

A Social-Ecologic Framework for Improving Bicycle Helmet Use by Children

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An estimated 67 million bicyclists in the United States ride roughly 15 billion hours per year¹ for recreation, exercise, and transportation. Each year, serious bicycle-related injuries result in lifelong debilitation and fatalities. These injuries account for more than 1.2 million physician visits, 580,000 emergency department (ED) visits, 23,000 hospital admissions, and approximately 900 deaths each year at an estimated cost of more than \$8 billion.²

If riders simply wore a standard bicycle helmet many of these injuries may have been prevented. Wearing a standard bicycle helmet reduces a cyclist's risk of injury by 88% and reduces the risk of a serious injury by a minimum of 75%.¹ Helmet use can specifically reduce bicycling-associated head injuries, which account for 62% of bicycle fatalities, 33% of ED visits, and 67% of hospital admissions.³

The social-ecologic theory is a strategy for behavioral modification that addresses numerous social and ecologic factors that affect risky behavior. This commentary reviews the litera-

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ture for interventions shown to increase the prevalence of helmet use among children and present a social-ecologic public health framework to increase helmet use and reduce bicycle-associated head injuries among children.⁴ The 4 levels explored include individual factors,

relationships, community, and societal opportunities (Figure).

SOCIAL-ECOLOGIC THEORY BASE

Individual

Bicycling is nearly ubiquitous among children; close to 85% own a bicycle, yet only about 38% actually own a bicycle helmet, and even fewer regularly wear them.⁵ Thus, the barriers to increase helmet use must include helmet ownership and the associated obstacles to using them. Research demonstrates that programs supplying free or subsidized helmets have success at increasing use, which is particularly important in economically challenged communities—both rural and urban.⁶

Relationships: Peers

Children generally know that wearing a helmet could save their lives and that a helmet is an effective way of protecting their heads.⁵

Nevertheless, they often have negative feelings toward helmet use, and usage is further decreased through negative peer pressure. In 1 survey, 60% of children specified that they discontinued bicycle helmet use because it was “ugly,” “silly,” “uncomfortable,” or “incon-

By establishing a multifaceted social-ecologic prevention program, the state could move to reduce the burden of childhood bicycle related head injuries.

venient.”⁵ Additionally, there is a gap in perception regarding what children believe about their peers, and what they actually report as a group. Although the vast majority of children (75%) felt their peers stopped using bicycle helmets due to the fear of being teased, only 1% to 3% of children actually reported this as the reason they stopped wearing a helmet. Similarly, most children (80%) believe their peers stop wearing helmets because friends did not use them, but again as a group, only about 10% actually reported this as their reason for ceasing helmet use.⁵ Educating children and adults about their role and dispelling the misperceptions surrounding bicycle helmet practices may be an opportunity to remove some barriers to using helmets.

Relationships: Parents/Clinicians

Parenting approaches can affect helmet use among children. Parents generally misper-

Figure. Social-ecologic Model for Increasing Childhood Bicycle Helmet Use



as well. Simply including bicycle safety preventative guidance during medical visits increased children’s likelihood of using a bicycle helmet by 87% (OR 1.87, 95% CI 1.29-2.71).⁹ In the same study, only 42.5% of children aged 5 to 14 years had received bicycle safety counseling during an office visit with a clinician within the preceding 12 months.⁹

Community

The findings of a Cochrane Collaboration review examining nonlegislative interventions promoting childhood bicycle helmet use are summarized in the Table.⁶ A nonlegislative program included 1 or all 3 of the following elements: health education, subsidized or free helmet distribution, or a media campaign. If an intervention took place at school, it was classified as a “school-based program;” all others were categorized as “community-based.” All reviewed programs show that both observed and self-reported helmet use increases with the interventions, but subgroup analyses show that the most robust influence comes from community-based efforts that provide subsidized or free helmets and free helmet distribution programs have the greatest overall effect. Education-only programs that do not offer helmet assistance have no statistical effect on helmet use (OR=3.08, 95% CI 0.69-13.80).⁶ These findings show that providing bicycle helmets for children appears to be an integral component for a successful helmet adherence program.

Society

Laws calling for the mandated use of bicycle helmets have proven to be the most effective means of improving helmet use. While some countries have adopted universal legislation, laws in the United States range from those in local municipalities to those covering an entire state. A systematic Cochrane Review (Macpherson and Spinks) found that legislation is effective at both increasing use of bicycle helmets (45% to 84%) and in reducing bicycle-related head injuries in children 17 years and younger (45% to 82%), when compared to non-mandated adult populations in the targeted jurisdictions.¹⁰ Another systematic review by

Table. Meta-analysis of Nonlegislative Helmet Interventions^a

Study	Observed Helmet Use OR (95% CI)	Self-reported Helmet Ownership OR (95% CI)	Self-reported Helmet Use OR (95% CI)
Community-based programs	4.30 (2.24-8.25) ^c	5.56 (0.82-38.98)	—
School-based programs	1.82 (0.94-3.52)	0.84 (0.47-1.49)	4.73 (1.09-20.49) ^c
Free helmet programs ^b	4.35 (2.13-8.89) ^c	5.56 (0.82-38.98)	6.05 (0.91-40.09)
Subsidized helmet programs	2.02 (0.98-4.17)	—	—
Composite analysis	2.30 (1.37-3.85) ^c	1.69 (0.65-4.38)	3.90 (1.42-10.69) ^c

^aTable compiled by author using the data presented in Royal, et al systematic review.⁶

^bAll of the studies with free helmets were community-based.

^cStatistically significant ($P < 0.05$)

ceive their children’s helmet use, reporting that their children wore a helmet 90% of the time, when the children actually indicate a 61% use. Conversely, children consistently report parent helmet usage in line with parents’ self-reported use (40%).⁷ It is not surprising that a child’s helmet habits correlate with parental practice. The presence of a parent at home during the work week strongly correlates with increased

bicycle helmet use by children in the family, further illustrating the value of parental influence in general.⁸

Clinicians should educate parents about their role in helping children make good helmet choices and help parents recognize that their own helmet use can set an example. Counseling a parent about injury prevention may have a valuable influence on helmet use

Karkhaneh, et al found a significant increase in child use of bicycle helmets post-legislation (OR 4.22, 95% CI 2.03-8.76).¹¹ The increases in helmet adherence after legislation were modest (OR=1.24) to very substantial (OR=22.25). Multiple factors inherent to each jurisdiction may explain the post-legislation variation. The strongest factors influencing increased helmet use post-legislation include lower baseline helmet use prelegislation and mandates that encompass universal enforcement.¹¹ The effect of a mandate was less in communities with high prelegislation helmet use.¹¹ The value of helmet legislation appears clear and well supported by evidence.^{5,10-14} To move legislation forward, it may be helpful for communities to establish coalitions in order to make state legislators aware of the issue.

CONCLUSION

Our review outlines a framework of evidence using a social-ecologic approach to both explain low helmet use and factors that might increase use in communities. In Wisconsin, brain injury caused by not wearing a bicycle helmet results in 1 in 5 of the lives lost by children under age 14.¹⁵ By establishing a multifaceted social-ecologic prevention program, the state could move to reduce the burden of childhood bicycle-related head injuries. To attain this goal, Wisconsin coalitions for injury prevention and primary care clinicians should focus on programs that are community-based, provide free or subsidized helmets, move to dispel the peer assumptions of helmet use among children, encourage helmet use role-modeling by parents, and advocate to pass mandatory statewide bicycle helmet legislation.

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REFERENCES

1. Thompson DC, Rivara FP, Thompson R. Helmets for preventing head and facial injuries in bicyclists. *Cochrane Database Syst Rev*. 2000;(2):CD001855.
2. Thompson MJ, Rivara FP. Bicycle-related injuries. *Am Fam Physician*. 2001;63(10):2007-14.
3. Injury-control recommendations: Bicycle helmets. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. *MMWR Recomm Rep*. 1995;44(RR-1):1-18. <http://www.cdc.gov/mmwr/preview/mmwrhtml/00036941.htm>. Accessed March 17, 2014.
4. Glanz K, Rimer BK, Lewis FM. *Health Behavior and Health Education: Theory, Research, and Practice*. 3rd ed. San Francisco: Jossey-Bass; 2002:624.
5. Rezendes JL. Bicycle helmets: overcoming barriers to use and increasing effectiveness. *J Pediatr Nurs*. 2006;21(1):35-44.
6. Royal ST, Kendrick D, Coleman T. Non-legislative interventions for the promotion of cycle helmet wearing by children. *Cochrane Database Syst Rev*. 2005;(2):CD003985.
7. Ehrlich PF, Longhi J, Vaughan R, Rockwell S. Correlation between parental perception and actual childhood patterns of bicycle helmet use and riding practices: implications for designing injury prevention strategies. *J Pediatr Surg*. 2001;36(5):763-766.
8. Coreil J, Wilson F, Wood D, Liller K. Maternal employment and preventive child health practices. *Prev Med*. 1998;27(3):488-492.
9. Chen J, Kresnow M, Simon TR, Dellinger A. Injury-prevention counseling and behavior among US children: results from the second Injury Control and Risk Survey. *Pediatrics*. 2007;119(4):e958-965.
10. Macpherson A, Spinks A. Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries. *Cochrane Database Syst Rev*. 2007;(2):CD005401.
11. Karkhaneh M, Kalenga J, Hagel BE, Rowe BH. Effectiveness of bicycle helmet legislation to increase helmet use: a systematic review. *Inj Prev*. 2006;12(2):76-82.
12. Keezer MR, Rughani A, Carroll M, Haas B. Head first: bicycle-helmet use and our children's safety. *Can Fam Physician*. 2007;53(7):1131-1132, 1136-1137.
13. Borglund ST, Hayes JS, Eckes JM. Florida's bicycle helmet law and a bicycle safety educational program: did they help? *J Emerg Nurs*. 1999;25(6):496-500.
14. Pardi LA, King BP, Salemi G, Salvator AE. The effect of bicycle helmet legislation on pediatric injury. *J Trauma Nurs*. 2007;14(2):84-87.
15. Centers for Disease Control and Prevention, National Center for Health Statistics. Data compiled from Compressed Mortality File 1999-2010 Series 20 No. 2P, 2013. CDC WONDER Online Database. January 2013. <http://wonder.cdc.gov/cmfi-icd10.html>. Accessed March 17, 2014.

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