



The Firearm Safety Among Children and Teens (FACTS) Consortium: defining the current state of the science on pediatric firearm injury prevention

Rebecca M. Cunningham^{1,2,3} · Patrick M. Carter^{1,2,3} · Mark Zimmerman^{2,3}

Received: May 3, 2019 / Accepted: June 26, 2019 / Published online: August 1, 2019
© Springer Science+Business Media, LLC, part of Springer Nature 2019

Abstract Five teams of FACTS researchers conducted a series of rigorous scoping reviews of the existing published scientific literature from the fields of medicine, public health, psychology, behavioral health, and criminology from January of 1985 through April of 2018 utilizing the Preferred Reporting Items for Scoping Reviews (Tricco et al., *Ann Intern Med* 169:467–473, 2018) framework to guide the search strategy, study selection, data abstraction, and analysis process. These scoping reviews characterize the existing scientific literature in five key areas related to Firearm Injury Prevention among children and adolescents (age 0–17): (1) Adolescent Firearm Carriage; (2) Risk and Protective Factors for Firearm Injury; (3) Primary Prevention Initiatives; (4) Long-term consequences and secondary prevention of negative outcomes after a firearm injury; and, (5) Effects of existing law and policy interventions on pediatric firearm outcomes. In this special issue of the *Journal of Behavioral Medicine*, we present these five scoping review articles.

Keywords Firearm · Adolescent · Children · Prevention

Firearms are the second leading cause of death among U.S. children and adolescents (age 1–17), responsible for over

1800 deaths and 7800 non-fatal injuries requiring emergency department (ED) treatment in 2017 (Centers for Disease Control and Prevention, 2017). Fatal firearm injuries have been increasing since 2013, with homicides increasing 45% and suicides increasing 49% (Centers for Disease Control and Prevention & National Center for Injury Prevention and Control, 2016; Cunningham et al., 2019b). Numbers of mass school shootings have also increased during the past 10 years, raising public awareness and concern about this public health problem (Cunningham et al., 2018). Further, current rates of firearm mortality (8.67 per 100,000) among ages 14–17, are now 15.3% higher than motor vehicle related mortality rates (7.52 per 100,000 children and adolescents). Resulting from these increases, regardless of underlying intent, middle and high school age children (age 14–17) in the United States are now more likely to die as the result of a firearm injury than from any other single cause of death.

Research funding, publications, and evidence-based interventions to decrease firearm injuries among children and adolescents have lagged substantially behind those for other forms of injury and disease (e.g., cancer, HIV) (Cunningham et al., 2019a). Recognizing the magnitude of this public health problem, the deficit of knowledge and research in this field, and the critical need to rapidly develop high quality research resources to address pediatric firearm injuries, the National Institute for Child Health and Human Development (NICHD/NIH) funded the Firearm safety Among Children and Teens (FACTS) Consortium in 2017. The primary goal of the FACTS Consortium, which includes 28 scientists from 14 academic institutions and 14 stakeholders (childfirearmsafety.org) is to reduce firearm injuries among children and adolescents (age 0–17), while also respecting firearm ownership as a vital part of the cultural fabric of U.S. society. The FACTS Consortium

✉ Rebecca M. Cunningham
stroh@med.umich.edu

¹ Department of Emergency Medicine, University of Michigan School of Medicine, 1500 East Medical Center Drive, Ann Arbor, MI 48109, USA

² School of Public Health, University of Michigan, 1415 Washington Heights, Ann Arbor, MI 48109, USA

³ FACTS Consortium, 2800 Plymouth Rd., Bldg 10-G080, Ann Arbor, MI 48109, USA

includes multidisciplinary expertise from the fields of medicine (i.e., emergency medicine, pediatrics, pediatric trauma surgery, psychiatry), public health (i.e., health behavior/education, health management and policy, epidemiology), criminology, psychology, sociology, and data and implementation science. Stakeholders include a diverse group of interested parties, including firearm owners, firearm safety trainers, educators, faith-based leaders, law enforcement, and hunting/sporting enthusiasts, who share a common goal of decreasing firearm injury and deaths among pediatric populations. The FACTS Consortium is broadly focused on developing research resources to inform the prevention of pediatric firearm injuries, including: (1) training a cadre of postdoctoral, graduate and undergraduate students to build the next generation of firearm researchers; (2) creating educational curriculum and tools for researchers about firearm injury science; (3) creating an accessible data archive of existing datasets that include pediatric firearm variables (hosted on the Consortium website www.childfirearmsafety.org) to facilitate secondary analysis and maximize past research investments; (4) funding pilot projects to generate preliminary data that inform future research to decrease the toll of child and adolescent injury and death from firearms; and, (5) creating a pediatric research agenda to inform the field.

As increasing rates of firearm deaths have renewed the focus on addressing this public health problem, several professional organizations have developed and released consensus agendas (Alper et al., 2019; Butkus et al., 2018; Dowd & Sege, 2012; Leshner et al., 2013; Ranney et al., 2017; Report of The Council on Science and Public Health, 2018) and best practice statements highlighting the need for new research. Yet, to date, we lack a comprehensive review of the extant scientific literature, especially focused on pediatric populations. Despite the dearth of federal funding during the past 20 years, researchers across multiple disciplines have continued to work to advance the science of firearm injury prevention and little had been done to catalog the state of the science. To address this gap and inform the development of a pediatric-specific research agenda on firearm injury prevention (Cunningham et al., 2019a), the FACTS Consortium focused initial efforts on summarizing the current state-of-knowledge about the science of pediatric firearm injury prevention. Five teams of FACTS researchers conducted a series of rigorous scoping reviews of the existing published scientific literature from the fields of medicine, public health, psychology, behavioral health, and criminology from January of 1985 through April of 2018 utilizing the Preferred Reporting Items for Scoping Reviews (Tricco et al., 2018) framework to guide the search strategy, study selection, data abstraction, and analysis process. These scoping reviews characterize the existing scientific literature in five key areas

related to Firearm Injury Prevention among children and adolescents (age 0–17): (1) Adolescent Firearm Carriage; (2) Risk and Protective Factors for Firearm Injury; (3) Primary Prevention Initiatives; (4) Long-term consequences and secondary prevention of negative outcomes *after* a firearm injury; and, (5) Effects of existing law and policy interventions on pediatric firearm outcomes. In this special issue of the Journal of Behavioral Medicine, we present these five scoping review articles.

The Schmidt et al. (2019) review found that most research has focused on *individual* level factors for predicting firearm victimization and perpetration across intentional (homicide and suicides) and unintentional firearm injury and death among youth. They found that firearm access was a consistent predictor of all three outcomes, but substance use was more predictive of victimization and perpetration for homicide and homicide attempts, than suicide. In addition, mental health factors were not a consistent predictor of any of the firearm outcomes reviewed.

One article in this series by Oliphant et al. (2019) characterizes the existing research on patterns, motives, and underlying risk and protective factors for adolescent firearm carriage, finding that among a literature largely focusing on urban youth, carriage appears to be highest among male Black youth, especially those engaged with the criminal justice system. Youth were also noted to carry firearms intermittently, rather than persistently, throughout adolescence and primarily for reasons of self-defense or protection in neighborhoods with elevated levels of community violence exposure. The article also summarized known risk and protective factors associated with adolescent firearm carriage, identifying that most of the literature has focused on individual level factors such as substance use, firearm availability, and delinquency. Among articles examining protective factors, school attachment, parental monitoring, neighborhood collective efficacy, and firearm policies restricting general firearm access among high-risk populations, were found to be associated with less firearm carriage among adolescents, although most articles were cross-sectional, rather than longitudinal, in nature.

The summary article by Zeoli et al. (2019) finds current U.S. firearm policies have the potential to have population-level effects on firearm suicide, nonfatal injuries, homicides, and unintentional deaths for children and adolescents. Few researchers have tested the association of these policies with child and adolescents' outcomes in a scientifically rigorous way. The review did find support in the literature, however, for a reduction in child and adolescents unintentional and firearm suicide deaths in association with child access prevention laws (CAPS laws), which pose a penalty on adults if children are able to gain access to their firearms.

With regards to primary prevention, Ngo et al. (2019) found clinician screening and education in health care settings around firearm safety, specifically when paired with the distribution of free gun locks, increases self-reports of safe firearm storage in homes with children (Rowhani-Rahbar et al., 2015). Regarding carriage, school-based programs have demonstrated positive outcomes on knowledge and attitudes on gun carriage (effects on behaviors such as carriage or use among youth are largely unknown). In viewing prevention from a community level, efforts from broader community samples (not only youth) suggest that blight reduction (e.g., vacant lot cleaning) and community greening projects have an impact on decreasing firearm assaults (Branas et al., 2011; Garvin et al., 2013; Heinze et al., 2016), other community-level interventions focused primarily on gang members, and/or adults over 18 years (Duncan et al., 2014; Furr-Holden et al., 2016; Skogan et al., 2009; Webster et al., 2013), show promise for reducing firearm injury, but need to be tested specifically among adolescent youth.

Ranney et al. (2019) summarized the state of the literature on what we know *after* a child or adolescent is shot, including the long-term consequences. Most studies available used retrospective cohorts or cross-sectional studies to describe the correlation between firearm injury and post-traumatic stress. A disproportionate number of studies examined the effect of mass shootings. Among all studies, a high rate of behavioral and physical health consequences of youth exposure to firearm injury are reported. Youth firearm injury exposure (whether mass shooting, peer and partner violence, self-harm, or unintentional injury) is clearly linked to high rates of post-traumatic stress symptoms and high rates of future repeat injury. Other studies suggest higher rates of depression, anxiety, substance use, and physical illness among both exposed youth and their parents.

The effect of the absence of significant federal funding was noted by authors in all the scoping reviews and manifests both in the lack of numbers of publications that would be expected for a public health problem of this magnitude, as well as in the strength of the evidence presented in the manuscripts to date. The latter is of critical importance as definitive science that would lead to strong recommendations on policy and practice was overwhelming not found in the scoping reviews. Thus, the lack of federal investment to seek data and solutions to firearm injury prevention among US children and teens resulted in a lack of data and evidence-based solutions that could be used to guide communities, law enforcement, schools and policy on best practices. Despite this, the current summarized literature provides the most comprehensive summary of our knowledge to date on pediatric firearm morbidity and mortality. It also provides a rich platform on which to

develop novel research and solutions that will advance the science of firearm injury and reduce the staggering toll of deaths that result from this preventable cause of pediatric mortality.

Funding This review was funded by NIH/NICHD 1R24HD087149-01A1. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funding agencies.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to report.

Human and animal rights and Informed consent Not applicable.

References

- Alper, J., French, M., & Wojtowicz, A. (2019). *Health systems interventions to prevent firearm injuries and death: Proceedings of a Workshop*. Washington, DC: The National Academies Press.
- Branas, C. C., Cheney, R. A., MacDonald, J. M., Tam, V. W., Jackson, T. D., & Ten Have, T. R. (2011). A difference-in-differences analysis of health, safety, and greening vacant urban space. *American Journal of Epidemiology*, *174*, 1296–1306.
- Butkus, R., Doherty, R., & Bornstein, S. S. (2018). Reducing firearm injuries and deaths in the United States: A position paper from the American College of Physicians. *Annals of Internal Medicine*, *169*, 704–707.
- Centers for Disease Control and Prevention. (2017). Web-based injury statistics query and reporting system (WISQARS). *US Centers for Disease Control and Prevention*. Retrieved May 1, 2019 from <http://www.cdc.gov/ncipc/wisqars>
- Centers for Disease Control and Prevention, & National Center for Injury Prevention and Control. (2016). Injury prevention and control: Data & statistics (WISQARS), key injury and violence data. Retrieved May 1, 2019 from http://www.cdc.gov/injury/wisqars/overview/key_data.htm
- Cunningham, R. M., Carter, P. M., Ranney, M., Walton, M. A., Zeoli, A. M., Alper, E., et al. (2019a). Prevention of firearm injuries among children and adolescents: Consensus-driven research agenda from the Firearm Safety Among Children and Teens (FACTS) Consortium. *JAMA Pediatrics*. <https://doi.org/10.1001/jamapediatrics.2019.1494>
- Cunningham, R. M., Goldstick, J., & Carter, P. M. (2019b). Letter to the Editor. *New England Journal of Medicine*, *380*, 1383–1385. <https://doi.org/10.1056/NEJMc1901264>.
- Cunningham, R., Walton, M., & Carter, P. (2018). The major causes of death in children and adolescents in the United States. *New England Journal of Medicine*, *379*, 2468–2475.
- Dowd, M., & Sege, R. (2012). Council on Injury, Violence, and Poison Prevention Executive Committee; American Academy of Pediatrics. Firearm-related injuries affecting the pediatric population. *Pediatrics*, *130*, e1416–e1423.
- Duncan, T. K., Waxman, K., Romero, J., & Diaz, G. (2014). Operation PeaceWorks: A community program with the participation of a Level II trauma center to decrease gang-related violence. *Journal of Trauma and Acute Care Surgery*, *76*, 1208–1213.
- Furr-Holden, C. D. M., Milam, A. J., Nesoff, E. D., Johnson, R. M., Fakunle, D. O., Jennings, J. M., et al. (2016). Not in my back

- yard: A comparative analysis of crime around publicly funded drug treatment centers, liquor stores, convenience stores, and corner stores in one mid-Atlantic city. *Journal of Studies on Alcohol and Drugs*, 77, 17–24.
- Garvin, E. C., Cannuscio, C. C., & Branas, C. C. (2013). Greening vacant lots to reduce violent crime: A randomised controlled trial. *Injury Prevention*, 19, 198–203.
- Heinze, J. E., Reischl, T. M., Bai, M., Roche, J. S., Morrel-Samuels, S., Cunningham, R. M., et al. (2016). A comprehensive prevention approach to reducing assault offenses and assault injuries among youth. *Prevention Science*, 17, 167–176. <https://doi.org/10.1007/s11121-015-0616-1>
- Leshner, A. I., Altevogt, B. M., Lee, A. F., McCoy, M. A., & Kelley, P. W. (2013). *Priorities for research to reduce the threat of firearm-related violence*. Washington: National Academies Press.
- Ngo, Q. M., Sigel, E., Moon, A., Stein, S. F., Massey, L. S., Rivara, F., et al. (2019). State of the Science: A scoping review of primary prevention of firearm injuries among children and adolescents. *Journal of Behavioral Medicine*. <https://doi.org/10.1007/s10865-019-00043-2>.
- Oliphant, S., Mouch, C., Rowhani-Rahbar, A., Hargarten, S., Jay, J., Hemenway, D., et al. (2019). A scoping review of patterns, motives, and risk and protective factors for adolescent firearm carriage. *Journal of Behavioral Medicine*. <https://doi.org/10.1007/s10865-019-00048-x>.
- Ranney, M. L., Fletcher, J., Alter, H., Barsotti, C., Bebart, V. S., Betz, M. E., et al. (2017). A consensus-driven agenda for emergency medicine firearm injury prevention research. *Annals of Emergency Medicine*, 69, 227–240.
- Ranney, M., Karb, R., Ehrlich, P., Bromwich, K., Cunningham, R., & Beidas, R. (2019). What are the long-term consequences of youth exposure to firearm injury, and how do we prevent them? A scoping review. *Journal of Behavioral Medicine*. <https://doi.org/10.1007/s10865-019-00035-2>.
- Report of The Council on Science and Public Health. (2018). *The Physician's role in firearm safety*. Retrieved May 1, 2019 from <https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/premium/csaph/physician-role-firearm-safety.pdf>
- Rowhani-Rahbar, A., Zatzick, D., Wang, J., Mills, B. M., Simonetti, J. A., Fan, M. D., et al. (2015). Firearm-related hospitalization and risk for subsequent violent injury, death, or crime perpetration: A cohort study. *Annals of Internal Medicine*, 162, 492–500.
- Schmidt, C. J., Rupp, L., Pizarro, J. M., Lee, D. B., Branas, C. C., & Zimmerman, M. A. (2019). Risk and protective factors related to youth firearm violence: A scoping review and directions for future research. *Journal of Behavioral Medicine*. <https://doi.org/10.1007/s10865-019-00076-7>.
- Skogan, W. G., Hartnett, S. M., Bump, N., DuBois, J., Hollon, R., & Morris, D. (2009). *Evaluation of Chicago ceasefire*. Washington, DC: National Institute of Justice.
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169, 467–473.
- Webster, D. W., Whitehill, J. M., Vernick, J. S., & Curriero, F. C. (2013). Effects of Baltimore's safe streets program on gun violence: A replication of Chicago's CeaseFire Program. *Journal of Urban Health*, 90, 27–40.
- Zeoli, A. M., Goldstick, J., Mauri, A., Wallin, M., Goyal, M., & Cunningham, R. (2019). The association of firearm laws with firearm outcomes among children and adolescents: A scoping review. *Journal of Behavioral Medicine*. <https://doi.org/10.1007/s10865-019-00063-y>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.