of suicide risk among sexual-minority adolescents. This is the first study to our knowledge to use geographical information system methods to identify social risk factors for suicide ideation and attempt among sexual-minority adolescents. Second, in documenting that LGBT assault hate crimes are associated with suicidality among sexual-minority adolescents, this study identified a previously unrecognized social-ecological risk factor for suicidal ideation and attempts in this population. Third, as multiple mechanisms are involved in adolescent suicide, researchers have acknowledged that prevention and intervention efforts should be comprehensive and involve the multiple domains in which adolescents are embedded.²⁰

Although there is currently a dearth of evidence-based mental health interventions or suicide prevention programs specifically for LGBT populations, studies have identified multiple risk and protective factors—particularly at the level of the individual, peer, family, and school—that may be effectively targeted in suicide-prevention programs.³ Our results suggest that existing suicide prevention efforts should be expanded to include sociocontextual factors, including neighborhood context (e.g., LGBT hate-crime rates), to promote the mental health of sexual-minority adolescents. In particular, community efforts to combat LGBT hate crimes may not only reduce violence targeting LGBT persons, an important outcome in and of itself, but may also contribute to a decrease in adolescent suicidality. ■

About the Authors

Dustin T. Duncan is with the Department of Social and Behavioral Sciences and the Harvard Youth Violence Prevention Center, Harvard School of Public Health, Boston, MA. Mark L. Hatzenbuehler is with the Department of Sociomedical Sciences and the Center for the Study of Social Inequalities and Health, Mailman School of Public Health, Columbia University, New York, NY.

Correspondence should be sent to Dustin T. Duncan, Harvard School of Public Health, Department of Social and Behavioral Sciences, 677 Huntington Ave, Kresge Building

7th Floor, Boston, MA 02115 (e-mail: dduncan@hsph.harvard.edu). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

This article was accepted April 29, 2013.

Contributors

D. T. Duncan assisted with the study design; geocoded and created the geographical information system measures of hate crimes against lesbian, gay, bisexual, and transgender individuals; conducted all statistical analysis; interpreted the results; and drafted the article. M. L. Hatzenbuehler conceptualized the study, interpreted the results, and drafted the article. Both authors have read and approved the final article.

Acknowledgments

D. T. Duncan was supported by the Alonzo Smythe Yerby Postdoctoral Fellowship at Harvard School of Public Health. M. L. Hatzenbuehler was supported by the Robert Wood Johnson Foundation Health and Society Scholars Program at Columbia University and by a grant from the National Institutes of Health (K01DA032558). The 2008 Boston Youth Survey was funded by a grant from the Centers for Disease Control and Prevention (U49CE00740) to the Harvard Youth Violence Prevention Center at Harvard School of Public Health (David Hemenway, PhD, principal investigator). A grant to D. T. Duncan from Robert Wood Johnson Foundation's Active Living Research Program (67129) supported the development of the Boston Youth Survey Geospatial Data Set.

The Boston Youth Survey was conducted in collaboration with the Boston Public Health Commission (Barbara Ferrer, director), Boston's Office of Human Services (Larry Mayes, chief), Boston Public Schools (Carol Johnson, superintendent), and the Office of the Mayor, the Honorable Thomas M. Menino. The survey would not have been possible without the participation of the faculty, staff, administrators, and students of Boston Public Schools as well as faculty, staff, and students of Harvard School of Public Health and City of Boston employees who participated in survey administration. We thank Steve Melly for creating the buffers and for calculating the neighborhood-level population counts in ArcGIS for this geospatial data set. We thank Jeff Blossom for providing technical assistance with building this geospatial data set and for providing technical assistance with geocoding the hate-crime data. We also thank the Boston Police Department for its cooperation in releasing the hate-crime data. Finally, we thank Renee M. Johnson, PhD, for commenting on an early version of this article, and we thank Miguel Marino, PhD, for statistical advice.

Note. The content is the sole responsibility of the authors and does not necessarily represent the official views of the Centers for Disease Control and Prevention, the National Institutes of Health, the Robert Wood Johnson Foundation, or the City of Boston.

Human Participant Protection

The Boston Youth Survey was approved by the institutional review board of Harvard School of Public Health. Participants provided informed consent.

References

- Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. Web-Based Injury Statistics Query and Reporting System (WISQARS). Available at: <http://www.cdc.gov/ncipc/wisqars>. Accessed August 21, 2012.

- Hawton K, Saunders KE, O'Connor RC. Self-harm and suicide in adolescents. *Lancet*. 2012;379(9834):2373–2382.
- Haas AP, Eliason M, Mays VM, et al. Suicide and suicide risk in lesbian, gay, bisexual, and transgender populations: review and recommendations. *J Homosex*. 2011;58(1):10–51.
- Garofalo R, Wolf RC, Wissow LS, Woods ER, Goodman E. Sexual orientation and risk of suicide attempts among a representative sample of youth. *Arch Pediatr Adolesc Med*. 1999;153(5):487–493.
- Russell ST, Joyner K. Adolescent sexual orientation and suicide risk: evidence from a national study. *Am J Public Health*. 2001;91(8):1276–1281.
- Almeida J, Johnson RM, Corliss HL, Molnar BE, Azrael D. Emotional distress among LGBT youth: the influence of perceived discrimination based on sexual orientation. *J Youth Adolesc*. 2009;38(7):1001–1014.
- Marshal MP, Dietz LJ, Friedman MS, et al. Suicidality and depression disparities between sexual minority and heterosexual youth: a meta-analytic review. *J Adolesc Health*. 2011;49(2):115–123.
- Wichström L, Hegna K. Sexual orientation and suicide attempt: a longitudinal study of the general Norwegian adolescent population. *J Abnorm Psychol*. 2003;112(1):144–151.
- National Academy of Sciences for the Institute of Medicine. *The Health of Lesbian, Gay, Bisexual and Transgender People: Building a Foundation for Better Understanding*. Washington, DC: The National Academies Press; 2011.
- Safren SA, Heimberg RG. Depression, hopelessness, suicidality, and related factors in sexual minority and heterosexual adolescents. *J Consult Clin Psychol*. 1999;67(6):859–866.
- Liu RT, Mustanski B. Suicidal ideation and self-harm in lesbian, gay, bisexual, and transgender youth. *Am J Prev Med*. 2012;42(3):221–228.
- Savin-Williams RC, Ream GL. Suicide attempts among sexual-minority male youth. *J Clin Child Adolesc Psychol*. 2003;32(4):509–522.
- Mustanski B, Liu RT. A longitudinal study of predictors of suicide attempts among lesbian, gay, bisexual, and transgender youth. *Arch Sex Behav*. 2013;42(3):437–448.
- Birkett M, Espelage DL, Koenig B. LGB and questioning students in schools: the moderating effects of homophobic bullying and school climate on negative outcomes. *J Youth Adolesc*. 2009;38(7):989–1000.
- Shields JP, Whitaker K, Glassman J, Franks HM, Howard K. Impact of victimization on risk of suicide among lesbian, gay, and bisexual high school students in San Francisco. *J Adolesc Health*. 2012;50(4):418–420.
- Ryan C, Huebner D, Diaz RM, Sanchez J. Family rejection as a predictor of negative health outcomes in White and Latino lesbian, gay, and bisexual young adults. *Pediatrics*. 2009;123(1):346–352.
- D'Augelli AR, Grossman AH, Salter NP, Vasey JJ, Starks MT, Sinclair KO. Predicting the suicide attempts of lesbian, gay, and bisexual youth. *Suicide Life Threat Behav*. 2005;35(6):646–660.
- Eisenberg ME, Resnick MD. Suicidality among gay, lesbian and bisexual youth: the role of protective factors. *J Adolesc Health*. 2006;39(5):662–668.

19. Walls NE, Freedenthal S, Wisneski H. Suicidal ideation and attempts among sexual minority youths receiving social services. *Soc Work*. 2008;53(1):21–29.
20. Gould MS, Greenberg T, Velting DM, Shaffer D. Youth suicide risk and preventive interventions: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry*. 2003;42(4):386–405.
21. Hatzenbuehler ML, Keyes KM, Hasin DS. State-level policies and psychiatric morbidity in lesbian, gay, and bisexual populations. *Am J Public Health*. 2009;99(12):2275–2281.
22. Hatzenbuehler ML, McLaughlin KA, Keyes KM, Hasin DS. The impact of institutional discrimination on psychiatric disorders in lesbian, gay, and bisexual populations: a prospective study. *Am J Public Health*. 2010;100(3):452–459.
23. Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Soc Behav*. 1995;(spec no.): 80–94.
24. Berkman L, Kawachi I, eds. *Social Epidemiology*. Oxford, UK: Oxford University Press; 2000.
25. US Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Lesbian, gay, bisexual, and transgender health. In: *Healthy People 2020*. Available at: <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=25>. Accessed August 21, 2012.
26. Hatzenbuehler ML. The social environment and suicide attempts in lesbian, gay, and bisexual youth. *Pediatrics*. 2011;127(5):896–903.
27. Green DP, McFalls LH, Smith JK. Hate crime: an emergent research agenda. *Annu Rev Sociol*. 2001;27: 479–504.
28. Herek GM. Hate crimes and stigma-related experiences among sexual minority adults in the United States: prevalence estimates from a national probability sample. *J Interpers Violence*. 2009;24(1):54–74.
29. Federal Bureau of Investigation. Hate crimes. Available at: <http://www.fbi.gov/about-us/cjis/ucr/hate-crime>. Accessed August 21, 2012.
30. Potok M. Anti-gay hate crimes: doing the math. *Intelligence Report*. Winter 2010; Issue No. 140. Montgomery, AL: Southern Poverty Law Center. Available at: <http://www.splcenter.org/get-informed/intelligence-report/browse-all-issues/2010/winter/anti-gay-hate-crimes-doing-the-math>. Accessed August 21, 2012.
31. Lambert SF, Copeland-Linder N, Ialongo NS. Longitudinal associations between community violence exposure and suicidality. *J Adolesc Health*. 2008;43(4):380–386.
32. Nickerson AB, Stater ED. School and community violence and victimization as predictors of adolescent suicidal behavior. *School Psych Rev*. 2009;38:218–232.
33. Duncan DT, Castro MC, Gortmaker SL, Aldstadt J, Melly SJ, Bennett GG. Racial differences in the built environment–body mass index relationship? A geospatial analysis of adolescents in urban neighborhoods. *Int J Health Geogr*. 2012;11:11.
34. Azrael D, Johnson RM, Molnar BE, et al. Creating a youth violence data system for Boston, Massachusetts. *Aust N Z J Criminol*. 2009;42:406–421.
35. Duncan DT, Aldstadt J, Whalen J, Melly SJ. Validation of walk scores and transit scores for estimating neighborhood walkability and transit availability: a small-area analysis. *Geofournal*. 2013;78(2):407–416.
36. Austin SB, Roberts AL, Corliss HL, Molnar BE. Sexual violence victimization history and sexual risk indicators in a community-based urban cohort of “mostly heterosexual” and heterosexual young women. *Am J Public Health*. 2008;98(6):1015–1020.
37. Austin SB, Ziyadeh N, Fisher LB, Kahn JA, Colditz GA, Frazier AL. Sexual orientation and tobacco use in a cohort study of US adolescent girls and boys. *Arch Pediatr Adolesc Med*. 2004;158(4):317–322.
38. Mustanski B, Newcomb ME, Clerkin EM. Relationship characteristics and sexual risk-taking in young men who have sex with men. *Health Psychol*. 2011;30(5):597–605.
39. Newcomb ME, Heinz AJ, Mustanski B. Examining risk and protective factors for alcohol use in lesbian, gay, bisexual, and transgender youth: a longitudinal multilevel analysis. *J Stud Alcohol Drugs*. 2012;73(5):783–793.
40. Brener ND, Collins JL, Kann L, Warren CW, Williams BI. Reliability of the Youth Risk Behavior Survey Questionnaire. *Am J Epidemiol*. 1995;141(6):575–580.
41. Duncan DT, Castro MC, Blossom JC, Bennett GG, Gortmaker SL. Evaluation of the positional difference between two common geocoding methods. *Geospat Health*. 2011;5(2):265–273.
42. Morenoff JD, Sampson RJ, Raudenbush SW. Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence. *Criminology*. 2001;39:517–559.
43. Deane G, Messner SF, Stucky TD, McGeever K, Kubrin CE. Not ‘islands, entire of themselves’: exploring the spatial context of city-level robbery rates. *J Quant Criminol*. 2008;24(4):363–380.
44. Messner SF, Baumer EP, Rosenfeld R. Dimensions of social capital and rates of criminal homicide. *Am Sociol Rev*. 2004;69:882–903.
45. Papachristos AV, Smith CM, Scherer ML, Fugiero MA. More coffee, less crime? The relationship between gentrification and neighborhood crime rates in Chicago, 1991 to 2005. *City Community*. 2011;10:215–240.
46. Dunbar E. Race, gender, and sexual orientation in hate crime victimization: identity politics or identity risk? *Violence Vict*. 2006;21(3):323–337.
47. Stacey M. Distinctive characteristics of sexual orientation bias crimes. *J Interpers Violence*. 2011;26(15): 3013–3032.
48. 2010 US Census. Available at: <http://www.census.gov>. Accessed June 3, 2013.
49. Nemes S, Jonasson JM, Genell A, Steineck G. Bias in odds ratios by logistic regression modelling and sample size. *BMC Med Res Methodol*. 2009;9:56.
50. Greenland S, Schwartzbaum JA, Finkle WD. Problems due to small samples and sparse data in conditional logistic regression analysis. *Am J Epidemiol*. 2000;151(5):531–539.
51. Bronfenbrenner U. *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MA: Harvard University Press; 1979.
52. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *Int J Epidemiol*. 2001;30(4):668–677.
53. Bandura A. Social cognitive theory: an agentic perspective. *Annu Rev Psychol*. 2001;52:1–26.
54. Savin-Williams RC. Suicide attempts among sexual-minority youths: population and measurement issues. *J Consult Clin Psychol*. 2001;69(6):983–991.
55. Diamond LM. New paradigms for research on heterosexual and sexual-minority development. *J Clin Child Adolesc Psychol*. 2003;32(4):490–498.
56. Meyer IH, Wilson PA. Sampling lesbian, gay, and bisexual populations. *J Couns Psychol*. 2009;56:23–31.
57. Matthews SA. Spatial polygamy and the heterogeneity of place: studying people and place via egocentric methods. In: Burton LM, Kemp SP, Leung M, Matthews SA, Takeuchi DT, eds. *Communities, Neighborhoods and Health: Expanding the Boundaries of Place*. New York, NY: Springer; 2011:35–55.
58. Diez Roux AV. Neighborhoods and health: where are we and where do we go from here? *Rev Epidemiol Sante Publique*. 2007;55(1):13–21.