

Child pedestrian safety: the role of behavioural science

Environmental strategies must be complemented by behavioural approaches to help children learn to use roads safely

In Australia, pedestrian injury is the leading cause of death among 1–14-year-olds.¹ In 2000, 38 child pedestrians in this age group died² and about 1140 (29 per 100 000) were hospitalised, often with lengthy stays, because of injuries sustained when hit by a vehicle.¹ These rates decrease with age and are lowest for 10–14-year-olds.¹

The most recent comparison with other OECD countries shows that Australia has the 13th lowest pedestrian fatality rate for 0–14-year-olds,³ with slightly more pedestrian deaths among 0–5-year-olds than the median rate for all OECD nations (1.03 per 100 000 versus 0.89 per 100 000).⁴

The primary predictors of this child pedestrian trauma relate to the interaction between the characteristics of the child and the design and nature of the road environment to which the child is exposed. A Western Australian case-control study of child pedestrians aged 1–14 years identified four key environmental and behavioural factors that independently predicted the likelihood of child pedestrian injury.⁵ These comprised the volume of traffic encountered by the child, presence of visual obstructions, availability of footpaths on the child's street of residence, and the child's behaviour.

Predictors also vary according to the age of the child. Whereas 1–2-year-olds are more likely to be hit by a reversing vehicle, the most common cause of pedestrian trauma in 3–9-year-olds is mid-block "dart-out" (entering the road between intersections and not seeing, or misjudging, a gap in traffic).^{6,7} Pedestrians aged under 10 years are particularly vulnerable because of their small physical size and underdeveloped abilities for dealing with traffic situations, both cognitive (attention focus, interpreting traffic signs) and perceptual (locating sounds, judging speed, peripheral vision).⁶ Given these limitations, children under the age of 10 do not have the ability to cross roads without adult help.

Ten to 14-year-olds are also vulnerable, but more because of their failure to apply safe pedestrian skills than because of their lack of skills. Further, road trauma in this age group may also be associated with general delinquency and problem behaviour.⁸

Many of these predictors of pedestrian trauma can be prevented or modified and are therefore amenable to intervention.⁷ While debate continues about the merits of environmental (passive) versus behavioural (active) intervention strategies to reduce this road trauma, evidence suggests that all are necessary, and no single strategy is sufficient.⁶ A multifaceted approach that combines strategies targeting the behaviour of all road users (including education, training and publicity), the road environment and vehicle design have been found to be the most effective.³ Strategic approaches involving public health, education, health promotion, urban planning, engineering and motor vehicle design are required.

Consequently, while efforts are needed to make the road environment safer for pedestrians by reducing the speed and volume of traffic to which they are exposed, it is also necessary for pedestrians (particularly children) to learn how to use these road environments safely. Yet, research into behavioural approaches to pedestrian safety has lagged behind environmental research.⁹

Behavioural programs for children need to be developmentally appropriate and include modelling and training by an adult in a social context and road environments relevant to the child. Programs also need to be interactive and involve problem-solving with consistent and prompt feedback from a caring adult, rather than merely following rules.¹⁰ The use of didactic knowledge-only strategies (such as rote learning of rules) is inappropriate, as younger children are not able to generalise this learning to real roads.¹¹

Roadside training and, to a lesser extent, realistic simulations appear to improve visual timing and gap selection, to increase the ability to identify safe and dangerous crossing locations, and to enhance learning of appropriate strategies for crossing at parked cars. Such training has produced positive results with children as young as 5 years.^{12,13}

Several new approaches to children's pedestrian safety education are being tested. These include programs targeting younger children and adults who care for children, and use of new technologies. Two Australian reviews recommend targeting 0–5-year-olds, arguing that, with good quality pedestrian safety training, young children could demonstrate a rudimentary conception of danger, which improves with age.^{14,15} Some Australian jurisdictions have developed curricula and materials based on these approaches, such as the Victorian "Starting Out Safely" program.

Engaging parents and helping them recognise their important role in their children's pedestrian safety has the potential to significantly enhance children's safety on and near roads.¹⁴ Parents provide the best role models and one of the only means for children to receive the necessary personalised one-on-one training and to practise crossing real roads.

Technologies that use interactive simulations (eg, visual reality computer) coupled with real road experience and "pretend" road practice (the "pretend" road is set up parallel to a real one) can enable children to practise their skills, receive consistent and instant feedback and repetition, and be introduced with careful control to the complexity of traffic.¹⁶

While reviews of the impact of behavioural and environmental programs on preventing road trauma in children have demonstrated mixed success, it is apparent that programs need to take a comprehensive preventive approach with modifications to the road environment, enforcement, engineering and education. While much still needs to be done to determine the optimal mix and "dose" of these approaches to reduce child pedestrian trauma, every effort must be made to keep children safe near traffic and roadways that are becoming increasingly busy and complex.

Donna S Cross
Professor

Margaret R Hall
Director

Child Health Promotion Research Unit, Edith Cowan University, Perth, WA
d.cross@ecu.edu.au

1 Al-Yaman F, Bryant M, Sargeant H. Australia's children: their health and wellbeing 2002. Canberra: Australian Institute of Health and Welfare, 2002.

EDITORIALS

- 2 Australian Transport Safety Bureau. Fatal road crash database. Available at: http://tssu.atsb.gov.au/Query_DB.cfm (accessed Jan 2005).
- 3 Organisation for Economic Co-operation and Development. Keeping children safe in traffic. Paris: OECD, 2004.
- 4 Australian Transport Safety Bureau. Australia's international pedestrian safety performance 1990 to 1997. Canberra: ATSB, 2000. Monograph 3. Available at: <http://www.atsb.gov.au/road/stats/pdf/roadsafe97.pdf> (accessed Jan 2005).
- 5 Stevenson M, Jamrozik K, Spittle J. A case-control study of traffic risk factors and child pedestrian injuries. *Int J Epidemiology* 1995; 24: 957-964.
- 6 Schieber RA, Vegega ME, editors. Reducing childhood pedestrian injuries: summary of a multidisciplinary conference. *Injury Prevention* 2002; 8 Suppl 1: i1-i10.
- 7 Moller JN, Kreisfeld R. Progress and current issues in child injury prevention. Australian Injury Prevention Bulletin 15. Adelaide: Australian Institute of Health and Welfare National Injury Surveillance Unit, 1997. Available at: www.nisu.flinders.edu.au/pubs/bulletin15/bulletin15.html (accessed Jan 2005).
- 8 West R, Train H, Junger M, et al. Accidents and problem behaviour. *Psychologist* 1999; 12: 395-397.
- 9 Bonnie RJ, Fulton CE, Liverman CT. Reducing the burden of injury: advancing prevention and treatment. Washington, DC: National Academy Press, 1999.
- 10 Whitebread D, Neilson K. Cognitive and metacognitive processes underlying the development of children's pedestrian skills. Road safety research report no. 6. London: Department of the Environment, Transport and the Regions, 1998.
- 11 Schieber RA, Thompson NJ. Developmental risk factors for childhood pedestrian injuries. *Inj Prev* 1996; 2: 228-236.
- 12 Thomson J, Tolmie A, Foot H, McLaren B. Child development and the aims of road safety education: a review and analysis. Road safety research report no 1. London: Department of the Environment, Transport and the Regions, 1996.
- 13 Tolmie J, Thomson J, Foot H, et al. Development and evaluation of a computer-based pedestrian training resource for children aged 5 to 11 years. Road safety research report no 27. London: Department for Transport, Local Government and the Regions, 2002.
- 14 Elliott BJ. Review of good practice: children and road safety education. Perth: Western Australian Department of Transport Office of Road Safety, 2000: 1-200.
- 15 Hill R, Lewis V, Dunbar G. Young children's concepts of danger. *Br J Dev Psychol* 2000; 18: 103-119.
- 16 McComas J, MacKay M, Pivik J. Effectiveness of virtual reality for teaching pedestrian safety. *Cyberpsychol Behav* 2002; 5: 185-190. □