BRIEF

NPM 7.2

MCH EVIDENCE

Strengthen the Evidence Base for Maternal and Child Health Programs

Injury Hospitalization (Ages 10 through 19)

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Injury hospitalization is one of 15 Maternal and Child Health (MCH) National Performance Measures (NPMs) for the State Title V MCH Services Block Grant program. The goal of **NPM 7.2: Injury Hospitalization—Ages 10 through 19** is to decrease the rate of hospital admissions for non-fatal injury among children and adolescents ages 10 through 19. The purpose of this evidence analysis review is to identify evidence-based and evidence-informed strategies that MCH Block Grant programs can implement to ensure that hospitalization rates for children and adolescents from unintentional and intentional injury are reduced. Prevention strategies range from school-based educational curricula to safety equipment to safety guidelines and legislation. Reducing the burden of non-fatal injury can greatly enhance the life course trajectory of children and adolescents resulting in improved quality of life and cost savings.[1]

The full report and supplemental implementation resources can be found at: www.mchevidence.org/documents/reviews/npm-7-2-injury-10-19-report.pdf, and www.mchevidence.org/tools/npm/7-child-safety.php. This review was conducted as part of Strengthen the Evidence Base for MCH Programs, a Health Resources and Services Administration (HRSA)-funded initiative that aims to support states in their development of strategies to promote the health and well-being of MCH populations.

Background

Child injury[2,3] represents one of the most immediate public health threats. Children and adolescents are particularly vulnerable to injury due to their size, growth and development, inexperience, and natural curiosity (Centers for Disease Control and Prevention (CDC), 2012). In the United States (U.S.), injuries and violence are still the leading causes of death among children and adolescents with almost 14,000 deaths in 2017 (CDC, 2019). In addition, children and adolescents accounted for approximately 227,000 injury-related hospitalizations and about 8.7 million emergency department (ED) visits in the U.S. (Children's Safety Network (CSN), 2020).[4] Globally, over 644,855 children under the age of 15 were killed by an injury and between 10 million to 30 million more suffered a non-fatal injury (Sleet, 2018).[5] In 2015, the total medical costs of injury-related hospitalizations of children age 19 and younger in the U.S. was $6.6 billion.[6] The physical, social, cultural, political, and economic environments in which children live can significantly increase or decrease their injury risks (CDC, 2012).

[1] https://mchb.tvisdata.hrsa.gov/PrioritiesAndMeasures/NPMDistribution
[2] According to the World Health Organization (WHO), injury is a broad term covering a multitude of types of health problems and the most basic classification of injuries is according to whether they are unintentional or intentional (https://www.who.int/ceh/capacity/injuries.pdf).
[3] An injury is defined as "the physical damage that results when a human body is suddenly subjected to energy in amounts that exceed the threshold of physiologic tolerance—or else the result of a lack of one or more vital elements, such as oxygen" (Baker, 1992).
[4] https://www.childrenssafetynetwork.org/resources/preventing-injuries-saving-lives-video-about-csn
[5] https://www.who.int/violence_injury_prevention/child/injury/en/
[6] https://www.childrenssafetynetwork.org/infographics/cost-hospitalizations

Unintentional injuries. Unintentional injuries or injuries that were unplanned can be defined as events in which the injury occurs in a short period of time—seconds or minutes, the harmful outcome was not sought, or the outcome was the result of one of the forms of physical energy in the environment or normal body functions being blocked by external means (e.g., drowning).[7] Unintentional injuries are a leading cause of morbidity and mortality among children in the U.S. (Judy, 2011) and differ by age group. In 2018, unintentional injuries accounted for more than half of all injury-related deaths among U.S. children ages 0-19 (CDC WISQARS).[8] The relative burden of mortality is far greater at younger ages, accounting for 31.5% of all deaths for children ages 1-9 and 39.6% of deaths for children, adolescents, and youth ages 10-24 (Heron, 2018). Taking a closer look by race and ethnicity, unintentional injuries rank third for the Hispanic population, accounting for 7.3% of deaths, but it ranks fourth for the non-Hispanic white (5.1% of deaths) and non-Hispanic black (4.5% of deaths) populations (Heron, 2018).

Every hour, a child in the U.S. dies from an unintentional injury. For each death, there are 29 hospitalizations and nearly 1,000 ED visits. In total, about 1 in 5 child deaths is a result of an unintentional injury (CDC WISQARS;[9] Dellinger and Gilchrist, 2019). Unintentional injuries are typically classified according to the means of their occurrence: poisoning, burns and scalds, drowning, falls, transportation-related, and so on.[10] The leading causes of unintentional injuries vary by age with the most common resulting from motor vehicle crashes, falls, fires and burns, drowning, poisonings, and suffocation.[11] In 2018, the three leading methods of unintentional injury deaths among children and adolescents aged 10-19 years were motor vehicle traffic, drowning, and poisoning (CDC WISQARS).[12] These three methods accounted for the overwhelming majority of all unintentional injury deaths for adolescents 10-19 years of age in the last decades.

Intentional injuries. Although unintentional injuries are the most common intent underlying injury deaths among children, intentional causes are increasingly common with injury deaths during adolescence (Cunningham et al., 2018). Intentional injuries refer to injuries resulting from purposeful human action, whether directed at one's self or others.[13] These injuries include interpersonal violence (homicide, sexual assault, youth violence, neglect and abandonment, and other maltreatment), suicide, and collective violence (war).[14] Intentional injuries are most prevalent among adolescents. Major risk factors for intentional injuries from interpersonal or self-inflicted violence include access to firearms, history of interpersonal violence, alcohol abuse, mental illness, poverty, cultural and social background, and loss.[15, 16] Being a victim of violence or witnessing a violent act is linked to lifelong negative physical, emotional, and social consequences.[17] A history of exposure to adverse experiences in childhood is associated with health risk behaviors such as smoking, alcohol and drug use, and risky sexual behavior, as well as obesity, diabetes, sexually transmitted diseases, attempted suicide, and other health problems (National Prevention Council, 2011).[18]

Data on unintentional and intentional injuries. The following table highlights the leading causes of injury deaths and nonfatal injury ED visits—both unintentional and intentional—by age group for adolescents, youth, and young adults.

[7] https://www.maine.gov/dhhs/mecdc/population-health/inj/unintentional.html
[8] Data source: National Center for Health Statistics (NCHS), National Vital Statistics System. Produced by: National Center for Injury Prevention and Control, CDC using WISQARS. https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_injury_deaths_highlighting_unintentional_2018-508.pdf
[9] http://www.cdc.gov/injury/wisqars/index.html
[10] https://www.who.int/ceh/capacity/injuries.pdf
[11] https://www.maine.gov/dhhs/mecdc/population-health/inj/unintentional.html
[12] Data source: National Center for Health Statistics (NCHS), National Vital Statistics System. Produced by: National Center for Injury Prevention and Control, CDC using WISQARS. https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_injury_deaths_highlighting_unintentional_2018-508.pdf
[13] https://www.maine.gov/dhhs/mecdc/population-health/inj/intentional.html
[14] https://www.who.int/ceh/risks/cehinjuries2/en/
[15] https://www.maine.gov/dhhs/mecdc/population-health/inj/intentional.html
[16] https://www.nwhu.on.ca/ourservices/SafetyandInjuries/Pages/IntentionalInjuries.aspx
[17] https://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Injury-and-Violence
[18] https://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Injury-and-Violence/determinants

Rank	Leading causes of injury deaths by age group, U.S.—2018[19]		National estimates of the 10 leading causes of nonfatal injuries treated in hospital Emergency Departments, U.S.—2017[20]	
	10-14	15-24[21]	10-14	15-24[22]
1	Suicide suffocation (361)	Unintentional motor vehicle traffic (6,308)	Unintentional struck by/against (451,267)	Unintentional struck by/against (755,114)
2	Unintentional motor vehicle traffic (360)	Unintentional poisoning (4,245)	Unintentional fall (451,183)	Unintentional fall (671,408)
3	Suicide firearm (134)	Homicide firearm (4,107)	Unintentional overexertion (222,433)	Unintentional motor vehicle occupant (595,092)
4	Homicide firearm (134)	Suicide firearm (2,995)	Unintentional cut/pierce (99,249)	Unintentional overexertion (493,072)
5	Unintentional drowning (86)	Suicide suffocation (2,237)	Unintentional unknown/ unspecified (67,107)	Unintentional cut/pierce (345,982)
6	Unintentional fire/burn (52)	Suicide poisoning (454)	Unintentional motor vehicle occupant (64,349)	Unintentional other specified (331,389)
7	Unintentional suffocation (43)	Unintentional drowning (431)	Unintentional other bite/sting (57,014)	Other assault struck by/against (312,205)
8	Unintentional other land transport (37)	Homicide cut/pierce (256)	Other assault[23] struck by/against (54,366)	Unintentional poisoning (246,611)
9	Unintentional poisoning (23)	Undetermined poisoning (224)	Unintentional pedal cyclist (49,283)	Unintentional other bite/sting (147,861)
10	Suicide poisoning (20)	Suicide fall (205)	Unintentional other transport (40,876)	Unintentional unknown/ unspecified (122,980)

"Mortality from all three forms of injury death—unintentional injury/accidents, suicide, and homicide—have increased for children and adolescents ages 10-19 in recent years after years of sharp decline."

— CDC, NATIONAL CENTER FOR HEALTH STATISTICS[24] (CURTIN ET AL., 2018)[25]

State inpatient database. NPM 7 is measured through data collected in the State Inpatient Databases (SID), a family of databases and software tools developed for the Healthcare Cost and Utilization Project (HCUP).[26] The SID includes inpatient discharge records from community hospitals in that state providing a unique view of inpatient care in a defined market or state over time.[27] The SID was developed through a Federal-State-Industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ) to help inform decision-making at the community, state,

[19] Data source: National Center for Health Statistics (NCHS), National Vital Statistics System. Produced by: National Center for Injury Prevention and Control, CDC using WISQARS. https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_injury_deaths_highlighting_unintentional_2018-508.pdf

[20] Data source: NEISS All Injury Program operated by the Consumer Safety Commission (CPSC). Produced by: National Center for Injury Prevention and Control, CDC using WISQARS. https://www.cdc.gov/injury/wisqars/pdf//leading_causes_of_nonfatal_injury_2017-508.pdf

[21] Unfortunately, the data source age groupings are not in line with the NPM age distinctions. Although the data go beyond the age of 19 and should be viewed with that limitation in mind, it still gives an indication of the leading causes of death and hospitalization for adolescents, youth, and young adults.

[22] Unfortunately, the data source age groupings are not in line with the NPM age distinctions. Although the data go beyond the age of 19 and should be viewed with that limitation in mind, it still gives an indication of the leading causes of death and hospitalization for adolescents, youth, and young adults.

[23] Includes all assaults that are not classified as sexual assault. It represents the majority of assaults.

[24] https://www.cdc.gov/nchs/pressroom/nchs_press_releases/2018/201806_Youth_Injury_Mortality.htm

[25] https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_04.pdf

[26] https://www.hcup-us.ahrq.gov/overview.jsp

[27] https://www.hcup-us.ahrq.gov/sidoverview.jsp

and national levels.[28] Over the last decade, there has been a steady decline in the injury hospitalization rate for adolescents ages 10 to 19 with the exception of a slight spike in 2015.[29] In 2016, the injury hospitalization rate was 216.4 per 100,000 adolescents ages 10-19.[30, 31]

Three E's of injury prevention. An approach to injury prevention is a focus on the *"Three Es: Education, Enforcement, and Engineering/Environment"* with the most effective injury prevention efforts using a combination of these strategies (CDC, 2012). More specifically:

1. **Education** and training can inform the public about potential risks and safety options and help people behave safely (e.g., through home visitation programs, by teaching expectant parents how to properly use a child safety seat),
2. **Enforcement** and enactment of laws and policies uses the legal system to influence behavior and the environment and can be very effective in preventing injuries, especially when combined with education (e.g., seat belt laws, healthy housing codes), and
3. **Engineering and environmental** solutions can reduce the chance of an injury event or reduce the amount of energy to which someone is exposed (e.g., tamper-proof packaging on medications, safety surfacing on playgrounds) (CDC, 2012).[32, 33]

THREE E'S OF INJURY PREVENTION

Injury hospitalization Evidence-based or informed Strategy Measures (ESMs). Across the states and jurisdictions that chose injury hospitalization as one of the NPMs, there are currently 17 ESMs that have been chosen by Title V agencies to monitor progress in advancing NPM 7.2. These ESMs fall into three categories:

- 2 represent activities directed to professionals (e.g., training activities, technical assistance),
- 8 are directed to families and their children (e.g., outreach materials to families, family-to-family support, development of care coordination plans), and
- 7 represent activities related to systems-building (e.g., engagement of stakeholder groups, quality improvement initiatives, collaboration between systems of care).

Findings from this report—specifically the evidence-based and evidence-informed interventions identified—can be used by Title V programs as models to strengthen current ESMs or to develop new measures to affect change for each of these categories.

Against a matrix of the "MCH Pyramid,"[34] the conceptual framework for services of the Title V MCH Block Grant program, of the 17 ESMs that focus on NPM 7.2:[35]

- 11 measure activities related to public health services and systems (foundational level of the pyramid) and

[28] https://www.hcup-us.ahrq.gov/sidoverview.jsp
[29] Data for 2016 and onward are based on ICD-10-CM and may not be comparable to previous ICD-9-CM estimates. This analysis is limited to community non-rehabilitation hospitals, which are defined as short-term, non-Federal hospitals. Community hospitals include obstetrics and gynecology, otolaryngology, orthopedic, cancer, pediatric, public, and academic medical hospitals. Excluded are long-term care facilities such as rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. U.S. estimates are calculated using the available State data and are not nationally weighted; therefore, U.S. estimates may not be comparable across years due to the different states included in any given year. For more information about the HCUP State Inpatient Databases (SID), please visit https://www.hcup-us.ahrq.gov/sidoverview.jsp. Population denominators are produced by the U.S. Census Bureau Population Estimates Program and reflect estimates as of July 1 for the data year.
[30] https://mchb.tvisdata.hrsa.gov/PopulationDomain/Detail/ChildHealth
[31] Overall, the rate for child injury for infants and children ages 0-9 is lower than the adolescent rate.
[32] https://www.childrenssafetynetwork.org/sites/childrenssafetynetwork.org/files/Evidence-Based%20Strategies%20FINAL.pdf
[33] Interestingly, a recent article argued that a fourth E, equity, must be used with the 3 E's approach to injury prevention (Giles, Bauer, & Jull, 2019). Although the 3 E's approach is grounded in assumptions that it is effective for everyone, there is evidence that it fails to consider opportunities for all populations to experience safe and injury-free lives (Giles, Bauer, & Jull, 2019). In addition, some organizations, such as Safe Kids Worldwide, have expanded the list to 6 E's adding evaluation, economic incentives, and empowerment (https://www.safekids.org).
[34] Title V Maternal and Child Health Services Block Grant to the States Program: Guidance and Forms for the Title V Application/Annual Report (OMB No. 0915-0172; Expires 12/31/2020).
[35] The conceptual framework for the services of the State Title V MCH Block Grant is envisioned as a pyramid with three tiers of services and levels of funding that provide comprehensive services. A goal is to "move on down" the pyramid with more states and jurisdictions engaging in public health services and systems. See https://mchb.tvisdata.hrsa.gov/Glossary/Glossary for a graphical representation of the pyramid.

- 6 measure strategies related to enabling services (middle level of the pyramid).
- There are currently no Title V programs funding strategies related to direct services in regards to reducing injury hospitalization (gap-filling level of the pyramid).

The MCH Evidence Center uses Results-Based Accountability (RBA)[36] as a conceptual framework to track how ESMs are measured. This framework consists of increasing levels of measurement across four quadrants (Quadrant 1 being the simplest measurement and Quadrant 4 being the most complex). States and jurisdictions should focus efforts in expanding how they measure programs by moving up the RBA quadrant scale.[37, 38]

- 16 current injury hospitalization ESMs measure effort:
  - 12 ESMs fall within Quadrant 1 (measuring the quantity of agency effort) and answer the question "what did we do?" (e.g., counts and "yes/no" activities) and
  - 4 ESMs fall within Quadrant 2 (measuring the quality of effort) and answer the question "how well did we do it?" (e.g., reach, quality of materials, satisfaction of intervention).
- 1 current injury hospitalization ESM measures effect (e.g., increases in skills/knowledge, change in behavior or circumstance):
  - 1 ESM falls within Quadrant 3 (measuring the quantity of the effect) to answer the question "is anyone better off?" (e.g., numbers of providers with increased knowledge).
  - There are currently no ESMs that fall within Quadrant 4 (measuring the quality of the effect) and answer "how are they better off?" (e.g., percentages of families whose self-efficacy improved).

Methods and Results

The child injury prevention research literature is vast and covers many types of injuries across different age groups. A preliminary database search by the Johns Hopkins University team yielded >20,000 results. In order to select a manageable corpus of studies, and align this evidence review with Title V priorities, this review built on the work of the Children's Safety Network (CSN), a national resource center funded by the Health Resources and Service Administration's Maternal and Child Health Bureau (HRSA MCHB) to support states and jurisdictions in implementing effective strategies to reduce injuries and hospitalizations. CSN's white paper *"Evidence-based and Evidence-informed Strategies for Child and Adolescent Injury Prevention"* (May 2019) lays out a roadmap for all the major injury areas, and identifies relevant systematic reviews in the injury prevention literature.[39]

In consultation with CSN and HRSA MCHB, a decision was made to focus on the systematic reviews identified in the CSN white paper, and to select studies from those reviews that fell within the last decade (2008-2019). It is important to note that there may be research prior to these years demonstrating effective interventions in the various injury areas. However, this approach enabled a comprehensive overview of the different injury areas and provided a basis for analyzing and summarizing effective strategies for each type of injury. A total of 425 studies were included across both evidence reviews for children and adolescents 0-19 years old.

Evidence continuum. Each study received a rating of effectiveness based on its own merit and each intervention type was rated for its overall level of evidence to speak to the public health impact. The intervention strategies were then placed along a continuum from *evidence against* (least favorable) to *scientifically rigorous* (most favorable) by setting. See the full evidence reviews for evidence ratings and strategies for each child injury area and evidence continuums for strategy types.[40]

Summary of evidence-based strategies across injury areas. The table below highlights intervention strategies with the ***highest*** evidence ratings in this review.[41] Notably, multicomponent interventions seem to be particularly effective across injury areas. This major takeaway is in alignment with the CDC finding that the most effective injury prevention efforts use a combination of strategies (CDC, 2012).

[36] RBA is described in the RBA Implementation Guide http://raguide.org/index-of-questions/
[37] ESM Review & Resources: National Summary https://www.mchevidence.org/documents/ESM-Review-National-Summary.pdf
[38] To search the MCH Library to find state ESMs, visit: https://www.mchlibrary.org/evidence/state-esms.php
[39] https://www.childrenssafetynetwork.org/sites/childrenssafetynetwork.org/files/Evidence-Based%20Strategies%20FINAL.pdf
[40] www.mchevidence.org/documents/reviews/npm-7-1-injury-0-9-report.pdf and www.mchevidence.org/documents/reviews/npm-7-2-injury-10-19-report.pdf
[41] There were no evidence ratings of scientifically rigorous or moderate evidence for Drowning, Falls and Playground Safety (one study, Pearn 2008, received a moderate evidence rating, but it was an intervention focused on children 0-4-years old), Motor Vehicle for Teen Passengers, and Bicycle-related. Therefore, these injury areas are not included in this summary table of highly rated, evidence-based strategies.

Summary of Evidence-Based Strategies Across Injury Areas			
INJURY AREA	INTERVENTION TYPE	INTERVENTION STRATEGY	EVIDENCE RATING
General Home Safety	Education + Environment/ Engineering + Enforcement	Home visiting with safety education, the provision of safety equipment, and enforcement of a safety checklist	Moderate evidence
Poisoning	Education + Environment/ Engineering + Enforcement	Home visiting with safety education, the provision of safety equipment, and enforcement of a safety checklist	Moderate evidence
Fires, Burns, and Scalds	Education + Environment/ Engineering	Home visiting with fire safety education and installation of smoke alarms	Moderate evidence
Sports and Recreation	Education	Educational materials on sports-related safety *(e.g., safety video and brochure)*	Moderate evidence
		Injury prevention warm-up program *(e.g., FIFA 11+ injury prevention complete warm-up program for female soccer players)*	Moderate evidence
Child Pedestrian-related	Environment/Engineering	Infrastructure changes to increase pedestrian safety *(e.g., installing new traffic and pedestrian signals; adding exclusive pedestrian crossing times; installing speed bumps, speed boards (radar-equipped digital signs that tell drivers how fast they are moving), and high-visibility crosswalks; and enforcing new parking regulations)*	Moderate/Emerging evidence
Firearm-related	Environment/ Engineering + Enforcement	Child access prevention (CAP) laws for safer storage of firearms	Moderate evidence
Underage Alcohol Use	Education	Universal, multicomponent school-based social and character development programs	Scientifically rigorous/ Moderate evidence
		Personality-targeted programs for students with high-risk personality traits *(e.g., anxiety sensitivity, hopelessness, impulsivity, and sensation seeking)*	Scientifically rigorous/ Moderate evidence
		Community-wide anti-binge drinking intervention	Moderate evidence
		School-based programs focused on social influence and harm minimization	Moderate/Emerging evidence
Illegal Drug Use	Education	Universal, multicomponent school-based social and character development program *(e.g., health motivation, social skills, social influence recognition, and knowledge development)*	Scientifically rigorous/ Moderate evidence
		Multi-year, motivational interviewing-based program	Moderate/Emerging evidence
		Classroom behavior management program *(e.g., Good Behavior Game introduced in 1st and 2nd grades aimed at socializing children to the role of being a student and reducing aggressive, disruptive behavior; same students were followed up at ages 19-21)*	Moderate/Emerging evidence
		School-based curriculum focused on social influence and harm minimization	Moderate/Emerging evidence
Bullying	Education	Single-component universal prevention programs *(e.g., coaches organize structured activities during recess and game times in classrooms)*	Moderate evidence
		Single-component selective prevention programs *(e.g., lunchtime mentoring program)*	Moderate evidence
	Education + Environment/ Engineering + Enforcement	Multicomponent universal prevention programs *(e.g., a school-wide program with a bystander-type intervention intended to raise awareness of the group's role, increase empathy for victims, promote strategies and self-efficacy to support victims, and increase coping skills for those who are bullied, with an anti-bullying computer game for primary school students, internet forum for secondary school students, environmental changes such as posters and brightly colored vests to increase teacher visibility in hallways, playgrounds, etc., direct interventions with students involved in bullying incidents (both children and youth who are bullied and children and youth who bully), and parents' guides)*	Scientifically rigorous/ Moderate evidence
	Education	Multicomponent selective prevention programs *(e.g., cognitive behavioral skills building with 8 weekly hour-long group sessions of cognitive therapy using role play and group discussions, education on bullying behaviors and adaptive coping strategies, and parental group meetings)*	Moderate/Emerging evidence

Summary of Evidence-Based Strategies Across Injury Areas

INJURY AREA	INTERVENTION TYPE	INTERVENTION STRATEGY	EVIDENCE RATING
Youth Violence	Education	Intensive residential military-styled programs *(e.g., intensive 17-month residential program divided into three phases: 1) a two-week orientation and assessment period, 2) a 20-week residential phase built around eight core components designed to promote positive youth development, and 3) a one-year post-residential phase featuring a structured mentoring program)*	Moderate evidence
Dating Violence	Education	Standard educational program *(e.g., curriculum including lessons on healthy relationships, sexual health, and substance use prevention)*	Moderate evidence
		Social norms theory interventions *(e.g., intensive bystander training for students who were considered popular opinion leaders taught by rape crisis center personnel)*	Moderate evidence
		Bystander interventions focused on dating violence *(e.g., traditional dating violence awareness program for undergraduate students)*	Moderate evidence
		Bystander interventions focused on sexual assault *(e.g., 20-minute video on changing attitudes and positive bystander behaviors viewed in regular high school classrooms by the entire class with vignettes on dating violence and sexual assault)*	Moderate evidence
Suicide	Education + Environment/ Engineering	Selective/Indicated interventions targeted to suicidal adolescents and their families *(e.g., individual and family therapy sessions, based on family interaction theory; comprehensive school- and home-based suicide prevention program for youth identified as at risk for suicide)*	Moderate evidence
	Education	Classroom behavior management program *(e.g., Good Behavior Game introduced in 1st and 2nd grades aimed at socializing children to the role of being a student and reducing aggressive, disruptive behavior; same students were followed up at ages 19-21)*	Moderate/Emerging evidence

Discussion and implications. Education and training in injury prevention were utilized as key strategies to reduce injuries and violence. The goals of these educational programs across injury areas were to change attitudes and perceptions, minimize risky behaviors, and motivate behavior change for children, parents/caregivers, and families, providers and other professionals such as teachers and child care providers. These education-based injury prevention programs developed effective educational materials, tools and resources, adapted and built upon best practices and practice-based evidence, and utilized new educational technologies to reach children and families. The creation of targeted, compelling, and consistent child injury prevention messages was pivotal to the success of educational initiatives aimed at inciting behavior change and promoting the uptake of safety practices. More specifically, parent educational opportunities, home visiting programs, and school-based educational programs proved highly effective at promoting a culture of safety and preventing child injuries and violence.

Reduced risk-taking oftentimes is a complement to environmental modifications. Policies regarding safe environments and products and safe behaviors have changed norms in communities and nationally. Effective injury prevention programs emphasized the importance of environmental modifications to ensure safety (e.g., smoke alarms, handrails, four-sided swimming pool fences) and the correct and consistent usage of safety devices and equipment (e.g., bike helmets, protective equipment, seat belts). Injury prevention programs also focused on better compliance and enforcement of existing policies and guidelines (e.g., enforcement of home safety checklists, safety standards for playgrounds). Systems-based initiatives affecting populations by changing the context in which individuals take actions and make decisions have led to greater uptake of safety practices. Further, public education campaigns and ongoing advocacy have been essential complements to safety legislation with enforced compliance.

Cross-system collaboration: Injury prevention is everybody's business. Many of the causes of child and adolescent injury are priority issues not only for HRSA MCHB, but for other federal agencies such as the CDC, Department of Education, Department of Justice, National Highway Traffic Safety Administration, Substance Abuse and Mental Health Services Administration, Administration for Children and Families, and Consumer Product Safety Commission. The multiplicity of stakeholders, including professional associations, advocacy groups, and health care

delivery systems, provide both opportunities and challenges for collaboration with Title V in implementing effective program initiatives at the national, state, and community level. There is a need to improve collaboration between agencies and other stakeholders to address child injuries in a coherent manner (Harvey et al., 2009). Program delivery modalities that are a part of the repertoire of current Title V program initiatives that deliver a range of MCH services, such as home visiting programs and school-based interventions, offer an entrée into child injury and violence prevention that is both practical and cost-effective.

Implications for policy and practice. The research being conducted to prevent child injury, support uptake of safety practices, and decrease the rate of injury hospitalization provides valuable insights that can inform current Title V program initiatives and partnerships to improve the health and well-being of children and their families.

1. **Considerations for vulnerable populations:** To reduce persistent inequities in child injury, program implementation and cultural adaptations of effective interventions should take into account the children at greatest risk for injury. The research has demonstrated that injury-related death and disability are more likely to occur among males, children of lower socioeconomic status, those living in specific geographic regions, and in certain racial/ethnic groups.[42]
2. **Child development and safety:** Child development is an important consideration in injury prevention and implementation of safety practices. Effective interventions duly consider age-appropriate prevention strategies, and partner parents with professionals who can increase knowledge and encourage uptake of safety practices based on the child's developmental stage.
3. **Safety considerations for children and youth with special health care needs (CYSHCN):** CYSHCN may have unique considerations for safety and injury prevention given their chronic physical, developmental, behavioral, or emotional conditions. By increasing parental awareness of the potential added complexity of creating a safe environment for their child and guiding parents towards community, state, and national resources, health care professionals can help parents provide a safe environment for their child to thrive and flourish.[43]
4. **Child injury and parental stress:** Childhood injuries have ripple effects and can also cause great trauma and stress for parents and caregivers, siblings, and other family members. When traumatic stress reactions persist for longer than a month, or inhibit normal life, then it is important for parents and caregivers to seek support for themselves.
5. **Parental and caregiver education and training to improve uptake of safety practices:** Parent education and training programs can improve maternal and paternal health, child behavioral problems, and parenting practices (Emery, 2017). Studies in this review demonstrate that by enabling services such as parent and caregiver education, especially when delivered as part of a home visiting program and combined with the provision of safety equipment, there can be an increased uptake of home safety practices, which can prevent injuries such as fires, burns and scalds, poisoning, drowning, and bicycle-related injuries, and diminish the risk of child maltreatment and motor vehicle crashes. Parenting education interventions focused on safety are important to inform a reduction in unintentional injury among children and improving home safety (Emery, 2017).
6. **Integrating child injury prevention into home visiting programs:** Home visitors can play an essential role in raising awareness about injury hazards, identifying risk and protective factors in the home, and teaching parents and caregivers how to prevent injuries in a culturally competent and developmentally appropriate way.[44] Research shows that home visiting can be highly effective in reducing intentional injuries, such as child maltreatment, as well as preventing unintentional injuries that happen in and around the home, such as suffocation, fires, burns and scalds, poisoning, drowning, falls, firearm-related injuries, pedestrian and bicycle-related injuries, and motor vehicle crashes.[45] Home visiting featured prominently as an effective intervention strategy across multiple injury areas in the review for children ages 0 through 9;[46] however, since it is an important strategy for preventing a number of unintentional injuries, it is therefore applicable to include in this review.

[42] For more information on disparities in child injury, see Considerations for Vulnerable Populations in the Discussion section of the full report.
[43] https://brightfutures.aap.org/Bright%20Futures%20Documents/BF4_Safety.pdf
[44] http://www.amchp.org/AboutAMCHP/Newsletters/Pulse/Archive/2014/NovemberDecember2014/Pages/Feature9.aspx
[45] http://www.amchp.org/AboutAMCHP/Newsletters/Pulse/Archive/2014/NovemberDecember2014/Pages/Feature9.aspx
[46] See evidence review for NPM 7.1: Injury Hospitalization – Ages 0 through 9.

7. **Use of the clinical setting to reduce child injury risk:** Health care professionals can act as safety advocates by disseminating information about child injury risks and encouraging uptake of safety practices within the context of direct health care services such as well-child visits. Health care providers can use resources such as *Bright Futures*, a national health promotion and prevention initiative led by the American Academy of Pediatrics and supported, in part, by HRSA MCHB, to provide age-appropriate injury prevention guidance to families, support evidence-based prevention practices, and promote the use of and access to safety devices.[47, 48] Studies in this review utilized the clinical setting to reduce injury risks associated with home safety, alcohol and drug abuse, self-harm, and violence. Because of their interactions with children and families, health care providers are in a position to effectively communicate best practices to reduce risk and prevent injury.
8. **School-based educational programs to improve children's safety knowledge, skills and behaviors:** School-based educational programs offer the opportunity to deliver preventive interventions to a large number of school-age children by improving their safety knowledge and skills, as well as their risk-taking behaviors and practices (Orton et al., 2016). Studies in this evidence review demonstrate that when used as early as possible, school-based interventions—universal, selective, and indicated—focused on "good behavior," life skills, social norms, social competence, positive youth development, and so on, can be effective in preventing substance abuse, violence, and self-harm, and can positively impact the lifelong trajectory of children. Not only does the prevention of injuries and violence help improve the school learning environment, but school-based education prevention programs could have a broader impact on community-wide efforts to promote safety (CDC, 2006).[49]
9. **Benefits of environmental modifications and the provision of safety tools:** Different environmental modifications are necessary during each stage of development from infancy through adolescence. Environmental and engineering interventions change the design of products or the physical environment to prevent injuries and are oftentimes coupled with education to encourage knowledge and behavior change and encourage uptake of the modifications or safety tools. Studies in this evidence review demonstrate that environmental modifications and safety equipment can prevent fires, burns and scalds, poisoning, drowning, motor vehicle-related injuries, and bicycle-related injuries. Interventions that provide free, low-cost, or discounted safety equipment appeared to be more effective in improving some safety practices. When safety practices involved little time, expense, or hassle, there seemed to be greater engagement and uptake by parents and caregivers.
10. **Adoption of safety guidelines:** There are global and national organizations dedicated to recommending guidance to promote safety and prevent injury. Safety tips can be organized by child age (e.g., babies 0-12 months, little kids 1-4 years, big kids 5-9 years, pre-teens 10-14, teens 15-19, CYSHCN), risks (e.g., bicycle, booster seat, sleep safety, burns and scalds, water and drowning, falls, sports, teen drivers), and space and place (e.g., home, sports and play, car and road).[50] Studies in this evidence review demonstrate the effectiveness of evidence-based guidelines and standards to promote safe driving skills among new drivers and to reduce the risk of injury in sports-related activities. Widespread dissemination of safety guidelines and consistent uptake of safety practices by parents, caregivers, health care providers, and school personnel are pivotal to diminishing child injury risk and creating a culture of safety.
11. **Population-based and policy level interventions to prevent child injury:** The policy domain is critical because it changes the context in which individuals take actions and make decisions (CDC, 2012). Mandated safety legislation and policy level interventions have strengthened the reach and impact of injury prevention efforts (Swahn et al., 2011). Studies in this evidence review demonstrate the effectiveness of policy interventions to increase motor safety through the use of graduated driver licensing and laws, to prevent drownings through safety legislation for barrier isolation, to decrease bicycle-related injuries with the mandated use of helmets, and to diminish firearm-related injuries with laws requiring safe storage. Although the field of injury prevention lags behind other health topics in its strategic use of policy (Swahn et al., 2011), there are examples of policy-driven levers of change.

[47] https://brightfutures.aap.org/Pages/default.aspx
[48] https://www.nihcm.org/categories/child-injury-prevention-fact-sheet
[49] https://stacks.cdc.gov/view/cdc/21064/cdc_21064_DS1.pdf
[50] https://www.safekids.org/safetytips

12. **Child injury materials and resources:** Many of the studies included in this evidence review used curriculum models, parent education materials, and assessment tools that proved to be effective. These resources, and others that have been vetted by the MCH Evidence Center, can contribute to the implementation of effective strategies to prevent child injury and promote positive parenting and child development in Title V programs.

From Evidence to Action

This review is part of a series of scholarly works focused on each NPM to identify and describe evidence-based and informed strategies from peer-reviewed and grey literature. The 425 studies analyzed in this review provide an overview of the scientific literature that can inform Title V program design, implementation, and measurement to prevent child injury and reduce injury hospitalizations. If you are looking to build or strengthen injury prevention efforts in your state or jurisdiction, moving "from evidence to action" can seem daunting. The MCH Evidence Center has developed a framework, tips, and resources to help you through the process. An NPM 7: Injury Toolkit is also available at www.mchevidence.org/tools/npm/7-child-safety.php. Email us with questions, comments, and requests for technical assistance at mchevidence@ncemch.org.

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