

YOUTH VIOLENCE: WHAT WE NEED TO KNOW

Report of the Subcommittee on Youth Violence of the
Advisory Committee to the Social, Behavioral and Economic
Sciences Directorate, National Science Foundation

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INTRODUCTION

Rampage shootings in schools differ in dramatic ways from “street violence” commonly associated with urban areas. School rampages typically occur in stable, close knit, low crime and very small rural towns and less often in exurbs. The shooter generally is a white adolescent male, with no recorded history of disciplinary problems, and no documented history of medical treatment for mental disorders. The shooter is often at the high end of the intelligence and academic achievement spectrum, but lacking in the badges of athletic ability and other social attributes that are highly valued by peers.

Urban “street shooters,” by contrast, are found in densely populated areas with high crime levels, low levels of social trust, and are rarely high academic performers. High poverty neighborhoods, often plagued by illicit drug and gun markets, are particularly at risk for youth violence. Although rampage shootings are rare, they are devastating because of the randomness of the victims. Urban bloodshed, which often unfolds between known antagonists, is far more ubiquitous and hence exacts a terrible toll on families and communities destabilized by persistent violence.

When gun violence of either kind occurs, it is only natural for citizens and policymakers to seek to identify “the cause.” Although tragic events like the Newtown shooting are caused by multiple risk factors, three main factors have been discussed—access to guns, exposure to violent media, and mental health. We have a body of reliable evidence and a stable of theories to explain youth violence that have emerged from decades of research, including research supported by the National Science Foundation, the National Institutes of Health, the National Research Council, and other federal agencies.

Particularly important within this corpus is research documenting risk factors for aggressive and violent behavior, especially poor parenting practices, households under economic stress, rejection from adolescent peer groups, deteriorating mental health, and intensive exposure to the fantasy world of online games that glorify violence and desensitize the viewer to its consequences. Particularly damaging is the fusion of masculinity and violence in popular culture that is consumed by adolescents in all corners of the country. The interplay, or additive nature, of these risk factors is important to consider because no single risk factor provides us with a comprehensive understanding.

Adolescents in low crime communities who believe themselves to be “social losers” see a solution in enacting dangerous, anti-social behavior because they will be able to replace a damaged identity with a new and more satisfying one: the notorious, dangerous, hyper-masculine anti-hero. Adolescents in high crime communities absorb the “code of the streets,” which requires individuals and groups to project – and sometimes to enact – a tough, violence-prone image in order to ward off threats they encounter in ordinary interaction.

Though we know a great deal about the etiology of youth violence, the changing online and gaming landscape, state level variation in access to weapons, and evolving nature of family structure, among other changes, require a forward looking research agenda to examine these changes and new challenges. Our understanding of the social relations within schools that can help youth to avoid violence as they contend with peer conflict, to develop social trust that governs levels of interpersonal conflict, and to come forward in the presence of threats, is underdeveloped. Advances in the study of large-scale datasets offer the possibility of learning about youth culture and “cyberbullying” from publically available social media that have become important forms of youth-to-youth communication. Additionally, while civil liberties implications will require further study, the potential for online intervention exists, which may prevent both cyberbullying and violent behavior.

In the sections that follow, we focus on key areas for future research. These suggestions are supported by the research summarized in Appendix A, where the contributing members of this advisory panel have described “what we know.”

¹ Co-Chair: Brad J. Bushman (The Ohio State University & VU University, Amsterdam, the Netherlands); Co-Chair: Katherine Newman (Johns Hopkins University); Participants: Sandra Calvert (Georgetown University), Geraldine Downey (Columbia University), Mark Dredze (Johns Hopkins University), Michael Gottfredson (University of Oregon), Nina G. Jablonski (Pennsylvania State University), Ann Masten (University of Minnesota), Calvin Morrill (University of California, Berkeley), Daniel B. Neill (Carnegie Mellon University), Daniel Romer (University of Pennsylvania), Daniel Webster (Johns Hopkins University)

YOUTH VIOLENCE AND EXPOSURE TO MEDIA VIOLENCE

Public debate on the link between violent media and aggressive and violent behavior can be contentious, especially in the wake of a shooting rampage. Anders Breivik, who murdered 69 youth in Norway, claims he used the video game “Modern Warfare 2” as a military simulator to help him practice shooting people. Similarly, Eric Harris and Dylan Klebold, who murdered 13 fellow students in Colorado, claimed they used the violent video game “Doom” to practice their shooting rampage. Violent video games have also been implicated in other school shootings (e.g., Bethel, Alaska; Paducah, Ky.; Jonesboro, Ark.).

It is not possible to know whether playing violent games *caused* Breivik, Harris and Klebold (or any other killer) to shoot their victims. However, a comprehensive review of more than 381 effects from studies involving more than 130,000 participants around the world shows that violent video games increases aggressive thoughts, angry feelings, physiological arousal (e.g., heart rate, blood pressure), and aggressive behavior. Violent games also decrease helping behavior and feelings of empathy for others. A meta-analysis of 26 studies involving 13,661 participants found that violent media exposure is also significantly linked to violent behavior (e.g. punching, beating, choking others), although the effects are smaller than for aggressive behavior. Yet, additional research is still needed to address some important questions about media impacts, particularly given the rapid evolution of the technology that is flooding young consumers with ever more realistic depictions of violent behavior on screen.

At-risk Individuals: Some individuals are more at risk for the effects of violent media than are others. We know very little about the differential impact of violent media on certain subpopulations.

- Are youth with certain mental illnesses more or less sensitive to violent media?
- Are males with extremely traditionally masculine gender roles particularly at risk for violent media effects?
- Very young children may be especially at risk for negative outcomes after violent media exposure. How much and what kinds of violent media do young children (< 8 years) consume and how does that exposure impact their development?
- How does playing newer kinds of aggressive games on apps influence children’s aggressive thoughts and behaviors?
- The relationship between gaming and depression among adolescents is poorly understood. Are youth becoming depressed because their engagement in gaming is removing them from social interaction and intensifying the feeling of isolation? Or are youth who are already socially isolated more attracted to gaming to begin with? Do virtual relations “crowd out” actual social bonds?

Fantasy-reality Distinctions and Transfer to Real-life Settings: The distinction between fantasy and reality is blurry for very young children. Older youth could be susceptible to such problems as well.

- What kinds of relationships do youth form with onscreen characters? Do youth perceive these fantasy figures as friends, role models (heroes and anti-heroes), or as embodying themselves? Do these different kinds of relationships with media characters differentially affect the likelihood of aggressive outcomes after media exposure?
- The relationship between fantasy behavior (shooting on screen) and aggressive behavior is well understood. In what circumstances, though, does this fantasy behavior transfer to violent, criminal behavior among youth? For example, what is the relationship between violent media consumption and access to or ownership of guns? Are the people who have lethal weapons also those who are fantasizing about their use through online worlds?
- Violent media are becoming progressively more immersive as the technology advances (e.g., high definition, 3-D, surround sound, larger screens, virtual reality). Do more realistic media interfaces make it more difficult for youth to distinguish between fantasy and reality and make it more likely that they will act on what they do or see in media experiences?
- How does the consumption of violent media impact the formation and sustenance of trust? Do children and youth who play aggressive games come to see the world as “mean and scary?” Or are those who are

already distrustful disproportionately attracted to violent media? Or is this relationship bi-directional?

Group Processes: Youth often play aggressive games in groups, sometimes in the same setting. Little is known about how intergroup processes in online and offline settings versus solitary play influence aggressive outcomes.

- How does the impact of violent media differ when online games are played in groups (where the players are “working” side by side), as distributed allies (where players are in teams but not co-located), or as dyads versus playing alone?
- How does competition and collaboration between game players influence aggressive outcomes? Do solitary players team up with other online players, potentially creating allies and friends, or do they compete against them, making them more likely to be perceived as enemies?
- Does group versus solitary interaction around violent media amplify the problems that may be experienced by individuals who suffer from mental illnesses?

Environmental Factors: The media environments of children and youth have increasing amounts of aggressive content delivered by numerous platforms.

- How much aggressive content is in current television programs, films, video games, apps, and music?
- Do consumption patterns of violent media vary by geography (rural, suburban, urban), socioeconomic status (SES), gender, ethnicity, or household composition?
- Youth violence is decreasing while violent video consumption is increasing. Are youth who live in risky environments actually more protected from actual violence because they are indoors consuming media and therefore out of harm’s way?
- Rating systems have not kept up with the increasingly violent content of popular media (e.g., PG-13 films contain as much violence today as R-rated films in the past). Ratings systems vary across media platforms and have included age and/or content markers. Because there are not standard ratings across platforms (e.g., R for movies; TV-MA for TV, T for Teen in video games), they are difficult for parents to understand. We need to evaluate the potential benefits of a universal rating system for all media (TV, films, video games, music, apps), with symbols that are more transparent. The PEGI (Pan European Game Information) system, for example, has five age-based ratings (3+, 7+, 12+, 16+, 18+) and six well-recognized symbols for potentially objectionable material (violence, sex, drugs, discrimination, fear, gambling).

Biological Factors: Researchers are beginning to explore the addictive nature of video games, but more research is needed.

- Do video games tap into biological reward systems (like other addicting substances such as drugs and alcohol)? Does group-shared fun while playing video games enhance reward effects? Self-control is important in other addictions. What role does self-control play in the use of video games?
- What is the difference between engagement, which can increase learning, and addiction?
- How do violent media impact brain development and function?

SOCIAL REJECTION AND PEER HIERARCHIES

Most youth who engage in lethal violence have a history of social rejection but are highly concerned about acceptance. However, rejection occurs in various forms and from various sources, and this may have important implications for understanding whether and under what circumstances rejection triggers violence versus other responses.

There is some suggestion that **rampage shooters** have a history of rejection from relatively small and cohesive peer networks that they have sought entry into often through behaviors that peers perceive as socially inept. Urban youth violence often occurs in response to perceived disrespect among **poor urban youth**, whose efforts to assert status within schools and on the street may take the form of highly aggressive behavior. These young men are at particular risk for school failure and dropout as a consequence of exclusionary disciplinary practices enacted in response to their transgressive behavior. Disengagement from school promotes entry to networks outside of school,

including gangs, that may encourage the use of violence to settle disputes.

In schools, how youth define and respond to behavior with peers and adults they find troubling needs to be studied holistically, incorporating violent behavior as a subset of potential responses and assessing how adults (including security guards) help to promote, as well as impede, nonviolent resolution of conflicts. Particularly important in these dynamics are peer/reputational hierarchies, the quality of interpersonal and group relations (e.g. strong as compared with weak ties) in different face-to-face and online spaces, and sex differences in regard to peer conflict. There needs to be more known about how these factors vary demographically across schools and broader contexts (e.g., urban compared with rural settings).

There is significant literature on school climates and cultures of social trust as undergirding, protective factors against violence and conflict. Much of this literature is based on self-reported beliefs and behaviors, but we know less about how trust is actually established and sustained over time, contributing to constructive conflict management that can stem the tide of aggression or violence.

Especially important in these processes may be the quality of adult-youth interaction and the facilitative impact of effective leadership. We need to know more about how security and exclusionary disciplinary regimes relate to social trust and adult-youth interaction, particularly with respect to peer hierarchies and youth conflict practices. Also important is greater knowledge about how off-campus, third parties (e.g., alumni, community members) can facilitate or inhibit the production of social trust in schools.

We know relatively little about how youth seek out help and support from adults when dealing with troubling situations either face-to-face or online. To study these dynamics, we need to expand our methodological toolkit to include comparative studies (across institutional types, from different countries, etc.), and multi-method studies that incorporate fieldwork, surveys, focus groups, and experimental designs.

- Across urban and rural contexts, it will be important to understand how heightened sensitivity to rejection develops and is sustained in youth. How do families, peers, schools, and societal stereotypes foster or moderate sensitivity to rejection? What goals do the use of violence, and especially lethal gun violence, serve among those who use it or plan to use it in response to rejection? Does violence provide a sense of escape from feelings of powerlessness?
- How do individual child characteristics, notably self-regulatory competency, moderate reactions to rejection and promote more adaptive responses to social threat?
- Adolescence is a time of rapid brain development. Understanding the neural basis of social threat and reactions to it is important and needs to be studied, potentially via functional and structural brain imaging.
- Understanding rejection by peers and adults in important settings such as schools—the form it takes in daily life: where, when and why and by whom—and how it interacts with the sensitivity to rejection of the target is important.
- Among marginalized youth, what kinds of relationships might reduce risk of extreme reactions to rejection, promote help seeking, and interrupt plans for revenge that might involve lethal violence? How do youth learn to seek help?
- Is evidence of sensitivity to rejection a useful indicator of heightened risk for extreme behavior, given that it is implicated in many types of disorders and has links with suicidal risk as well as to violence?
- How do youth handle peer conflict across different contexts? What social and institutional conditions (strong and weak ties) facilitate nonviolent as compared to violent responses?
- How is social trust produced in schools and what effects do different security regimes have on it?
- A number of rampage shooters have been college students or dropouts. Understanding what contributes to risk of lethal violence among college age students is important because they have aged out of adolescent peer groups and may be even more difficult to identify as a result.

COMPARATIVE CRIMINOLOGY

More research is required to discover the similarities and differences between rampage shootings or mass killings and other, more common forms of violent crimes and delinquencies. How the characteristics of the incidents themselves and the backgrounds and characteristics of the individuals involved differ from other types of aggressive, violent and weapon-involved crimes would be useful (e.g., the extent of planning, the relationship between levels of self-control or self-regulation and violence, the solitary or group nature of the offending, and the time, place, and method of occurrence).

The connection between self-destructive behavior and ideation and rampage shootings needs more study. Many rampage shootings seem characterized by both suicidal and homicidal ideation. What are the precursors of such ideation and how do these forms of ideation translate into action? How does this form of both suicidal and homicidal ideation differ from either form alone?

The news media cover rampage shootings heavily, but very little is known about the effects of such coverage on adolescents and young adults. Does such coverage increase thoughts of imitation, as it seems to in suicide? Is it more likely to influence thoughts of imitation among youth who already have thoughts of suicide and homicide? There is evidence that school shootings encourage (mainly false) reports of school bombings, but do some youth use such events as a way to achieve notoriety, as has been suggested in sensational coverage of suicides?

Given the established relationship between age and violence (with the peak age falling at late adolescence or early adulthood), there is a need to know more about:

- the relationship between suicide and homicide, and the intersection between the two;
- whether there are differential effects of self-control or self-regulation for the development of suicidal and homicidal ideation; and
- how school and other social institutions can create enhanced social efficacy and bonding effects for students, and how differences in school climate can reduce levels of crime and violence, particularly during adolescence.

FAMILY INFLUENCES ON VIOLENT BEHAVIOR

There is a large body of research suggesting that families are involved in different ways in the development and prevention of antisocial and violent behavior. Evidence also indicates that numerous aspects of family influence on children are malleable through intervention. Yet there are many gaps in knowledge about the roles of families in violent behavior that could inform policy and interventions to reduce risks for youth violence and promote resilience among high-risk children.

Research is needed on the role of early environments, both prenatal and post-natal, for neurobehavioral development related to risk, vulnerability and the protective factors strongly associated with the later development of violence in children. These include the effects of physiological stress on the development of executive functions and stress-regulation systems, and the effects of parenting on brain development and socialization of behaviors that predict violence. Research is also needed on the best intervention strategies for reducing stress in pregnant mothers and helping families prepare their children for kindergarten and gain access to high-quality child care and early learning experiences for children.

Monitoring by parents is implicated in violence development and prevention. Research is needed on the best strategies and developmental timing for parents to promote positive child uses of media, safe behavior around firearms, and healthy connections to pro-social peers, activities, and mentors. Because parents may not appreciate their influence on older youth, research is needed on educating parents about staying involved with their adolescent children.

Large, new studies planned on child development, such as the National Children's Study, should be urged to include survey items and methods that will inform these questions. Important data on the following questions can also

be gleaned from existing longitudinal datasets.

- How do prenatal or early post-natal exposures to stress or trauma and environmental toxins alter the risk for violence later in development?
- Do interventions that improve self-control skills reduce youth violence? What are the most cost-effective strategies and timing for these interventions?
- What are the most effective interventions for educating parents about effective and age-appropriate ways to monitor child behavior, including their media use, peer interactions, and school involvement?
- High-risk families (e.g., unstable, homeless, with incarcerated parents or violence in the home) contribute disproportionately to violence in inner-city neighborhoods. What interventions make a difference in interrupting this cycle?
- Is the foster care system a “violence feeder system” in that young people who age out are particularly vulnerable to crime, domestic violence, and homelessness? What can be done to address the special needs of children in foster care?
- What kind of mental health and community resources are needed for families concerned about a child who demonstrates signs of preoccupation with violence, violent media, or violent behavior?
- Do large-scale interventions that aim to increase academic achievement (e.g., Race to the Top) also mitigate youth violence?

DATA MINING FOR PREDICTION AND INTERDICTION OF SHOOTINGS

Online data sources may have multiple potential uses for understanding, predicting, and preventing violence. These include but are not limited to (a) tracking population-level demographic and geographic trends in risk behaviors, (b) geographic “hot spot” prediction for urban violence, (c) “risk stratification” to identify—with appropriate safeguards—those who are signaling violent intentions and who would benefit from early intervention, (d) facilitating the reporting of planned or potential attacks by others (e.g., friends and classmates) with knowledge of impending events, and (e) understanding bullying behavior and its role in influencing violence. Each of these potential applications should be explored further to analyze its potential impact (benefits and risks) and feasibility of implementation. To be successful, research in any of these domains must address the potential biases and limitations of these online data sources. Clearly, it will also be necessary to address and mitigate serious risks to privacy.

Many of the methodological tools needed for these analyses (such as anomalous pattern detection, predictive modeling, sentiment analysis, and social network analysis) have already been developed in the fields of machine learning, data mining, computational linguistics and statistics. These existing tools should be integrated into systems which can address the challenges listed above.

Additionally, an interdisciplinary approach is needed to understand and address the gaps between the current methodological state of the art and what methods are actually needed to fully address these problems. For example, we may need more work on “deeper” natural language analysis to identify the intent of online text (e.g., distinguishing an actionable threat from other negative sentiments) and to infer user characteristics (e.g., location, age group, gender, mental illness). Similarly, we may need to develop better algorithms for learning and inference using complex data (with many types of information, multiple network and relational structures, multilingual data, etc.) and for detecting relevant, anomalous patterns in such data.

The focus should be on developing tools that can be broadly used, and framing methodological questions (e.g., early event detection and prediction) that generalize across multiple domains. The solutions to such problems would then advance the science, for example, of language understanding, massive data analysis, and pattern discovery, as well as potentially preventing or reducing youth violence. Open questions for further research include:

- Can Twitter and other online data sources (e.g., gaming forums) be used to track the demographic and geographic trends in consumption of violent media and correlate these with other indicators (e.g., use of violent language), accounting for demographic and other biases in these data sources?
- Can new data sources (e.g., online data such as Twitter or specialized systems to monitor, identify, and

track graffiti) be integrated with currently used law enforcement and 911 call data to enhance the timeliness and accuracy of prediction (“where” and “when” street shootings are likely to occur, as well as predicting “who” may be the perpetrators and victims—e.g., which gangs are likely to be involved)?

- Can we identify “risk factors” for individual mass shooters which are both (a) predictive and (b) can be reliably extracted from online data, such as latent user attributes (location, age, gender), socioeconomics (poverty), family (divorce, single parents), access to guns, expressions of violent sentiments, intentions, and plans, signs of certain mental illnesses, attitudes toward violence, social relationships (marginality, social rejection, encouragement by peer groups), etc.? Can administrative data be integrated with online data for more accurate risk predictions?
- Can we accurately model both the probability that these risk factors are present given noisy, unstructured online data, and estimate the overall risk of violent action given these factors? Given that these are very rare events and that the data are both limited and noisy, it is likely that an appropriate role of such monitoring would be to enable subpopulation-level early interventions among high-risk groups (e.g., availability of mental health counseling).
- Is there a role for monitoring online data in early warning and rapid response to mass shootings, similar to its role in disaster response more generally, to inform law enforcement and potential victims?
- Can we understand and develop a framework to inform and encourage best practices of online interventions at various stages leading up to a potential mass shooting (teachers providing online, positive influences; availability of mental health counseling; mitigating negative impacts of social rejection; facilitating reporting of potential threats and at-risk individuals in need of help)?
- Can online data from occurrences of “cyberbullying” be captured and analyzed to understand the causes, processes, and impacts of bullying behavior more generally? What are the similarities and differences between online and offline bullying behavior (e.g., online anonymity and greater spread of embarrassing information), and how do these change the impacts on victims of bullying?
- What are the risks of mining online data to individual privacy and how can these risks be mitigated or eliminated? For example, when are aggregated counts and de-identified data sufficient to study violent behavior? On the other hand, under what conditions is it acceptable to use online data to intervene at the individual level (which may not be possible without identifying at-risk individuals)? How are these privacy challenges affected by (a) data from children, (b) the role of parents and schools, and (c) public perceptions (e.g., it may not be considered acceptable to mine certain data even if those data are publicly available)?

GUN POLICY AND YOUTH

More than 80 percent of homicides involving victims or perpetrators ages 15-24 were committed with firearms, as were virtually all mass killings committed by youthful perpetrators. Due to developmental and social conditions mentioned elsewhere, it is critical to reduce access to firearms to youth, especially those with a history of delinquency, crime involvement, and certain mental illnesses.

The vast majority of youthful handgun offenders acquired their handguns from “street or black market” sources or from friends or family. But little is known about how the underground gun market functions for youth. Whereas social networks may be key to gun acquisition for urban youth in disadvantaged neighborhoods, youth who use guns to commit suicide or carry out rampage shootings typically access guns from parents or close family members. Thus, the following are key questions that should be addressed:

- What is the relationship between minimum age or youth-focused firearm restrictions (e.g., safe storage) and youth-perpetrated violence? Is the effectiveness of these laws dependent upon other gun regulations designed to deter the diversion of guns to prohibited persons (e.g., universal background checks, licensing provisions)?
- How do penalties and illegal gun suppression tactics by police affect illegal gun carrying and use by youth? More studies of gun law effects on youth violence are needed in which intervention and comparison jurisdictions have similar levels and trends in youth gun violence before they experiment with new gun poli-

cies. We need studies of this kind to establish causal inference in the effectiveness of policies.

- How do factors such as price, trust in gun sellers, gun characteristics (new/used), and perceived risks of prosecution affect youth illegal acquisition by youth of firearms? How easily do youth adapt to interdiction strategies (e.g., access sources outside of state if state gun laws reduce gun diversions)?
- Do youth steal guns opportunistically or target homes, stores, or individuals for gun theft? How important are stolen guns to the underground gun market where youth acquire guns? How commonly do youth discard guns, lose them to theft, sell them, or have them confiscated by parents, police, or school authorities?
- How do youth access ammunition?
- How much do community members know about how youth are illegally acquiring guns, stashing, and carrying guns? How willing would community members be to share this information on an anonymous basis with police?
- To what degree and under what conditions do youth share guns? What are the perceived norms and risks associated with gun sharing?
- Can violence interruption and conflict mediation by street outreach workers used to combat urban youth violence incorporate efforts to disarm or keep guns from youth engaged in the conflict?
- Similarly, can friends attempt to keep guns from youth planning rampage shootings?
- What is the potential for new technologies (personalized guns) to interrupt violent behavior among youth? How will consumers react to the introduction of these new technologies?

CONCLUSION

It is estimated that the social cost of gun violence is roughly \$174 billion a year.² Beyond this enormous financial toll, we recognize the devastating emotional impact of lost lives, neighborhood destabilization, and fear of attack. For children in particular, exposure to violence erodes confidence in social institutions and the society they live in. These costs alone justify the dedication of our federal research agencies and the scientific community to understanding the problem of youth violence.

Researchers are ready to speak to the concerns of citizens and policymakers, building on many decades of work that informs the suggestions in this report. To do so, collaboration will be necessary across directorates of the National Science Foundation, since the basic scientific research spans a wide range of disciplines from psychology to cognitive science to computer science, from sociology to communications, from neurobiology to neuroscience, and across the age span from pre-natal environments to adolescence. Moreover, the multiple federal research agencies that apply basic science insights and develop policy responses will need to integrate and coordinate their efforts.

Further discussion will be needed to identify immediate and pressing questions that can be assessed rapidly as well as the long-term research problems. No single factor stands alone as an explanation for the violence patterns described here and hence it will take a collective effort to solve them.

² Firearm injuries cost \$174 billion in the United States in 2010 and the government's firearm injury bill alone exceeded \$12 billion. The costs include medical and mental health care costs, criminal justice costs, wage losses, and the value of pain, suffering and lost quality of life. <http://www.childrensafetynetwork.org/cost-gun-violence>

APPENDIX A: SUMMARIES FROM SUBCOMMITTEE PARTICIPANTS

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Adolescent Pecking Orders, Failed Joiners and the Logic of Signaling Behavior Among Rampage Shoot Shooters

Katherine S. Newman, Ph.D., Dean of Arts and Sciences, Professor of Sociology, Johns Hopkins University

Rampage shootings in schools differ in dramatic ways from what we might call “street violence” commonly associated with urban area. They typically occur in stable, close knit, low crime and very small rural towns (the dominant pattern) or exurbs (the minority pattern). The shooter generally is a white adolescent boy, generally with no recorded history of disciplinary problems. Although the small sample size makes it difficult to generalize, it is not uncommon to find that the shooter is at the high end of the intelligence and academic achievement spectrum but lacking in the badges of athletic ability that are highly valued among his peers. Urban “street shooters,” by contrast, are found in densely populated areas with high crime levels, low levels of “social efficacy,” and are rarely high academic performers.

The rampage shooter in schools, particularly the classic cases of boys who are present or past members of the school community, share sociological characteristics. Though commonly presupposed to be loners who act out of anger, ethnographic and archival research on these very rare events indicates the truth is otherwise. Typically, rampage shooters in schools are adolescent boys who have a long history of trying to join peer groups, but find themselves continuously rebuffed. They are socially awkward, but not disengaged. This painful social position often leads to clown-like behavior or bullying, both designed to get attention or capture social status from the margins, or lead to victimization at the hand of bullies. More often than not, shooters sit on the margins and endure the persistent sense that they must push a social rock up a hill every day, as whatever evidence of achievement (a friendly gesture, a moment of inclusion) melts away and the long quest for acceptance begins again.

Because they are also generally at the early onset of severe mental illness, with symptoms they find frightening, but sufficient awareness of the stigma that follows, they often go entirely undiagnosed and untreated. Those who survive into their twenties often develop full blown mental disorders that are immediately recognized, but at the ages of 12-14, these conditions are often just beginning, but lead the shooter to magnify slights and feel severely depressed by rejection that troubles millions of adolescents.

The behavioral repertoire of the socially marginal boy includes attention-getting behavior ranging from “clowning around,” to swaggering, or aggressive self-promotion. Over time, the would-be shooter gains a reputation for constantly saying “crazy things” but is ignored by peers. In short, behavior designed to get attention ends up harvesting rejection, but also the formation of a social persona as someone who broadcasts bizarre commentary. The day this marginal character lands on the now sadly familiar script of shooting people, the social landscape changes. Now peers are paying attention. Whatever ambivalence shooters feel about the consequences of their actions, they are now committed to them because to do otherwise is to risk a catastrophic social failure and public humiliation.

If so much broadcasting is going on at the gateway to peer groups, why don’t kids come forward with the information that something terrible is going to happen? First, they often find it hard to interpret what they are hearing, considering the source. It is a noisy signal coming from someone who often says crazy things. Apart from the periods when we have a rash of shootings, it also seems such a far-fetched possibility, that shooting is discounted as something beyond the realm of the possible, particularly for kids who were too young when the last series of shootings happened for this to be a framework for interpreting hints or threats. Second, the social cost to them of crossing over to the adult world in the midst of their own adolescent separation from it is high. Third, they don’t believe what they have to say will be taken seriously or handled confidentially and can give many examples in which neither was the case. Accordingly, the best—and possibly the only—credible source of information about what is to come is lost.

What We Need to Know

Because rampage shootings are intimately connected to adolescent pecking orders, the experience of frictional social relations, and the consequent logic of broadcasting warnings, it is here that we need to intervene and make it more likely that peers will come forward with what they know, and that adults will react promptly but privately. The interdiction of signaling is essential. What do we need to understand better to make this a more common outcome?

- **The role of social media in signaling behavior.** Since the late 1990s and the early 2000s, social media (Facebook, Twitter, etc.) has become a primary method of communication among adolescent peers. While face to face behavior still counts, especially in the contained world of high school, increasingly it is via the Internet that we see the intensification of the kinds of communication (bullying, hinting, warning, etc.) that count in the lead up to rampage shootings. We need sociological and anthropological studies of social media and its role in adolescent social life, linguistic studies of this kind of communicative repertoire (what are its conventions, amplifications, etc.), and interpretive studies that will tell us something about how meaning is drawn from and projected through social media.
- Studies of **institutional trust.** We have instances of “foiled plots” in which young people “betray” their confidants and come forward to adults, as well as completed shootings in which those who might have been able to stop it by warning authorities did not do so. What makes the difference? Are there institutional practices that promote trust?
- We have a fair amount of research on adolescent social groups, but not as much as we should have on the **intersection between adolescents and adults.** If we want to understand how young people view the adults around them, why they trust them or don’t with socially compromising information, we need a better baseline than the one we have. This domain falls in between the cracks of studies of adolescent behavior or adult social worlds.
- **The relationship between institutional structure and the detection of deviant behavior.** Picking up patterns of behavior that should lead to greater attention or treatment is more difficult in institutions where the capacity of teachers to put together a comprehensive view of a student is hampered by the short time in the day when they are together, limited inter-instructor communication, the commitment to “clean slates” to avoid prejudicing next year’s teachers with this year’s bad behavior. Are there better and worse ways to consolidate information about student behavior that will make patterns more visible?
- **Perceptions of masculinity.** Young men are in a particularly sensitive part of the life cycle in which their **sense of masculinity is developing against popular media that glorifies violence and domination.** It is often the least physically developed young boys who lose out in pecking orders that value height, masculinity, athletic prowess, and mature looks. Yet the fathers, teachers, counselors, and other men in the real world around them rarely look like Rambo and are not necessarily skilled athletes. It is this gap between the cultural icons of masculinity and the actual male models before them whose meaning, and role in adolescent pecking orders, we need to understand. This is the root of the school shooter’s marginality and it is what is driving him to take actions that seem closer to the popular culture model.

Media Violence and Youth Violence

Brad J. Bushman, Ph.D., Professor of Communication and Psychology, Margaret Hall and Robert Randal Rinehart Chair of Mass Communication, The Ohio State University & Professor of Communication Science, VU University, Amsterdam, the Netherlands

When violent shooting sprees occur, people want to identify “the” cause. Violent behavior is very complex and is caused by multiple risk factors, often acting together. One possible risk factor is exposure to violent media (e.g., TV programs, films, video games). Of course, it is impossible to know whether exposure to violent media causes shooting sprees because researchers can’t use guns in their laboratory experiments! However, in one experimental study,¹ we measured what could be considered assaultive behavior. Dutch boys ($M_{age} = 14$) played a violent or nonviolent video game for 20 minutes, and rated how much they identified with the game character (e.g., “I wish I were a character such as the one in the game”). Afterwards, they competed on a task with another “boy” where the winner could blast the loser with loud noise through headphones. They were told that the highest noise levels (i.e., 8, 9, or 10) could cause “permanent hearing damage.” Boys who played a violent game, and identified with the violent character in that game, did in fact administer potentially damaging noise blasts. During the debriefing, one boy said, “I blasted him with level 10 noise because he deserved it. I know he can get hearing damage, but I don’t care!” Another boy said he liked the violent game “because in this game you can kill people and shoot people, and I want to do that too.” A third boy said, “I like Grand Theft Auto a lot because you can shoot at people and drive fast in cars. When I am older I can do such things too. I would love to do all these things right now!”

A comprehensive meta-analysis of violent video game effects,² which included 381 effects from studies involving 130,295 participants from all over the world, found that violent video games increased aggressive thoughts, angry feelings, physiological arousal, and aggressive behavior. Violent games also decreased prosocial behavior (e.g., helping, cooperation) and feelings of empathy for others. The effects occurred for males and females of all ages, regardless of the country they live in. Similar effects have been found for all types of violent media (e.g., TV, film, music and music videos, comic books).³ A meta-analysis of 26 studies involving 13,661 participants found that violent media exposure is also significantly linked to violent behavior (e.g. punching, beating, choking others), although the effects are smaller than for aggressive behavior. This makes sense because violent criminal behavior is rarer and more difficult to predict than less severe aggressive behavior. As one example, a recent CDC-funded, cross-sectional study⁵ involving incarcerated delinquents (and a comparison group of high- school students), parents/guardians, and teachers/staff, found that consumption of violent media was related to serious violent behavior such as using a weapon against another child.

It is well known that people who consume a lot of violent media come to view the world as a hostile place.⁶ People who consume a lot of violent media also think violence is “normal” behavior, because media characters often use violence to solve their problems.⁷

It is useful to consider a child’s life as filled with a succession of social problems that must be solved. The child uses a set of programs (called *scripts*) for solving social problems. In theater, scripts tell actors what to do and say. In memory, scripts define situations and guide behavior: The person first selects a script for the situation, assumes a role in the script, and behaves according to the script. In many shooting sprees, the perpetrator puts on a uniform (e.g., hockey mask, trench coat, movie costume, military uniform), as if following a script. This allows the perpetrator to identify more closely with other killers. The perpetrator then gathers up a bunch of guns and ammunition, goes to a place where there are a lot of people gathered, kills as many people as possible, and then often kills himself. For most people, carrying out such a script would be impossible. But it can occur for some people who don’t experience negative emotions or who see such acts as normative, or for whom performing such an act might be perceived as achieving a sense of accomplishment and “leaving their mark on the world.” Consider, for example, statements made by the two killers at Columbine High School. Dylan Klebold said, “Directors will be fighting over this story.” Eric Harris added, “Tarentino, Spielberg.”

There is also a downward spiral⁸ between aggression, rejection, and consumption of violent media. Aggressive youth tend to be rejected by their peers,⁹ and therefore spend their time consuming media (often violent media) and associating with other aggressive youth (who have also been rejected by others), which, in turn makes them even more aggressive.

Aggressive youth often consume violent media because it allows them to justify their own behavior as being normal.¹⁰ A child's own aggressive behavior normally should elicit guilt, but this guilt is relieved if the child who has behaved aggressively consumes violent media. The reduction in guilt that consuming violence provides makes continued aggressive and violent behavior by that child even more likely.

Violent media often contain guns, and research has shown that the mere presence of guns, even at a subliminal level, can increase aggression.¹¹ In summary, violent behavior is very complex and is caused by multiple risk factors, often acting together. One possible risk factor is exposure to violent media (e.g., TV programs, films, video games). Although it is not the only risk factor, or the most important risk factor, it is one of the easiest risk factors to change. Other risk factors (e.g., being male, social rejection) are difficult or impossible to change. Parents can, however, restrict the amount of violent media their children consume.

Parents are the key, but producers of violent media can help parents out. For example, there could be a universal rating system on all media (TV, films, video games), with universal symbols that are easy for parents to understand. The PEGI (Pan European Game Information) system, for example, has five age-based ratings (3+, 7+, 12+, 16+, 18+) and six well-recognized symbols for potentially objectionable material (violence, sex, drugs, discrimination, fear, gambling). The current rating system is like alphabet soup and is confusing to parents (e.g., R for movies; TV-MA for TV, FV for fantasy violence in video games).¹² Another possible idea is to put warning labels on violent video games. In 1964, the U.S. surgeon general issued a warning on tobacco, and that warning appears on all tobacco products. In 1972, the U.S. surgeon general issued a warning for violent TV programs: "It is clear to me that the causal relationship between televised violence and antisocial behavior is sufficient to warrant appropriate and immediate remedial action...There comes a time when the data are sufficient to justify action. That time has come."¹³ Warning labels are like a double-edged sword. On the one hand, parents find warning labels informative.¹⁴ On the other hand, they are like magnets to children.¹⁵

Educating parents about the research on violent video games is also important. This is an uphill battle, however, because the source of news and information for parents is the mass media, and the mass media are reluctant to report that violent media are harmful.¹⁶

Almost all of the research on violent video games has been conducted using single-player video games. But players often play with others. In a pair of studies conducted in our lab,¹⁷ participants were tested in pairs with an ostensible partner of the same sex (actually a confederate). Participants in the *cooperative condition* were instructed to work together with their partner to get as many points as possible by killing enemies and staying alive. Participants in the *competitive condition* were instructed to try and kill their partner more times than their partner killed them. Participants in the *control condition* played the game in the single player mode. After gameplay, participants competed with their ostensible partner on a task in which the winner could blast the loser with loud, unpleasant noise through headphones. In both studies, participants in the cooperative condition were less aggressive than participants in the other conditions. More research on multi-player games is clearly needed.

More research is also needed on what types of individuals are most strongly affected by violent video games. Many of the spree shooters have been described as "social outcasts." Are such individuals more likely to behave aggressively after playing a violent game? Are such individuals more likely to play violent games alone?

Research should test whether aggression is enhanced by playing in a first-person compared with third-person mode, and by whether the enemies are realistic humans versus aliens. Some research has shown that the gorier the video game, the larger the effects,¹⁸ but more is needed.

Youth Violence: Influences of Exposure to Violent Media Content

Sandra L. Calvert, Ph.D., Professor of Psychology and Director of the Children's Digital Media Center,
Georgetown University

Youth have considerable access to violent media messages, as documented by content analyses of television and video game content. Between 1994-1997, 60 percent of U.S. television programs contained violent content,^{19, 20} with heavier concentrations in children's (67 percent) than in non-children's programs (57 percent).²¹ Similarly, violent content was found in 98 percent of a sample of "Teen"-rated video games that entered the marketplace in 2001 and in 64 percent of video games with an "Everyone" rating that entered the marketplace between 1985 and 2000.^{22, 23}

Theoretical Predictions About the Effects of Youth Exposure to Violent Content

Youth who are exposed to violent content can be impacted in multiple ways. In *arousal theory*, violent content can cause physiological responses to the content, such as increases in heart rate. With heavy exposure, habituation to the content occurs, with desensitization to violence taking place.²⁴ Then heavier doses of exposure to violent content must occur to obtain the initial level of physiological response. Habituation to the plights of others can also occur, resulting in a lack of empathy for people in real-life contexts. The direction in which the arousal is released that has accrued after exposure to aggressive content is based on environmental cues, so theoretically, youth could demonstrate aggressive or pro-social behavior.²⁵ In *social cognitive theory*, children and youth are more likely to imitate aggression after observing media models commit acts of aggression that are either rewarded or that have no consequences, but aggressive acts that are punished lead to decreased levels of aggression.²⁶ Therefore, it is notable that heroes are often rewarded for morally justified aggressive conduct.²⁷ In gaming, youth become the character committing the acts of aggression rather than observing it, which means that youth directly encode aggressive behavior (e.g., they know how it feels to pull a trigger to shoot others²⁸). In social cognitive theory, the behaviors that youth are taught to inhibit, such as harming others, can also be disinhibited through ongoing exposure to aggressive media experiences.

In *schema theory*, in which youth create cognitive structures that anticipate events, exposure to aggressive content can lead to expectations that they should act aggressively, particularly for males who hold traditional views of what it means to be a man. Gender stereotypes are a simple kind of gender schema.²⁹ Exposure to aggressive content can also lead to the priming of aggressive thoughts and actions, making it more likely that these behaviors will be acted upon.³⁰ In *psychoanalytic theory*, aggression is an innate drive in humans.³¹ Through catharsis, in which youth observe others act aggressively or engage in symbolic acts of aggression through game play, aggressive impulses should theoretically be harmlessly drained off through fantasy.

The Evidence

The evidence about exposure to violent media documents outcomes about stereotyped beliefs of masculinity, the motivation to perform aggressive acts, and actual aggressive conduct.

Stereotype formation. Traditional views of masculinity include the development of personality characteristics such as aggression, assertiveness, forcefulness, dominance, self-sufficiency, individualism, and competitiveness.³² Media heroes are typically depicted as males, in part, because heroes display aggression and must be daring in the face of danger, qualities that are part of the masculine role.³³ Repeated exposure to a consistent kind of message can reinforce and entrench a particular schema.³⁴ For example, those who follow traditional gender stereotypes tend to have more rigid gender schemas whereas those who are more non-traditional tend to be more flexible in their gender schemas.³⁵ Media depictions also provide male role models that display the kinds of behaviors that are expected of males, (e.g., aggression). For males who are isolated and who have weak social ties with their peers, face-to-face relationships may be displaced by relationships through characters in gaming contexts.

Motivational incentives. Motivational incentives to act aggressively include the status gained by accruing the most points and being successful and admired for that success during game play. For instance, first-person shooter games reward players with increased status for killing other players. The role of the hero may be particularly appealing to males because rewards, such as more status and power, are associated with acting aggressively.³⁶ For youth who have few social rewards in their everyday life, opportunities abound for them to assume a more successful alter identity in virtual experiences. In short, socially isolated youth can become the popular "super" male that has eluded them in their experiences with their peers.

Behavioral outcomes. Meta-analyses, in which numerous studies on a topic are analyzed, reveal that exposure to aggressive video games leads to increases in physiological arousal, aggressive behavior, aggressive thoughts, and aggressive feelings as well as to decreases in empathy and pro-social behavior.³⁷ Similarly, meta-analyses about exposure to violent television content reveal increased levels of antisocial behavior.³⁸ In addition to exposure to media violence, additional risk factors emerge in empirical studies, including prior antisocial behavior, poor social relationships, poor psychological functioning, parents who treat their children indifferently or in a rigid style, and in some instances, being a male.^{39, 40} Overall, the evidence supports the idea that exposure to media violence can increase aggressive behavior because of arousal, social learning from media models, and the development of aggressive schemas and scripts. By contrast, little evidence supports catharsis. Therefore, viewing or interacting with violent media content has been treated as a risk factor for childhood and adolescent aggressive conduct.⁴¹

Link between Media Aggression Research and Rampage Shootings

Empirical studies could never be conducted that demonstrate causal connections between exposure to media aggression and rampage shootings. Theoretically, youth who commit such crimes should be affected by media aggression in the same ways that other youth have been shown to be affected: through arousal, desensitization, lowered empathy, the development of aggressive schemas including schemas about males being aggressive, and social learning of antisocial behaviors that are rewarded in game play. However, the vast majority of youth do not kill or harm anyone even after playing aggressive video games repeatedly. The youth who do commit rampage shootings are probably on the extremes of the distribution on multiple risk factors, such as prior levels of aggression, peer rejection, and poor parental monitoring. They are also positively reinforced for rampage shootings through extensive press coverage.

Reducing the Risks for Rampage Shootings

Reducing the number of youth risk factors could potentially disrupt aggressive behavior.⁴² While reducing youth exposure to media aggression may be a partial solution to rampage shootings, the First Amendment will make it virtually impossible to limit access to violent media content. The environmental trigger that is most likely to result in these massive rampage killings is access to actual assault weapons. The use of a transparent universal ratings systems of the content on all media platforms and educating parents about the risk factors involved in youth exposure to aggressive content are viable ways to move forward. In addition, we need a better understanding of how we can mitigate these effects by conducting ongoing studies of media-aggression outcomes in our rapidly changing media environment.

Rejection and Lethal Violence

Geraldine Downey, Ph.D., Professor of Psychology and Dean of Social Sciences, Columbia University

Rejection is often identified as a trigger of lethal youth violence. Yet, rejection is ubiquitous and it rarely triggers lethal violence. In whom and under what circumstances might rejection trigger lethal violence?

Aggression Versus Ingratiation

Classic work on rejection focused on its role in inducing ingratiation and conformity. Recent work has provided robust evidence linking rejection with hostility and aggression. Efforts to reconcile these apparently contradictory consequences of rejection suggest that rejection will trigger ingratiation and other efforts to gain favor when the rejection is harsh and occurs in situations and in forms that are deeply threatening to the target's self-definition and when the target of the rejection has the possibility of gaining acceptance.⁴³ By contrast, aggression is more likely when the rejection is deemed both irrevocable and unfair because it occurs despite the individual's efforts to gain acceptance. Withdrawal is also a common response to rejection and may propel adolescents to seek distraction in cyberspace and perhaps to social media experiences that normalize violence.

Individual Differences in Sensitivity to Rejection

Everyone gets rejected. Some respond in extreme ways, whereas others respond with equanimity. Drawing on attachment theory and attributional theory,⁴⁴ the rejection sensitivity model was developed to help explain variation in response to rejection. The model posits that the experience of rejection (perhaps when combined with biological vulnerability) leads children to develop a heightened sensitivity for threats of rejection and to expect and feel angry or anxious about the possibility of rejection in situations where it might occur. Importantly, they learn to respond in an "if..then" manner to rejection cues. To reduce the sense of threat, they do whatever they think will bring acceptance, even at considerable cost to the self. If efforts to gain acceptance are met with irrevocable rejection, hostile responses to the perceived injustice may occur.

"If..Then" Perspective on Responses to Rejection Cues This perspective takes account of the fact that the cues that trigger rejection threat may be specific to the individual or group to which the individual belongs: The rejection **source** and **form** may matter. Rejection from the peer group may have a stronger impact than rejection from a significant individual on males than on females and vice versa.⁴⁵ Devaluation of valued aspects of one's identity about which one feels insecure may be particularly likely to elicit a hostile response. Among adolescent males, rejection in forms that convey powerlessness and devaluation of one's masculinity may be particularly threatening to a relative fragile sense of self and likely to elicit aggressive, power assertive efforts to get revenge.

Self-regulatory Competency

An important moderator of intense reactions to rejection (and to other sources of threat) is self-regulatory competency; that is the ability to behave in a flexible, discriminative, and strategic manner under stress that takes account of the current situation's demands and one's long-term goals.⁴⁶ Numerous studies have shown that the ability to dampen hot, impulse-driven responses has both immediate and enduring benefits. For example, rejection sensitive children who could delay gratification assessed in Mischel's classic paradigm did not show the increase in peer aggression shown by rejection sensitive children who were low in delay ability.⁴⁷ The converse, poor regulatory competency—whether dispositional or a situational response to immediate or enduring stress—is characterized by several features that facilitate extreme and highly risky reactions to threat (this is the kind of coping described by Norma Haan⁴⁸ as defensive or fragmented). First, emotions and cognitions about others are likely to be split into all good or all bad. Second, negative outcomes are catastrophized: The worst has happened and things will never get better. Third, because of the need for immediate escape from a situation perceived as unbearable, risk is underestimated and potentially effective solutions are weighted as less effective than those that may provide immediate relief but that do not solve the problem. One such response is impulsively using a lethal weapon that happens to be accessible. A second type of response that may act as a balm, in the same way as using a psychoactive substance, is engaging in planning revenge. When a young person is untethered (for whatever reason) from healthy peers and adults who can break into revenge fantasies, the same processes that lead anyone to do anything they initially find hard to do may operate: (a) There may be a facilitation/disinhibition effect of repeated consideration of the plan; or (b) a relatively simple plan to implement an intention may greatly increase the probability of its implementation.⁴⁹

Why Does Rejection Have Such a Profound Effect in Adolescence?

Two factors may make adolescents particularly sensitive to rejection and likely to overreact in aggressive ways. First, adolescence is a time when identities are being formed and consolidated. Thus, adolescents are particularly vulnerable to identity threat and may be particularly attuned to the reactions of peers. Second, adolescence is a time of considerable biological upheaval. New work from functional imaging supports the view that adolescents show both heightened reactivity in the amygdala (which is implicated in threat response) and lower activity in the prefrontal cortex (implicated in self-regulation) relative to either adults or latency age children.⁵⁰ Thus, the brains of adolescents as a group may be more prepared to react intensively and in an unmoderated way to social threat.

Why Lethal Violence?

One feature of individuals who are highly sensitive to rejection or who otherwise feel powerless is that when in a state of physiological threat, they perceive the danger posed by the threat source as exaggerated.⁵¹ Thus, presumably the magnitude of their response is likely to be exaggerated. When weapons are on hand they may be used because they may be perceived as eliminating a potentially lethal sense of psychological threat to the self.

Need for Future Research

- While the rejection sensitivity model was inspired by clinical reports of the rejection-lethal violence link, the link has not been tested.
- Rejection–violence link is evident in rampage shooting, intimate violence, and gang/drug related violence. Do the same processes apply?
- Rejection is also a trigger of suicidal behavior. Are the processes leading to these lethal behaviors the same?

Effects of Online Influences on Experiences of Rejection and Risks for Suicide and Homicide

Dan Romer, Ph.D., Director, Adolescent Communication Institute, Annenberg Public Policy Center,
University of Pennsylvania

The intersection between the experience of rejection and online communication inevitably invites consideration of the mental condition of the user. It has been noted that young rampage shooters commit suicide following their acts, placing their behavior into the highly unusual category of murder-suicide.⁵² Although murder-suicides are rare,⁵³ they are disproportionately likely to involve multiple homicide victims.⁵⁴ It is likely that suicidal youth who consider killing others as well as themselves have hostile attitudes toward others, perhaps blaming them for their condition. Given the links between bullying, suicidal ideation, and violent tendencies,⁵⁵ it is worth considering whether the growth of Internet communication has had an influence on both suicidal and homicidal ideation in young people.

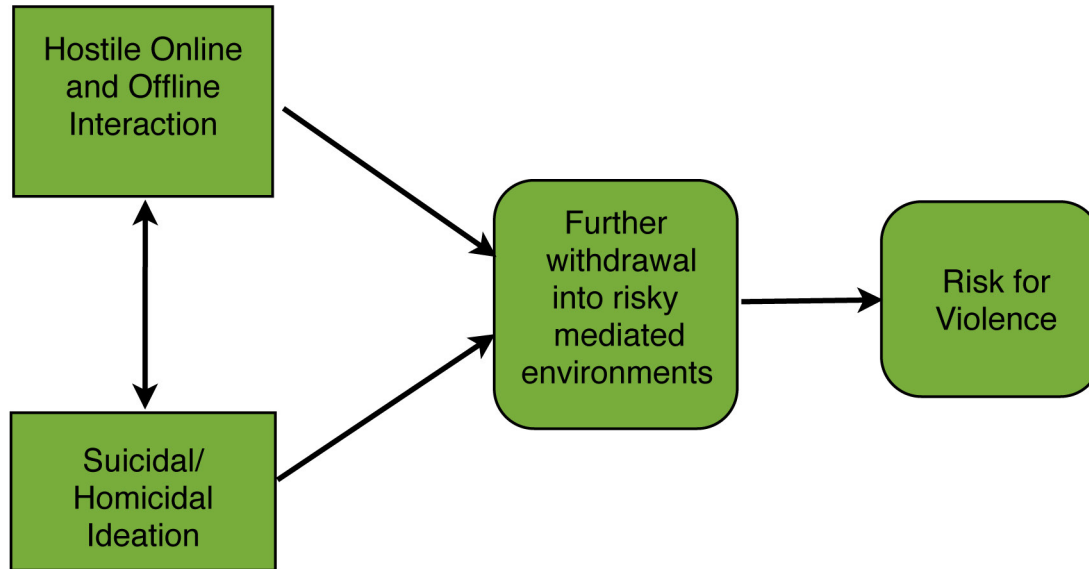
Suicide rates among young people rose dramatically in the 1960s and have remained stubbornly high to this day.⁵⁶ Trends in offline bullying, as far as we know, have remained stable or declined,⁵⁷ along with homicide rates.⁵⁸ However, rampage shootings have become more common in young people in the last 20 years.⁵⁹ Thus, it is tempting to hypothesize that recently emerging online social influences have encouraged this trend, since youth suicide has been relatively stable while homicide has declined.

One major change that has occurred with the emergence of the Internet is the much wider opportunity to make contact with others who have similar interests. In the 1960s and 70s, youth culture was mostly influenced by mass market media, such as TV, music, and films. This influence was primarily top-down from single sources to large audiences. With the advent of the Internet, youth can connect with a more diverse range of peers who have the ability to create media materials that can be shared and discussed with each other.

In our research, we have found evidence for the importance of online discussion groups in the progression toward suicidal ideation.⁶⁰ Youth who spend time chatting about suicide online report enhanced suicidal ideation. There is also some evidence that young rampage shooters join such discussions to vent their feelings of rejection and to gain the support of other similarly inclined users.^{61, 62} These discussion sites may well be places where seriously disaffected persons go that were not available prior to the advent of social media.⁶³ Thus, it may not only be the experience of rejection that has increased through online interaction (e.g., through cyberbullying) but also the opportunity to connect with others who have had similar experiences. These group interactions may intensify feelings of rejection and support for violent action.⁶⁴ When combined with suicidal intent, the risk for murder-suicide may be even greater.

Another opportunity that may have increased in the Internet era is the use of online gaming. Many of these games enable users to play with others at the same time and when they involve simulated shooting, the opportunities to intensify aggressive impulses, again supported by others, may be greater than previously available.⁶⁵ We have found that depressed and hopeless youth migrate toward gaming and Internet activity in general.⁶⁶ Aside from the direct effects of violent video games on aggressive ideation, youth who use this opportunity to play violent games may then come into contact with other similarly inclined youth, reinforcing their aggressive impulses. There is already some suggestive evidence that online violent gaming is associated with cyberbullying.⁶⁷ This may increase the exchange of rejecting messages, thereby further exacerbating hostile feelings among suicidal youth.

Future research can profit by examining the intersection of hostile and suicidal ideation in youth as a marker for youth who are at risk for murder-suicide and other violent action. At present, we know virtually nothing about this important intersection in adolescent cognition. The figure below suggests a basic model behind this proposal.



This model of mediated risk enhancement proposes that the risks of mediated communication are particularly harmful for youth who are disaffected. At left are the potential reciprocal relations between hostile interaction (both online and offline) and violent ideation. These influences in combination may encourage disaffected youth to seek out media and online activities that enhance the risk for violence by either linking with like-minded peers or becoming engrossed in violent content. Some questions raised by the model are: Is media violence more likely to be interpreted as self relevant to such youth? Do such youth perceive media violence and gaming as more realistic and aspirational than other youth?

Lessons Worth Pursuing From the Study of Suicide in Youth

Researchers have studied the problem of youth suicide for some time and various efforts have been directed toward reducing its occurrence. Given the intersection between suicidal and homicidal ideation that appears to be common in rampage shootings, it is worth considering whether some of the same strategies might be applied to this more lethal form of violence. One important effort has been to educate the press about the potential for contagion resulting from press reports of suicide (see <http://reportingonsuicide.org/>). It is not surprising that the news media cover rampage shootings heavily, but very little is known about the effects of such coverage on adolescents and young adults. Even less is known about the role of social media in echoing news reports through online friendship networks. Does such coverage increase thoughts of imitation, as it seems to in suicide? Is it more likely to influence thoughts of imitation among youth who already have thoughts of suicide and homicide? There is evidence that school shootings encourage reports of school bombings (mostly unfounded), but do vulnerable youth see such events as a way to achieve notoriety, as has been suggested in sensational coverage of suicides?

Because rampage shooters often reveal their intentions beforehand, it is also worth considering some of the strategies that have been developed to identify suicidal youth in schools so that they can be referred for appropriate mental health care.⁶⁸ These programs involve educating students and staff to the warning signs of suicide and to reducing barriers to report such signs to appropriate staff. Evaluations of these programs suggest that they can identify students and raise awareness of suicide as a risk in schools.

Some efforts along the same lines have been developed to identify youth at risk of committing violence in schools. For example, a threat assessment program developed for schools in Virginia includes strategies to reduce bullying and improve school climate in the hopes that encouraging reports of student victimization will reduce the kinds of risks that have attended mass violence in schools.⁶⁹ A statewide evaluation of the Virginia program suggests that it could be successful in improving school climate and reducing student victimization and harsh discipline that could lead to resentments against peers and school staff.⁷⁰ However, the study did not involve randomization to treatment and further research is needed to evaluate such programs.

A Brief Look at Sociological Perspectives on Peer Hierarchies, Organizational Conditions in Schools, and Youth Violence and Conflict¹

Calvin Morrill, Ph.D., Professor of Law and Sociology and Director, Center for the Study of Law and Society, University of California, Berkeley

Sociologists regard active relational practices as key social mechanisms for how youth make, unmake, and experience peer hierarchies.^{71, 72} Such practices are typically bound up in identities both locally produced and informed by broader social categories, including age, class, race, gender, and popular-cultural expression. At stake in peer hierarchies are meaningful social ties, identities, and interpersonal power. Beyond this general orientation, how sociologists conceptualize and study peer hierarchies differ dramatically. For the purposes of this memo, I concentrate on high-school youth, typically 14-19 years of age, and their experiences with interpersonal and intergroup violence, excluding mass youth violence.

Conceptualizing Peer Hierarchies

Multiple generations of sociologists, beginning with the Chicago School, emphasize insider/outsider group dynamics as constituting peer hierarchies. The earliest work along these lines focused on gangs⁷³ and then hierarchically-arrayed urban youth subcultures.⁷⁴ Coleman combined these perspectives with early network analysis to identify hierarchies of peer cliques in high schools.⁷⁵ Later, British researchers conceptualized youth subcultures as working-class resistance to capitalist domination.⁷⁶ More recently, sociologists reframed insider/outsider dynamics in terms of racially-inflected cultural boundaries.^{77, 78} A second perspective concentrates on self- and other-perceived rankings of individual youth in peer status hierarchies,⁷⁹ sometimes measuring rank as point centrality in peer social networks.⁸⁰ A newer perspective examines how youth negotiate personal and group relationships through spatial dynamics, marking and being marked by movement across and confinement within physical, social, and cultural terrains.⁸¹

The “Toll” Exacted on Youth by Peer Hierarchies

The toll on youth exacted by peer hierarchies—other than involving massive amounts of time and concern across school, home, work, and on the streets—varies tremendously with individual-level attributes, context, and type of hierarchy.⁸² In schools, self-perceived low positions in academic peer hierarchies, for example, have been associated with heightened levels of stress in female but not male youth, while self-perceived low positions in popularity hierarchies are related to heightened stress in male but not female youth.⁸³ At the same time, high-achieving students, regardless of race or gender, are often stigmatized by peers as “nerds” or “geeks,” especially when high-achievers are perceived to be socially- or economically-advantaged in some way.⁸⁴ Students who demonstrate multiple “cultural competencies” by effectively navigating across academic and popularity hierarchies (especially associated with racial or ethnic identity), often experience more positive academic and mental health outcomes than youth oriented and confined to single hierarchies.⁸⁵

From The Study of Youth Violence to the Study of Youth Conflict

During the late 20th century, sociologists and criminologists devoted enormous funds and energy investigating the intertwining of peer hierarchies with everyday urban youth conflict. This research emerged in response to the rise of urban youth assault and homicide during the 1980s and early 1990s, although urban youth violence has declined over the past decade.⁸⁶ Much of this research views urban youth violence through a gang lens, documenting and explaining it as violent, intergroup dispute settlement and status competition in illicit, inner-city drug markets.⁸⁷ There is some disagreement on differential rates of male and female gang violence, with official statistics revealing far more male than female physical violence while self-report surveys indicate equal proportions across the sexes.⁸⁸ Apart from gang violence, sociologists have investigated inner-city, interpersonal cultures of violence organized around “codes of the street” that define fighting and aggressive verbal ripostes as a way of life and the primary mechanisms for securing favorable positions in local reputational hierarchies among African American⁸⁹ and Latino male⁹⁰ and female youth.⁹¹ Scholars also argue that street codes may function less as descriptions of behavior than indexical accounts signaling cultural competence in particular urban contexts.⁹² Moreover, some urban scholars have produced evidence that peer hierarchies are less recognized by youth than by adults, both on the streets and in schools. In these instances, what bind youth are common identities with neighborhoods and/or schools, which stay with them as they move through life.^{93, 94} Far less is known about these processes in non-urban settings.

¹ I thank Michael Musheno for comments.

Turning to schools, sociologists have challenged conventional wisdom that youth at the tops of peer hierarchies are most likely to perpetrate and socially marginal youth to be victimized by peer aggression (defined as physical and verbal behavior that causes pain to another). Parallel in some ways with code-of-the-street arguments, from this perspective youth use aggression as a means to climb status hierarchies in order to sustain their relational power over peers. These effects are mitigated when cross-sex friendships are plentiful but when cross-sex friendships are rare, cross-sex interactions magnify status differences, creating the conditions for aggression.⁹⁵

An emergent perspective peels back the layers from youth violence to youth conflict practices (how youth handle trouble with peers via nonviolence and physical violence) to cultural context and peer relationships among youth. In this perspective, scholars have drawn from the law and society tradition, combined with sociology and anthropology, to examine how youth make sense of and respond to situations they find troublesome and/or threatening. Rather than focus only on violence, researchers using this approach study the entire range of youth conflict practices and decision-making perspectives revealed in long-term ethnographic observations of youth and youth narratives about conflict.^{96, 97, 98} At issue are the ways youth avoid or respond to violence in nonviolent ways. In youth narratives, for example, both male and female storytellers from low-income urban areas spin tales of lone-actor, violent aggression that overcomes the reputational stigma of being “beat down” by a peer—the classic code-of-the-street account. Observed via long-term ethnography, however, these same youth rarely engage in violent responses to reputational threats, and their conflict practices are deeply embedded in normative commitments to peer relations. When violent conflict practices occur, they commonly occur among weakly-tied youth on the front-stages of public, peer visibility; nonviolent conflict practices more commonly occur among strongly-tied youth on the back-stages of social interaction.⁹⁹ In the aftermath of peer violence with those to whom they have strong ties, youth aggressors often experience deep emotional dissonance and ambivalence^{100, 101} parallel to what adult aggressors experience.¹⁰²

How Organizational Conditions in Schools Can Affect Peer Hierarchies and Youth Conflict

Much of the research on how organizational conditions in schools influence peer hierarchies and youth violence examines delinquency prevention,¹⁰³ breakdowns in everyday social order on campuses,¹⁰⁴ the rise of penal-like disciplinary orders associated with surveillance and cultures of control (e.g., “zero tolerance” and “safe schools”^{105, 106, 107}), and the vulnerabilities of minority youth populations to such disciplinary orders.¹⁰⁸ Another emergent stream of research investigates how youth aggression—especially “bullying”—varies across organizational conditions in school contexts. This research finds that perceptions of social trust (mutual regard and expectations about commitments to others^{109, 110}) facilitates teachers and youth working together to constrain peer aggression among youth.¹¹¹ A complimentary line of research uses a long-term, multi-method case study to reveal how an urban public school historically sustained social trust in a school culture of increasing ethnoracial difference and the introduction of penal-like disciplinary orders that threatened to undermine that trust. Social trust—embedded in student-teacher alliances and campus organizations and enabled by administrators—undergirds the school’s resilience and its ability to adapt and innovate in the face of change. Social trust also creates opportunities for peers to gain competence at navigating multiple social hierarchies and collectively share geographic and other spaces. These dynamics allow student movement off and on front and back stages of peer interaction, which increases the possibilities for inclusive peer relationships that cross social lines, the capacity of youth to identify with those different from themselves, and a predominance of nonviolent conflict practices.¹¹²

A Note on Methods

Sociologists use both qualitative and quantitative methods to study peer hierarchies and youth conflict and violence, but especially favor single-site ethnographies, in-depth interviews (including narrative analysis), self-report surveys (which may span multiple sites), and analysis of institutional data. Less prevalent are multi-sited ethnographies, comparative historical analyses, field quasi-experimentation, and multi-method approaches that mix quantitative and qualitative strategies.

Future Research Questions

At the school level:

- What are the conditions (including changing levels of cultural difference, resource allocation, community change, teacher turnover, inter-organizational relations, frontline workers, etc.) under which schools can develop and sustain social trust among youth and adults over time?

- What is the relationship between social trust, the character of peer hierarchies/relations, and the repertoire of conflict practices on school campuses?
- How can school-based social trust be sustained in the face of urban and suburban change, especially as neighborhoods are gentrified or deteriorated by metropolitan development and population turnover?
- How can actions indicative of social trust be empirically measured?

At the relational and individual levels:

- How do youth conflict practices vary with the kinds of social relationships they form?
- What is the relationship between youth control of and movement across geographic and other forms of space (e.g., on line), and repertoires and usage of conflict practices among youth?
- What is the relationship between the capacity to navigate multiple peer and adult hierarchies and youth conflict practices?
- How are gender, race, ethnicity, and social class implicated in the repertoire of conflict practices available to and used by individual youth?
- How are adults implicated in the formation of peer hierarchies and patterns of aggressive conflict practices among youth?

Some Key Facts About Criminal Violence Pertinent to the Relation of Self-control to Violence

Michael Gottfredson, Ph.D., President and Professor of Sociology, University of Oregon

There is a robust and substantial correlation between misconduct early in life and violence during adolescence and adulthood. The correlation between early childhood problem behaviors and crime (including violent behavior) later in life is reported regularly in longitudinal studies from a variety of disciplines.

There is a characteristic distribution of violent behavior over the life-course, such that incidents of violence increase in frequency with age up to late adolescence or early adulthood and then rapidly and continuously decline throughout life. Violent crime, like most problem behaviors, is very disproportionately adolescent and young adult behavior. Research has shown that these rates pertain to individuals as well as aggregates.

There is a correlation between problem behaviors of parents and the level of violence of their children. Furthermore, there are correlations between the strength of attachment between children and their parents and level of crime and violence. The effect of family on crime and violence has been a staple of empirical criminology for decades.

There are substantial correlations for individuals between the level of violent behavior and the level of other forms of delinquency and criminal behavior. Also there are substantial correlations between violent behavior and other problem behavior, such as drug use, accidents, illnesses, school performance, and employment. Delinquents/offenders by and large do not specialize in violent or nonviolent behavior, a fact long validated in both self-report and in official statistics.

Much violent behavior is short-sighted, and seemingly adventitious. It produces little gain but it engenders considerable long-term negative consequences for the actor. Most violent acts are not planned long in advance, but rather often seem nearly spontaneous (and, in hindsight, even to the offender to be unaccountable). Quite frequently, alcohol or other drugs are involved.

There is considerable stability in individual differences in the tendency to engage in delinquency and crime over the life course. This is so even though the decline in crime and delinquency with age (post adolescence) maintains generally.

Individual differences in self-control or self-regulation are among the strongest and most consistently shown individual correlates of crime, delinquency, violence, and other problem behaviors. Self-control or self-restraint is among the most widely researched perspectives in the field and as such the empirical literature addressing it is large.^{113, 114, 115, 116, 117}

Interventions in early childhood may effectively alter the likelihood of later delinquency and crime. Piquero and colleagues¹¹⁸ report meta-analysis of 55 studies indicating evidence for effective interventions; for focused efforts of self-control [Piquero et al., 2010], and provide evidence for effective change based directly on self-control enhancements for a sample of 34 studies.^{119, 120}

Questions: three broad classes of issues related to mass shootings and gun violence are apparent:

- To what extent are incidents of shootings distinct from or similar to more common forms of adolescent problem behaviors in ways pertinent to etiology? Some characteristics seem similar, others different. Do such events belong in the same domain of explanation as more ordinary forms of violent and delinquent acts? In most instances of more common forms of delinquency and criminal violence, the violence permits the offender some momentary personal gain—the theft of property, the end of an argument, or even a sense of personal status. On the other hand, some criminal violence lacks apparent momentary gain or seems designed to satisfy more long-term rather than short-term objectives (even as these objectives are atypical). Contrary to most adolescent violence, some appear to be highly planned and difficult to execute. Do the individuals involved have extensive involvement with other problem behaviors? A threshold problem for the science of violent conduct is scope or definition and domain—how should these types of incidents be considered?
- How are differences in self-control or self-regulation in childhood related to exposure to weapons, to the amount and content of media, and to the frequency and nature of video games? How do they differ in degree or in kind?
- Can self-control be enhanced in effective and appropriate ways such that delinquent and criminal violence can be reduced?

See Bibliography References¹²¹

Family Roles in Youth Violence

Ann S. Masten, Ph.D., Irving B. Harris Professor of Child Development
Institute of Child Development, University of Minnesota

There is a large body of research suggesting that families are involved in many different ways in the development and prevention of antisocial and violent behavior. Many family-based qualities and processes have been implicated as important risk or protective factors for antisocial behavior, including youth violence.^{122, 123, 124, 125} Risk factors based in the family include low social status, poverty, harsh and rejecting parents, chaotic family life, interparental conflict, domestic violence, child abuse and neglect, family stress (prenatal and post-natal exposure), poor monitoring by parents, criminal behavior or incarceration of parents, and mental illness in parents. Protective factors based in the family include close attachment bonds with consistent caregivers, effective parenting, good cognitive skills or education in parents, and families that are organized, safe, and well-regulated. Many of these same family qualities implicated in research on criminality and youth violence are found across a large, global literature on risk and resilience in diverse situations of risk, ranging from studies of children in economic crisis to child soldiers or natural disasters.^{126, 127, 128} There are powerful and fundamental adaptive systems that jeopardize or protect human development in many different situations.

There is good evidence that risks and problem behaviors arising initially in the family can spread over time to affect peer interactions and success at school or work.¹²⁹ Some of these developmental cascades can increase the risks for youth violence; Dodge and colleagues have described a cascade to youth violence backed by data.¹³⁰ Evidence is growing that there may be positive cascade effects as well, when well-timed and targeted interventions have positive, spreading effects. Family-focused interventions may generate such positive cascades.

Family-focused Intervention and Youth Violence

Interventions for a broad range of conduct problems and delinquency have focused on family function, often targeting parenting behavior. Strong evidence based on experimental (randomized controlled trials) and quasi-experimental studies supports the efficacy of targeting change in family processes for prevention of antisocial behavior and crime.^{131, 132} Well-known preventive interventions in early childhood, such as the Nurse-Family Partnership pioneered by David Olds and his colleagues,¹³³ have demonstrated effects on later antisocial and criminal behavior in adolescence and early adulthood. In adolescence, Multisystemic Family Therapy (developed by Henggeler and colleagues¹³⁴) has shown short- and long-term effects on offending in youth and young adults in multiple, well-designed studies.¹³⁵

Numerous other multimodal efforts to prevent conduct problems, substance abuse, and other risky or unhealthy behaviors in youth associated with violence and serious offending have included parent training or education components. Investigators at the Oregon Social Learning Center (OSLC) have developed and tested parent management training strategies for decades that show short-term, long-term, and spreading effects over time on problem behavior in children and youth, including crime and aggressive, antisocial behavior.¹³⁶ Norway has implemented large-scale interventions focused on improved parenting using the “PMTO” model (Parent Management Training–Oregon) developed by the OSLC.

There is rapidly growing interest in the field of prevention in figuring out whether some individual children respond better to a particular prevention or treatment program. More knowledge of these differences could lead to more effective and tailored interventions, a kind of “personalized prevention.” There is particular excitement about understanding whether these differential effects are related to individual differences in sensitivity to experience.^{137, 138} Such individual differences in responsiveness to experience could have roots in genetic variation or early experience (or interplay of “G x E”), personality, or other measurable qualities at the neurobiological or behavioral level.

New research designs have emerged to study these interactions, including studies that measure specific genes in experiments to see if children with different genotypes related to greater sensitivity show greater response to the intervention. This new research on possible genetic moderating effects on intervention are called “G x I” designs, referring to gene by intervention interactions.^{139, 140} Early examples of this new work suggest that gene variations could influence who responds to family-based prevention.¹⁴¹

Recent Reports on Family Roles in Risk and Resilience

The significance of families for human development has been highlighted in a prominent series of recent national reports and journal articles that provide overviews of what we know and what we need to know about the role of families for promoting healthy development and preventing psychopathology.^{142, 143, 144} There also is a surge of research attempting to understand more deeply how good parenting works and how families can buffer their children from stress and adversity either caused by violence or leading to the development of violence, whether it arises in individual families, as in the case of abuse, or in the context of mass disasters and war.^{145, 146}

Barriers to Families Seeking Help for Youth Violence Concerns

Given the many responsibilities and roles of families, one would expect that family members would be in a good position to recognize the need for help and seek assistance; this appears to be the case in families worried about homicide, suicide, and other serious, violent behavior in their children. However, families appear to face substantial barriers to securing needed help. There is likely a variety of reasons, including lack of knowledge, lack of access to health or mental health services, costs, stigma, resistance from the youth or other family members, fear, and concerns about privacy. More research is needed on these barriers and what works to mitigate them for families with children and youth at high risk for violence, and how best to help parents who are frightened and concerned about behavior they are observing in their children.

Mining Existing Longitudinal Data on Families and Youth Violence

Many existing longitudinal studies in the United States include data pertinent to understanding pathways toward or away from violence in youth, risk, and protective influences, and the effects of particular interventions on those pathways. Some were designed to study delinquency or the roots of violence, while others were designed to understand something else entirely. These extant datasets could and should be mined further for knowledge on the antecedents and consequences of violent behavior in youth.

Building on Future Longitudinal Studies of Child Development

Forthcoming new studies with potential to inform this topic also need to be considered, including large-scale interventions and naturalistic studies. The National Children's Study is now in the development and planning stages, with preliminary studies underway. It would be wise to ensure that relevant data are included in such studies to address questions about the development of youth violence and related outcomes, including the roles of families in risk or protective processes in development. Similarly, large-scale interventions underway as a result of national initiatives such as Promise Neighborhoods or Race to the Top could be evaluated for outcomes pertinent to youth violence as well as youth achievement. Achievement and school success or failure have been implicated in many ways in research on the paths to violence.

Needed Research on Family Roles in Prenatal Development and Early Childhood

Research is needed on the role of early experiences, both prenatal and post-natal, for neurobehavioral development related to risk, vulnerability, and protective factors strongly associated with the later development of violence in children. These include the effects of physiological stress on the development of executive functions and stress-regulation systems and the effects of parenting on brain development and socialization of behaviors that predict violence. Research is also needed on the best intervention strategies for reducing stress in pregnant mothers, helping families prepare their children for kindergarten, increasing access to high-quality childcare and early learning experiences for children, and other strategies designed to promote positive development in high-risk families and avert cascades toward youth violence.

Strategies to Improve Monitoring by Parents to Reduce Youth Violence

Monitoring by parents is widely implicated in violence development and prevention in much of the research cited above and elsewhere in this Appendix. Research is needed on the best strategies and developmental timing for parents to promote positive child uses of media, safe behavior around firearms, and healthy connections to pro-social peers, activities, and mentors. Parents may not appreciate their influence on older youth, and therefore research is needed on educating parents about staying involved with their adolescent children.

Research Needed on Intergenerational Transmissions of Risk and Protection for Violence

Intergenerational transfer of risk or vulnerability for violence (through biological and social processes) is another important research topic. New frontiers of research are delineating the processes by which such risks may be transmitted to the next generation. Research also is needed on interrupting these processes and promoting positive transformations and their transmission across generations.

Improving Systems Designed to Support Families

Finally, society needs to consider its own role in family processes through child and family welfare policies and practices. Exposure to the foster care and juvenile justice systems, intended to be helpful, may have iatrogenic effects on children, increasing their risk for antisocial behavior, violence, or becoming a parent in a high-risk family. Recent research on improving the quality of foster care and support for youth who are aging out of this system is promising.^{147, 148} Similarly, housing policies and practices for residentially unstable and homeless families need to be examined with an eye toward the immediate and long-term well-being of children and their future families. Residential and school mobility in the context of poverty are associated with many of the risk factors that predict antisocial behavior and violence discussed throughout the summaries in this Appendix.^{149, 150}

Understanding Factors of Youth Violence Through the Study of Cyberbullying

Mark Dredze, Ph.D., Assistant Research Professor of Computer Science, Johns Hopkins University

Cyberbullying interactions among teenagers in social media provide new large-scale data for the study of social, behavioral, and cultural factors of youth violence.

Teens and Social Media

Social media have exploded in popularity: Facebook features 800 million users sharing 734 million comments a day and Twitter's 500 million users share 500 million tweets a day. As is common with new technology, these media have been widely adopted by teenagers: 90 percent use social media, 75 percent use a social networking site, and more than half check such sites at least once a day.¹⁵¹ Interpersonal relationships have spilled onto these sites and major aspects of active social lives involve social media, online forums, and texting. While this creates new friendships, increased social confidence, and improved self-image,¹⁵² it also means that negative and harmful interpersonal behaviors exist online as well.

Cyberbullying

Bullying poses a serious threat to children on or offline.^{153, 154} Bullied children are at increased risk for anxiety, depression, substance abuse, and mental disorders.^{155, 156} Online bullying, or cyberbullying, can take the form of messages, images, or videos meant to hurt or embarrass a person. Cyberbullying has the same potential for negative effects and can even lead to teenage suicide.¹⁵⁷ One example of cyberbullying is slut shaming, where a person, usually a woman, is made to feel guilty or inferior for engaging in sexual behaviors¹⁵⁸ by sharing a compromising picture or video. A girl's reputation can be destroyed as messages quickly spread in a large social network. School administrators, parents, and communities have focused on cyberbullying with recognition of the risks of emotional, psychological, and physical harm.^{159, 160} Increased online social activity raises the risk of being bullied¹⁶¹ and nearly three quarters of students have experienced online bullying. Often times, online bullying is an extension of in-school bullying, and the extension of bullying outside the school can further increase social anxiety.¹⁶² Furthermore, online bullying has the added concern of anonymity, which can make the problem more serious.¹⁶³ The study of bullying must include online interactions.

Bullying and Violent Behavior

The well-known association between bullying and violent behavior¹⁶⁴ has unfortunately been highlighted by mass shootings in schools carried out by victims of bullying. Bullying and being bullied correlates with greater involvement in violent behaviors, including carrying a weapon and physical fighting.¹⁶⁵ Addressing bullying behaviors is critical for violence prevention and reduction.¹⁶⁶ The confluence of these factors—social media use by teenagers, cyberbullying, and the connection between bullying and violence—means that the study of online bullying, hate speech, and violent language is critical to the understanding of social, behavioral, and cultural factors of youth violence.

Computational Methods

Computer science research for online bullying has included new user interfaces, social network mechanisms, intelligent agents, and natural language processing systems for a variety of applications.¹⁶⁷

Detection

The first step is detection: automatically finding cases of cyberbullying and offensive language. This requires natural language processing technologies that can process messages to identify examples of bullying.¹⁶⁸ Studies on this topic have collected and annotated messages for bullying language for the evaluation of automated systems. Examples include automated identification of sensitive topics, such as sexuality, race/culture, intelligence and physical attributes,¹⁶⁹ flagging negative comments that contain profanity and insults,¹⁷⁰ and general identification of offensive content.¹⁷¹ Additionally, algorithms that apply common sense reasoning can infer more subtle bullying intent.¹⁷² Others have found that considering gender and other user characteristics can improve detection.¹⁷³ Naturally, the ability to detect affect, emotion^{174, 175} and sentiment¹⁷⁶ from the message can help as well. Beyond the use of language, certain patterns in social behaviors and network can suggest bullying.¹⁷⁷ For example, a user's reaction and behavior after a social interaction can suggest bullying has taken place.^{178, 179} Some systems infer user roles in bullying interactions—the bully, victim and defender—to help identify such interactions.¹⁸⁰

Prevention and Intervention

Interfaces and agents can aid in preventing bullying, intervene in bullying interactions, or support victims of bullying, all of which can prevent negative effects. Educators can take an active role in preventing cyberbullying, much as they employ programs to combat in-person bullying in schools.¹⁸¹ Towards this goal, computer interfaces can aid teachers in identifying whether cyberbullying is occurring among students.¹⁸² Since most adults are unaware of cyberbullying—few students tell an adult about cyberbullying¹⁸³—we must consider automated prevention methods, which can be activated by bullying detection systems. For example, an automated agent can interact with bullies and victims to promote positive behavior and punish negative behavior in some online communities.¹⁸⁴ Reflective user-interactions can deter bullying by promoting empathy among users.¹⁸⁵ Finally, the negative effects of bullying can be mitigated through positive engagement and encouragement of bullied students. Bully victims can be provided with materials describing coping skills¹⁸⁶ and distressed teenagers can be automatically connected with other teens in similar situations, showing them that they are not alone.¹⁸⁷

Studying Factors of Youth Violence in Social Media

Interviews with students, parents, teachers, and school officials are the primary mechanism for studying bullying and its impact on youth violence. While valuable, interviews cannot provide direct observations of bullying situations, meaning that all information is filtered through other observers. However, the online traces of bullying behavior are preserved for study. A recent study demonstrated the potential of these “bullying traces” as a data source for the study of bullying behaviors.¹⁸⁸ Others have developed fine grained emotion identification systems, which can be used by experts to aid in the understanding of behaviors over large-scale datasets.^{189, 190} The technological capabilities that have been developed in this area for identifying bullying messages and interacting with bullied teenagers suggests that these data could be more widely used in an effort to study bullying and the factors of youth violence. The paradigm of collaboration between computer scientists and domain researchers in the analysis of large-scale social media data has already achieved success in other domains. Cross field collaborations have produced new public health information from large-scale analyses of Twitter¹⁹¹ that include the ability to track infectious disease,^{192, 193, 194, 195, 196, 197, 198, 199, 200} characterize patient safety events,^{201, 202} and learn about emerging illicit drugs.²⁰³ These investigations in health, coupled with detection algorithms for bullying behavior in social media, indicate that researchers interested in bullying behaviors and youth violence have a ready and abundant data source.

Data Mining for Prediction of Youth Violence: Methods, Challenges, Open Questions

Daniel B. Neill, Ph.D., Associate Professor of Information Systems; Director, Event and Pattern Detection Laboratory, H.J. Heinz III College, Carnegie Mellon University

“Data mining... may be particularly helpful in identifying signaling behavior that precedes rare events. What are the most recent advances in understanding signaling behavior through data mining? What are the civil liberties implications of their use?”

Background

Data mining can be defined as the science of analyzing massive, complex datasets to identify relevant patterns and other information. Most such analyses are performed automatically, using computational algorithms that scale to large quantities of data, while other approaches integrate these algorithms with human users “in the loop” (e.g., domain experts or trained analysts) to achieve results for which neither man nor machine can perform adequately alone. Typical data mining tasks include *prediction* of unknown quantities (often termed *classification* or *regression*, for discrete-valued and real-valued quantities respectively), *modeling* the relationships between variables (e.g., learning a probabilistic model) or between data records (e.g., identifying links, clusters, or groups), and *detection* of patterns (focusing the user’s attention on a small portion of the data; e.g., a subset of data records and attributes, of potential interest). Scalable and powerful algorithms exist for addressing all of these problems, and ongoing work by the data mining community continues to achieve advances in accuracy and scalability. Many questions related to *youth violence* can be framed in terms of these data mining tasks; for example, predicting whether an individual will commit a violent act (binary classification), estimating the amount of gang violence that will occur in an urban neighborhood (regression), or identifying anomalous patterns of broadcast or person-to-person communication that are potentially predictive of violence, including social rejection, expressions of violent sentiments or intentions, signs of mental illness, attempts to purchase weapons, glorification of violence, or suspicious behaviors reported by others.

Methods

To date, researchers have been successful in developing techniques for *place-based crime prediction*, including mapping, detection, and prediction of geographic “hot-spots” of crime^{204, 205, 206, 207, 208, 209} and such techniques have been used by law enforcement in cities including Chicago,²¹⁰ Los Angeles,²¹¹ Santa Cruz,²¹² and New York. These techniques work well because urban crime, measured in aggregate, often follows regular patterns, including higher crime rates in certain neighborhoods and at gang boundaries, seasonal trends, escalation of violent conflicts between gangs, and correlations of crime rates with socioeconomic status, collective efficacy,²¹³ and other neighborhood characteristics. Such techniques identify *where* and *when* crime is likely to take place, but not *who* is likely to commit the crime, and would not be appropriate to predict rare but shocking events such as Newtown. However, I would argue that reducing the overall level of street violence has tremendous direct benefits to society as well as potential to reduce individuals’ likelihood of committing violent acts. These methods also present fewer privacy concerns: Most rely only on aggregate counts of crimes and other leading indicators, or de-identified crime reports, for prediction, and in some cases can use publicly available data such as crime offense reports and 911 emergency calls.²¹⁴

Successful examples of *individual-based crime prediction* include the software used in Baltimore, Philadelphia, and Washington, D.C., to predict which individuals on probation or parole are most likely to murder or commit other crimes.²¹⁵ Such approaches rely on detailed information collected about each offender’s life history^{216, 217} and criminal record and thus will not help prevent first-time offenders. Other approaches look for suspicious *links* between individuals,²¹⁸ and are potentially useful for detecting patterns indicative of terrorist activity or organized crime, but not an individual actor working alone.

Challenges

Individual-based surveillance to predict mass shootings is inherently much more difficult than place-based surveillance for several reasons. First, there is a huge “class imbalance” problem since mass shootings are extremely rare: Even if features are identified that increase an individual’s probability of committing violence by a factor of 10, this may still mean only that one in thousands of individuals displaying these factors may actually perpetrate violence, while huge numbers of individuals may display these factors and never commit violent action. Second, there may be wide discrepancies in the amount and types of data available for each individual (e.g.,

some potentially dangerous individuals may not use online communication or may not reveal anything predictive). Third, there are huge risks to individual privacy which are difficult to mitigate (since we are inherently asking about an individual rather than a group or a place), presenting both moral and legal issues. Some of the many open questions include:

- What features can be automatically extracted from unstructured text data from online sources such as Facebook and Twitter, to be most predictive of crime (keywords, topic modeling, link structure, posting of violent images, etc.)? What additional data sources can be integrated with these to improve prediction accuracy?
- Is the amount of predictive power gained from monitoring such data sufficient to compensate for the class imbalance problem and provide actionable information?
- Can techniques for privacy-preserving data mining, which “operate on distorted, transformed, or encrypted data to decrease the risk of disclosure of any individual’s data”²¹⁹ sufficiently mitigate risks to privacy from mining individuals’ online data?
- Can crowdsourcing techniques be applied successfully to flag suspicious individuals, similar to spam email identification or flagging of inappropriate video content?
- Can Twitter and other data from the “crowd” (e.g., identifying suspicious behaviors or reporting gunshots) be used immediately prior to an event or in the early stages to appropriately warn potential victims and direct law enforcement response?²²⁰
- Are risk classification and visualization techniques used for understanding chronic disease risk factors at the population level²²¹ also useful for risk of violent action?

Patterns of Access to Guns Among Adolescents/Young Adults, Recent Advances in Interdiction, Public Opinion Toward Assault Weapons

Daniel W. Webster, ScD, MPH, Professor and Director, Johns Hopkins Center for Gun Policy and Research

Youth Exposure to Firearms in the U.S.

A 1994 supplement to the National Health Interview study collected data on gun ownership in homes with children and teens under age 18. One or more firearms were kept in 35 percent of these households and in 13 percent at least one gun was stored unlocked.²²² But the prevalence of gun ownership has been on a steady decline since the early 1990s until a recent upturn in 2012 due to a variety of societal changes.²²³ Case-control studies indicate that the presence of firearms in the home greatly increases the risk of adolescent and young adult suicide.^{224,225,226} Storing firearms unlocked is associated with increased risk for suicide²²⁷ and state laws requiring gun owners to store their guns locked up in order to prevent unauthorized youth access appear to significantly reduce adolescent suicide risks.²²⁸

Data from the 2011 National Youth Risk Behavior Survey (YRBS) indicate that 5.1 percent of high-school students in the U.S. reported that they had carried a firearm during the prior 30 days.²²⁹ Actual prevalence of gun carrying among adolescents may be higher because the YRBS does not reach adolescents who have dropped out or miss school.

There has been no national study to examine how adolescents acquire firearms; however, my colleagues and I recently analyzed data from a 2004 survey of a nationally-representative sample of state prison inmates who were younger than 21 when they committed a crime with a handgun which led to their incarceration. Nearly half (47 percent) reported that they acquired their handgun from a “street” or black market supplier and 36 percent reported acquiring the handgun from a friend or family member. Ten percent of these youth obtained their handgun through theft and 5.6 percent said that they obtained it from a licensed gun dealer, although it is against federal law for such dealers to sell handguns to youth under age 21.

Source of handgun by age at current offense (n=1,407)

	Less than 21 (n=642)		21 and older (n=765)	
	n	%	n	%
FFL	36	5.6	123	16.1
Friends/Family Member	233	36.3	323	42.2
Street/Black Market	303	47.2	224	29.3
Gun Show/Flea Market	5	0.8	19	2.5
Stolen/Victim	65	10.1	76	9.9

The forced-choice options from this standardized survey leave certain questions unanswered. Who are the “street/black market” sources of guns? How do you identify and view these sources? Studies which have devolved into these questions using qualitative research methods have found that older teens and young adults who are involved in crime are selective in deciding from whom they will buy a gun and rarely purchase a gun from a stranger.^{230,231} In my study of incarcerated youth in a high-security facility in Maryland, we found that older youths rarely bought a gun from a stranger and almost always acquired their guns through friends, family, or were connected with a supplier identified by a trusted source. This was consistent with the findings of an ethnographic study of gang members and other high-risk youth in South Chicago. Investigations of illegal gun trafficking indicate that straw purchases and straw purchase rings are the most common routes of trafficking guns to youth.²³² Although very few youth are getting guns directly from licensed gun dealers, the ethnographic survey in Chicago found that traffickers and brokers often had ties to corrupt gun dealers who could supply large quantities of guns for the underground market. A relatively small proportion of licensed gun dealers account for a large share of guns used in crime and undercover stings and legal actions against scofflaw gun dealers who facilitate illegal sales has been shown to significantly reduce the flow of guns into the illicit market.^{233,234} Strong regulation and oversight of licensed

gun dealers has been shown to reduce the diversion of guns into the underground gun market, as have several other state laws which enhance gun seller accountability such as requiring background checks for all gun sales, mandated reporting of lost or stolen guns, and permit to purchase licensing systems.^{235,236} However, no study has specifically examined the effects of these policies on youth violence.

How Should the Debates Over Gun Control Be Productively Framed to Capture the Adolescent and Young Adult Access Questions?

In my opinion, youth under age 21, who cannot legally consume alcoholic beverages in any of the 50 states due to concerns about the recklessness that commonly comes with youth and the lethal consequences of drunk driving, should be legally proscribed from purchasing or possessing handguns. Currently, the minimum age for handgun possession in 44 states is 18, in one state is 19, and in only five states is 21. Regulatory and enforcement strategies applicable to keeping guns from felons, or those whose mental illness makes them a threat to others, should be applicable to preventing the diversion of guns to the illicit market where many youth access guns. Laws requiring safe storage of firearms to prevent unsupervised, underage access that have shown to reduce adolescent suicides could be promoted and have the potential to reduce youth perpetrated gun violence. Seventy percent of adults and 52 percent of gun owners responding to a recent nationally-representative survey support setting 21 as the legal minimum age for handgun possession. There is also very broad support, including large majorities of gun owners, for policies designed to prevent criminals from obtaining firearms including universal background checks, stronger regulation of licensed gun dealers, and stiffer penalties for illegal gun trafficking.²³⁷

An Evolutionary Perspective on Youth Violence

Nina G. Jablonski, Ph.D., Distinguished Professor of Anthropology, Pennsylvania State University

Humans evolved in small, tightly knit social groups composed mostly of close kin. Ours is a particularly long-lived ape species which, throughout most of its 200,000 year history, has been characterized by low rates of natural population increase. Under these conditions, humans evolved sophisticated behavioral, social, and cultural means to prevent and mitigate interpersonal violence, and to resolve conflict by non-lethal methods.²³⁸ This does not mean that our history is characterized by a lack of aggression, rather that it has been characterized by the evolution of complex mechanisms of conflict management.²³⁹ Pro-social, affiliative, and reconciliatory behaviors are supported by several neurological structures including enlarged amygdaloid nuclei that receive cortical input and sensory information from temporal association areas.^{240, 241} These structures—particularly the lateral amygdaloid nucleus—are larger in humans than in apes and appear to be related to increased cortical input and the processing of emotion within highly communicative social networks.²⁴²

Keen powers of observation and an unmatched capacity for behavioral mimicry also are hallmarks of the modern human condition. These attributes made possible, the evolution of diverse and sophisticated modes of communication and technology, and our ability to survive under adverse and extreme environmental conditions.^{243, 244} Compared to our nonhuman primate relatives, humans are slavish imitators, and learn practical motor skills, modes, and nuances of communication, and social norms, largely by imitation.²⁴⁵ Humans are selective in who they imitate, however, and prefer to mimic individuals of high status or those whose actions have produced desired results.

The brain structures involved in interpersonal behavior and moral decision-making are influenced by a complex network of genetic, endocrine, and environmental factors.²⁴⁶ Early life stress—including maternal aggression or indifference, neglect, trauma, sexual abuse, social isolation, bullying, and peer rejection—affect the hypothalamic-pituitary-adrenocortical axis (HPA axis) and is associated with inappropriate aggression, impulsiveness, and mood disorders.²⁴⁷ Modifications of the HPA axis, in turn, modify the expression of genes involved in the production of brain proteins and affect synapse formation and structural differentiation. The magnitude of epigenetic modification of brain structure and function as the result of chronic or powerful episodic stress, especially during early life, is only beginning to be grasped.

These considerations are relevant and, possibly, indispensable as foundations for the discussions of the origins of gun violence and rampage shootings among youth. They support the hypothesis that violent antisocial rampages by youth have been rare in our species' history, and that they are provoked by a complex chain of causality that involves *ongoing interactions in developing individuals between genetic, endocrine, and environmental factors*. Chronic stress, social isolation, and estrangement, potent forms of media stimulation, and lethal weapons have only been brought together in the shaping of human behavior in very recent times.

A methodical, epidemiological approach will make it possible to discover the links, hierarchies, and thresholds involved in this chain of causality. It is unlikely that any single cause—such as stimulation by violent media (including music) or the availability of guns—is going to be necessary or sufficient to produce pathological behavior on the scale of a rampage shooting. Rather, youth whose brains have been functionally and structurally altered by chronic stress and/or depression and who are living in the absence of regular interaction with trusted peers and senior group members, may be more likely to be adversely affected by these factors.

Illumination of the complex chain of causality involved in youth violence requires large prospective studies of youth behavior involving surveys, interviews, and biological measures of stress, gene activity, and *in vivo* brain function (at least in a sample of subjects). Cross-cultural studies will also help to shed light on the relative importance of early life stressors, violent media exposure, peer behavior, and weapons availability in the manifestation of rampage shootings or other serious episodes of youth violence. In this connection, studies conducted in seemingly disparate youth cultures of Japan and Sierra Leone may be enlightening. The studies proposed here will involve multiple programs within NSF's Social, Behavioral, and Economic Sciences Directorate, as well as the social and behavior sciences offices of the National Institutes of Health.

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