



## Child and Youth Mortality Review Committee

Te Rōpū Arotake Auau Mate o te Hunga Tamariki, Taiohi

# Low Speed Run Over Mortality

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# Low Speed Run Over Mortality

## Introduction

In its *Fifth Report to the Minister of Health* (2009), the Child and Youth Mortality Review Committee (CYMRC) noted that systems to review non-traffic deaths are inconsistent and less well developed compared with systems to review traffic deaths.<sup>1</sup> Extensive legislation and enforcement exists to support safety on the roads. Motor vehicle deaths on roads are reviewed by Police and the Ministry of Transport. Meanwhile, workplace-related motor vehicle deaths are reviewed by the Department of Labour, regardless of whether they are traffic or non-traffic. Off-road, non-workplace vehicle deaths may get reviewed by various organisations, but the duty of review does not consistently fall to any one lead organisation. As a result, 'children and young people on farms, off-road in all-terrain vehicles or in driveways may die with no organisation maintaining a systematic overview of the whole picture for this class of death' (CYMRC 2009: 50).

When non-traffic deaths were reviewed to bring into focus common themes and issues, two substantial groups emerged. Since strategies to prevent these two groups are different, they are considered in separate reports. The first group, involving deaths related to vehicles moving at low speed in an off-road setting<sup>2</sup>, is covered in this chapter. The second, involving deaths related to all-terrain vehicles, motorcycles, and farm machines in an off-road setting, will be published by CYMRC in 2012. For both groups, it is recognised that some fatalities in traffic settings have prevention themes in common with deaths occurring in off-road, non-traffic settings. This chapter focuses on deaths related to vehicles moving at low speed, regardless of setting.

## Background

Most injuries to preschool children happen in and around their own homes, where they spend most of their time (Peden et al 2008). Vehicles are now an integral part of most families' daily activities, and it is easy to forget the lethal force they can deliver. One of the most disastrous events that can occur in a child's immediate home environment is being run over. These injuries are especially tragic and distressing as the infant or child is frequently known to the person driving the vehicle.

It has been estimated that on average four children die in non-traffic pedestrian events in New Zealand each year (Kypri et al 2000). In the Auckland area, driveway information from a trauma monitoring system noted six fatalities and 76 hospitalisations because of injuries over a 45-month time period (Murphy et al 2002). For every child killed by a vehicle moving at low speed, approximately 12 are hospitalised. Some 11 percent of these non-fatal injuries are severe, leading to permanent disability (Murphy et al 2002).

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1 Traffic deaths are those that occur on roads. Non-traffic deaths are those that occur on driveways, footpaths, car parks, and private property (including farms). According to the Land Transport Act 1998, a road is defined as: (a) a street; (b) a motorway; (c) a beach; (d) a place to which the public have access, whether as of right or not; (e) all bridges, culverts, ferries, and fords forming part of a road or street or motorway, or a place referred to in (d); and (f) all sites at which vehicles may be weighed for the purposes of this Act or any other enactment.

2 While a majority of these deaths occur on driveways, some also occur in car parks, on lawns and on footpaths.

Prevention has been aimed at physically separating moving vehicles and children, increasing driver awareness and supervision, and modifying the design of vehicles and driveways. Improvements in driveway design and/or the addition of fencing aim to reduce the risk created when children have easy access to areas used by moving vehicles (Chambers 2007; Hsiao et al 2009; Murphy et al 2002; Roberts et al 1995). Other preventative measures focus on issues associated with limited rearward visibility due to vehicle design, supervision of children around places where vehicles move, and driver behaviour (Chambers 2007).

## Methods

### **The CYMRC data collection**

The New Zealand Mortality Review Data Group (MRDG) collects and securely stores information about all child and youth deaths in New Zealand from 1 January 2002 to the present for CYMRC. The information comes from a variety of sources, including:

- Births, Deaths and Marriages
- Ministry of Health
- Child, Youth and Family
- Coronial Services
- Ministry of Transport.

CYMRC also maintains a network of local child and youth mortality review groups (LCYMRGs) in district health boards (DHBs). The LCYMRGs review the deaths in their region and provide additional data, when available, into the CYMRC database, which is housed by the MRDG. Often these data contain contextual information that provide greater detail on the cases.

### **Main underlying cause of death and sample selection**

For the data collected from the Ministry of Health's National Mortality Collection, all deaths are assigned a single main underlying cause of death (ICD-10-AM), plus as many contributory causes (ICD-10-AM) as required. The analyses in this special report includes only cases with a main underlying cause of death in the ranges outlined below, in order to ensure that each individual is allocated a single cause, and so that the totals in tables and graphs sum to 100 percent. The methods used in selecting cases for inclusion would not always have captured cases where death follows sometime after the initial injury, eg, a severe head injury that led to premature death some years later.

Initially, cases were selected based on the context of infants or children under six years old being outside a vehicle and killed by a vehicle moving or manoeuvring at low speed in a non-traffic setting. However, in recognition of the common themes for prevention, cases were also chosen from traffic settings where the vehicle was moving or manoeuvring at low speed. Speed was determined by contextual information contained in the CYMRC database and considered to be less than 10 km/hr. Collectively, these cases are referred to as 'low speed run over.'

The following analysis thus includes all children and young people aged 28 days to 5 years and 364 days who died in New Zealand between 1 January 2002 and 31 December 2008 and whose main underlying cause of death, as identified in the National Mortality Collection, was in the following range:

- pedestrian injured in collision with car, pick-up truck or van, non-traffic accident V030
- pedestrian injured in collision with car, pick-up truck or van, traffic accident V031<sup>3</sup>
- pedestrian injured in non-traffic accident involving other and unspecified motor vehicles V090
- pedestrian injured in traffic accident involving other and unspecified motor vehicles V092
- pedal cyclist injured in collision with car, pick-up truck or van, driver injured in non-traffic accident V130.

#### **Thematic analysis of the case details**

For the selected cases, the details available on the CYMRC database were subjected to a thematic analysis. The information consistently available was described using the following fields: time of day, month, and day of week; activity of the child; nature of supervision; child relationship to the place (eg, own home or visiting); type of place; driver relationship to child; driver gender; direction of vehicle movement; place of death; vehicle type; and alcohol involvement.

Activity of the child was categorised according to what the child was doing at the time of the incident. Content of the narrative details contained in Police, local mortality review, or coroner's reports was read repeatedly to answer: 'what was the activity of the child in the time leading up to the injury?' Criteria were developed to classify the child's activity at the time of injury into five distinct categories:

- passive play or wandering<sup>4</sup>
- playing with other children
- in transition from passenger to pedestrian
- reported to have done a sudden unexpected movement
- 'unknown' – where there was insufficient information to classify the activity of the child.

In 12 cases it was possible to identify the exact location where the child died, and Google Earth and/or Zoodle.com images of the site could then be retrieved. These images were analysed in conjunction with coronial narratives and information from the CYMRC local review groups in order to better understand how the close proximity of a moving vehicle and a child might have occurred.

In a few cases, the CYMRC database contained some conflicting information. Where this occurred, in keeping with standard CYMRC practice, the information from the coroner's report was used.

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3 For the deaths that occurred in a traffic setting, only those where the vehicle was moving or manoeuvring at low speed were kept.

4 Between the ages of one and two years, it is a normal part of healthy development for toddlers to actively explore their environment. This includes climbing, opening cupboards, going through doors and moving from place to place acquiring new knowledge and skills.

## CYMRC cases selected by main underlying cause of death

### Unintentional, low speed vehicle mortality

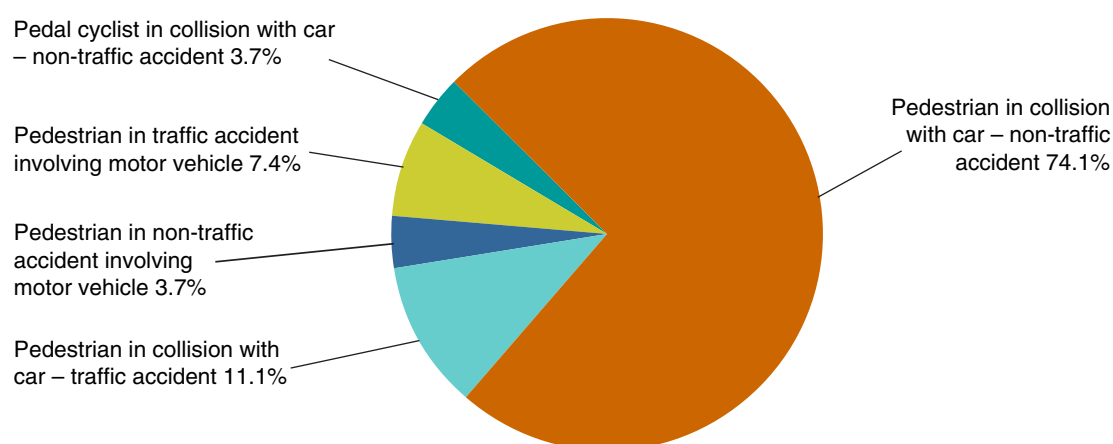
Twenty-seven cases were selected for inclusion over the seven-year period. Most deaths were classified as non-traffic accidents; however, five were selected from traffic accidents as they involved a vehicle at low speed.

**Table 1** Deaths (number, rates per 100,000 resident population) due to low speed run over in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 (n=27 deaths)

Accident type (ICD-10-AM)	2002	2003	2004	2005	2006	2007	2008	Total	Total (%)	Rate per 100,000: 2002–2008
Pedal cyclist in collision with car – non-traffic accident	-	-	-	1	-	-	-	1	3.7	0.29
Pedestrian in collision with car – non-traffic accident	6	2	4	3	1	3	1	20	74.1	5.81
Pedestrian in collision with car – traffic accident	-	-	1	-	-	1	1	3	11.1	0.87
Pedestrian in non-traffic accident involving motor vehicle	-	-	-	-	-	-	1	1	3.7	0.29
Pedestrian in traffic accident involving motor vehicle	-	-	-	1	-	-	1	2	7.4	0.58
<b>Total</b>	<b>6</b>	<b>2</b>	<b>5</b>	<b>5</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>27</b>	<b>100.0</b>	<b>7.85</b>

Source: Numerator: CYMRC Cases by ICD-10-AM Main Underlying Cause of Death as assigned in the National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

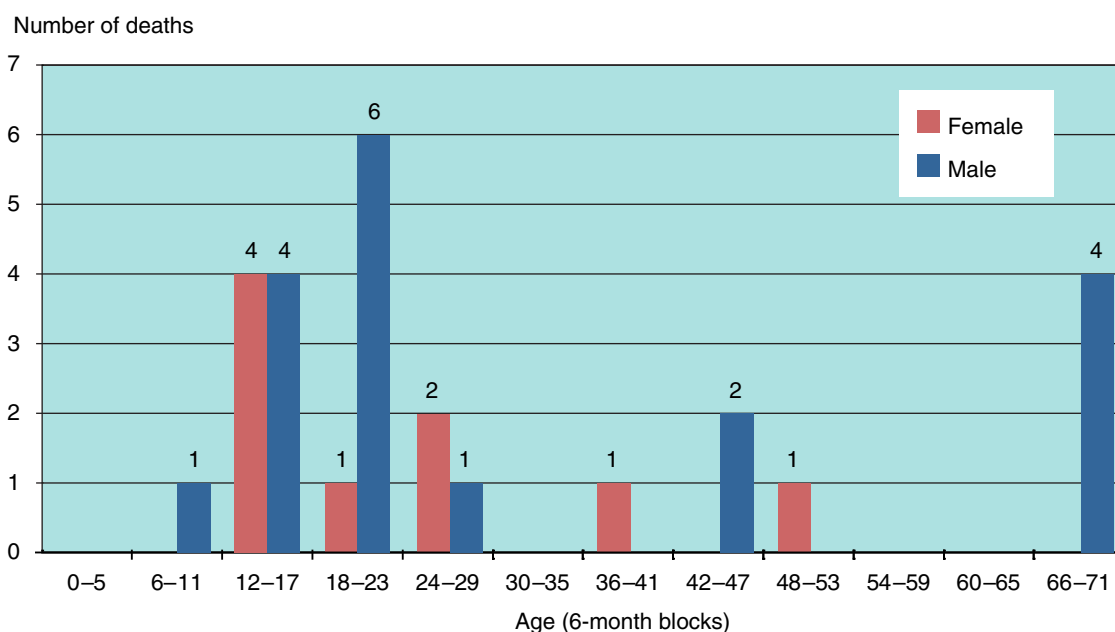
**Figure 1** Deaths due to low speed run over in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)



Source: CYMRC Cases by ICD-10-AM Main Underlying Cause of Death as assigned in the National Mortality Collection

## Low speed run over deaths by age and gender

**Figure 2** Low speed run over deaths in children and young people aged 28 days to 5 years and 364 days by age in six-month age blocks, New Zealand 2002–2008 combined (n=27 deaths)



Source: CYMRC Data Collection. Note: there are no common themes in the four boys that died in the 66–71-month age group.

## Low speed run over deaths by prioritised ethnicity

**Table 2** Low speed run over (number of deaths, rates per 100,000 resident population and 95% confidence intervals) by prioritised ethnicity in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 (n=27 deaths)

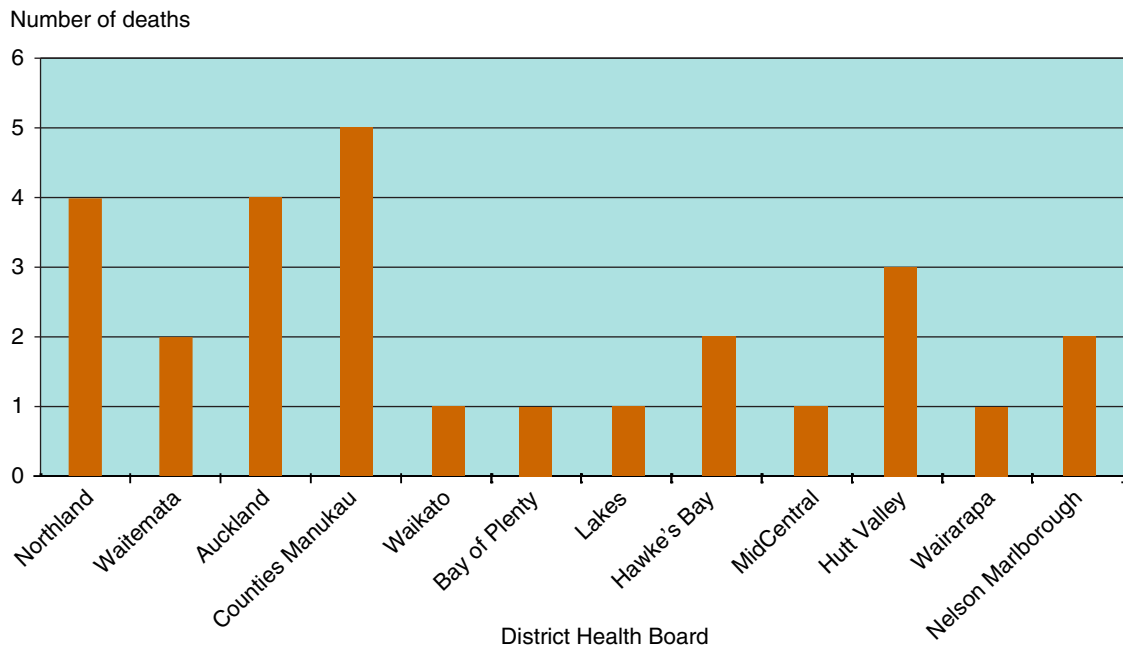
Ethnic group	2002	2003	2004	2005	2006	2007	2008	Total	Rate per 100,000: 2002–2008	Rate ratio	Confidence interval (95%)
European and other	2	-	1	1	-	2	1	7	3.15	1.00	
Māori	1	2	3	4	-	1	2	13	14.82	4.71	0.36–60.86
Pacific	3	-	1	-	1	1	1	7	20.60	6.54	0.37–117.15
Total	6	2	5	5	1	4	4	27	7.85		

Source: Numerator: CYMRC Cases by ICD-10-AM Main Underlying Cause of Death as assigned in the National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

## Geographical distribution

Locality is described by the DHB the death occurred in. Five deaths occurred in a DHB that was not the child's DHB of residence; 93 percent of the deaths occurred in the North Island.

**Figure 3** Low speed run over deaths by location of death (DHB) in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)

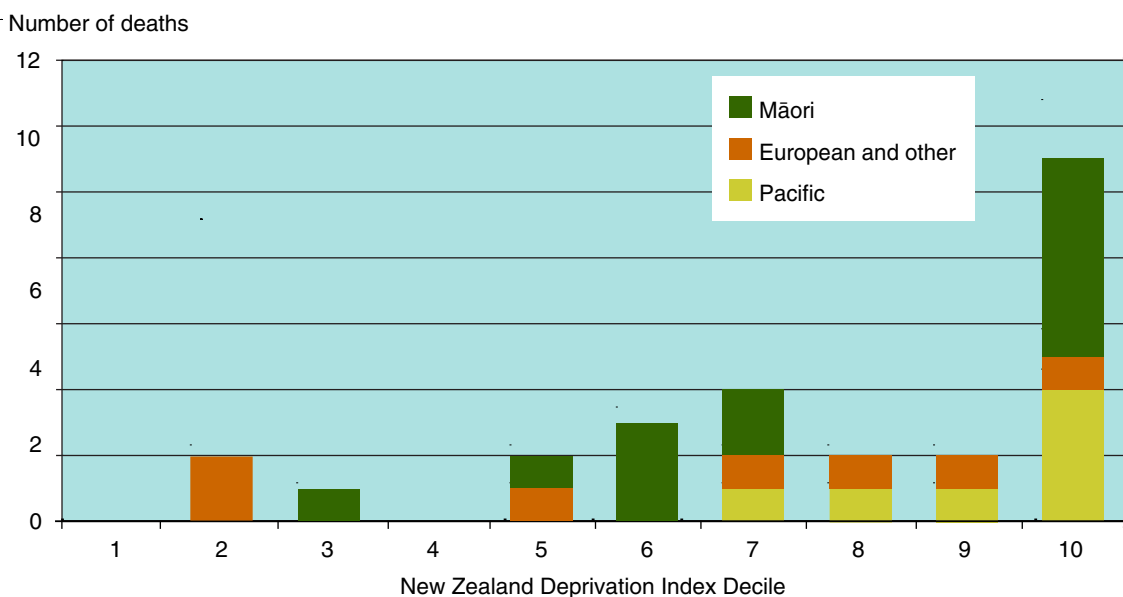


Source: CYMRC Data Collection. Note: we do not provide rate data by DHB because rate data for such small numbers would not be statistically valid.

### Ethnicity and NZ Deprivation Index

Ethnicity of the child was described in the context of levels of deprivation. Figure 4 highlights that more deaths occurred in homes with higher levels of deprivation, especially NZ Deprivation Index decile 10. Children growing up in more deprived circumstances are likely to live in more crowded situations, be in contact with older cars, have fewer safe play spaces, and are more likely to live in a rental property.

**Figure 4** Low speed run over deaths by NZ Deprivation Index and prioritised ethnicity in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)



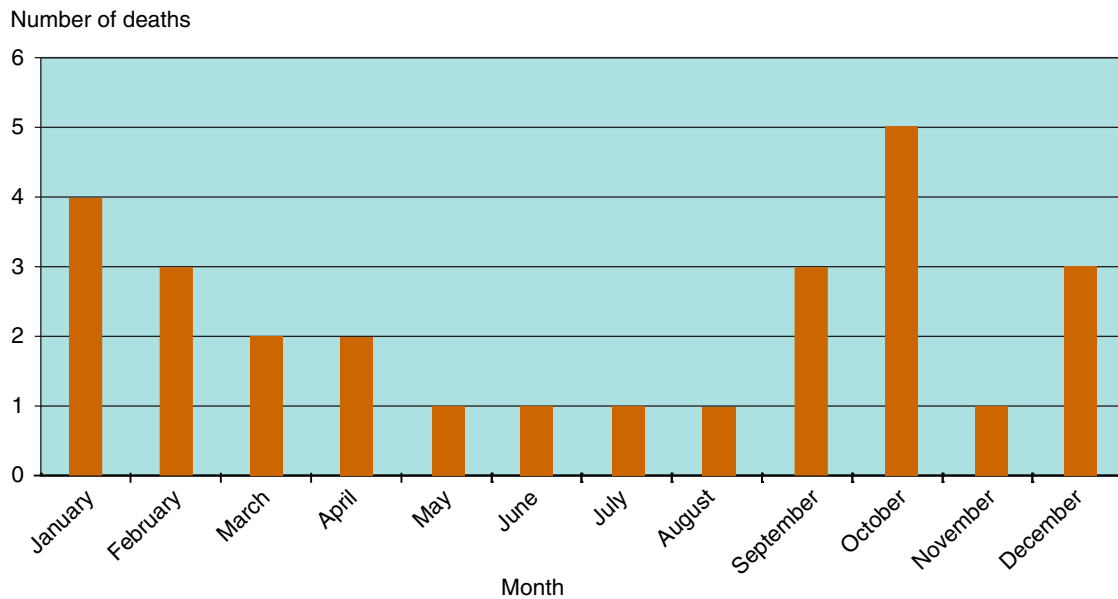
Source: CYMRC Data Collection



## Time of year, time of day, and day of week

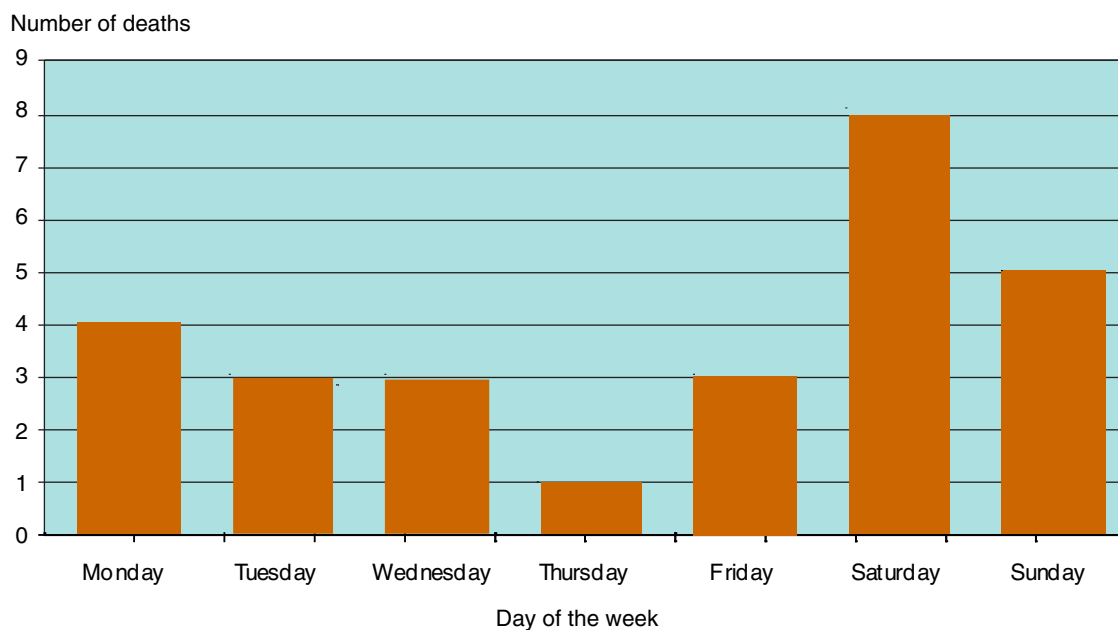
Deaths from low speed run over occurred all year round. Fewer deaths happened in the winter months ( $n = 3$ ), while more occurred in summer and spring (10 and 9 fatal cases respectively). Hsaio et al (2009) reported similar findings. In their study, 43 percent occurred in the summer months, correlating with better weather and longer daylight hours, with peak frequency in December. According to the CYMRC data, about 30 percent of deaths happened on a Saturday and nearly half occurred on a weekend.

**Figure 5** Low speed run over deaths by time of year in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined ( $n=27$  deaths)



Source: CYMRC Data Collection

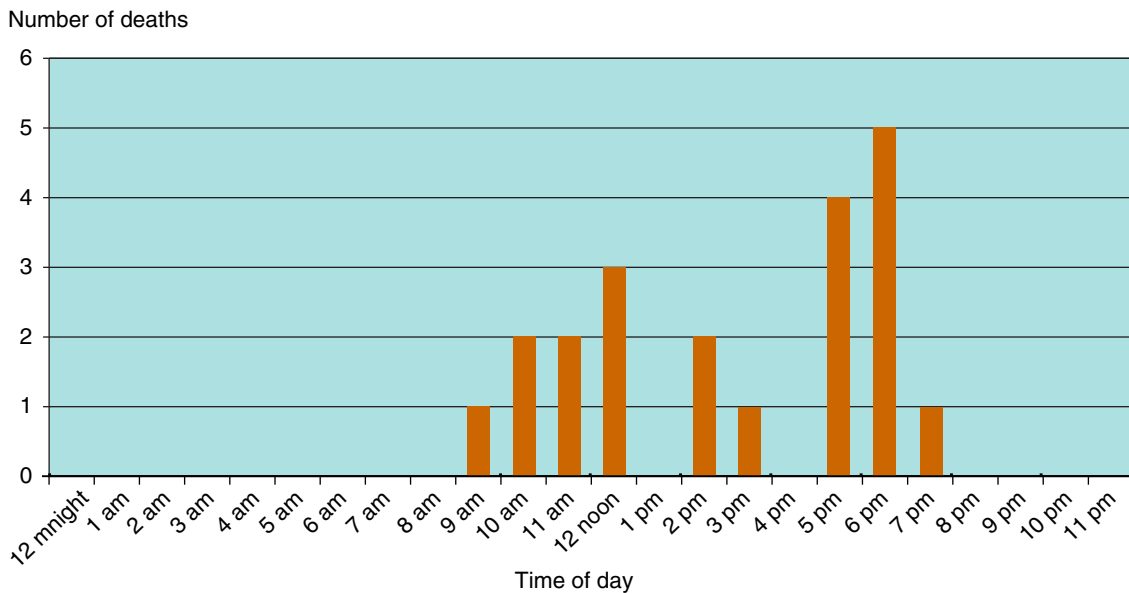
**Figure 6** Low speed run over deaths by day of the week in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined ( $n=27$  deaths)



Source: CYMRC Data Collection

Time of day, closest to when the fatal injury occurred, is shown in Figure 7. Time of day was not available for six deaths. Deaths occurred throughout the day but with an apparent peak time between 5 pm and 7 pm, suggesting vigilance is always required especially around evening meal times. Hsaio et al (2009) found this as well. Their data showed that accidents tended to occur in the afternoon, especially between 4 pm and 7 pm, with a second peak around 11 am. A similar distribution of cases has been described in Queensland (Griffin et al 2011).

**Figure 7** Low speed run over deaths by time of day in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=21 deaths)



Source: CYMRC Data Collection

## Main themes emerging from the individual case reviews

The CYMRC local review process allows for an in-depth review of each case, thus allowing for the collection of information on the details of each child or youth death. Caution must be used when interpreting this information because it is not always collected systematically and the numbers are small. Given those limitations, it is interesting to note a number of common themes from the local review group data.

Common circumstances surrounding the deaths included children:

- playing on driving surfaces
- wandering unsupervised
- getting out of a vehicle
- thought to be safe and supervised elsewhere.

## Driver and vehicle characteristics

The driver of the vehicle was usually known to the child and was often a parent or relative (Table 3). Other 'driver' circumstances were also noted, such as the sudden unexpected vehicle movement related to starting the vehicle in gear or the hand brake being released by children at play. It was noted that the driver was male in 18 of the 25 cases where the vehicle was being controlled by a driver.

**Table 3** Low speed run over deaths, showing relationship to deceased, in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)

Driver's relationship to deceased	Number of deaths	Percentage of total known n = 24 (%)
Father	9	35.7
Mother	3	12.5
Other family member or relative	4	16.7
Family friend or visitor	5	20.8
Neighbour	3	12.5
No driver or driver relationship unknown	3	-
Total	27	100.0

Source: CYMRC Data Collection

CYMRC was interested to understand if alcohol was a factor contributing to poor supervision or as a cause of driver impairment. Only very limited information was available. Alcohol was ruled out as a factor in five of the 27 deaths. The poor data available with regard to these cases is a marked contrast to the routine collection of alcohol levels from drivers on the road. Police do not have the mandate to enforce collection of alcohol levels from drivers of vehicles that are not on the road.

The type of vehicle was not known for five of the 27 cases (Table 4). Four-wheel drive vehicles (4WDs) and vans together contributed to more than 70 percent of the fatal cases where vehicle type was known. This may be because the increased size of the vehicle directly results in more fatalities or because larger vehicles have larger blind spots. Without further investigation it is not possible to draw conclusions. It does highlight that all vehicle types can be involved and so reinforces the need for caution with all types of vehicles.

**Table 4** Low speed run over deaths, showing type of vehicle, in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)

Type of vehicle <sup>5</sup>	Number of deaths	Percentage of total known n = 22 (%)
Van	6	27.3
4WD/SUV	10	45.5
Truck	2	9.1
Car	4	18.2
Unknown	5	-
Total	27	100.0

Source: CYMRC Data Collection

Overall, about 70 percent of cases occurred on or around a driveway, usually the driveway of the property where the child lived. Some vehicles were also being driven across lawns, car parks, or footpaths at the time of injury. In most cases the vehicle was being reversed, but in at least 32 percent of cases the car was moving forward (Table 5).

5 Four-wheel drive vehicles include only those vehicles of larger design. Vehicles with size and shape of a normal sedan or station wagon but with four driving wheels were placed in the car category.

**Table 5** Low speed run over deaths, showing direction of vehicle movement, in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)

Direction of vehicle movement	Number of deaths	Percentage of total known n = 25 (%)
Forwards	8	32.0
Reverse	17	68.0
Unknown	2	-
Total	27	100.0

Source: CYMRC Data Collection

The child’s activity at the time of injury was unknown in six cases (Table 6). In most of the remaining cases, the child was engaged in passive play (n=11). Typically they were aged between 12 and 24 months and the vehicle was reversing down a driveway. In five of these 11 cases, all aged between 12 and 20 months, the child had managed to exit the house without their supervisor’s knowledge. In some cases the child had wandered away from home and was run over by someone who had no idea a child was in the vicinity.

**Table 6** Low speed run over deaths, showing activity of deceased, in children and young people aged 28 days to 5 years and 364 days, New Zealand 2002–2008 combined (n=27 deaths)

Activity of deceased	Number of deaths	Percentage of total known n = 21 (%)
Passive play or wandering	11	52.4
Playing with other children	4	19.0
Transition from passenger to pedestrian	4	19.0
Unexpected sudden movement	2	9.5
Unknown	6	-
Total	27	100.0

Source: CYMRC Data Collection

The type of supervision was unknown in five cases. Adult supervision was the most common arrangement occurring in 19 cases. On four occasions one adult believed the child was safe and being actively supervised by another, and on other occasions there was thought to be supervision from an older sibling or from someone within a group of playing children.

## House and driveway design

In most of the cases examined there was no evidence, photographic or narrative, of physical separation of the house, garden and play spaces from the driveway. We also noted that often large parts of the properties appeared to be suitable for use by vehicles and that these areas might also be used by children for play. A common feeling across the local review groups was that barriers, such as doorway gates, could have prevented children accessing driving surfaces from within homes and other buildings.<sup>6</sup>

It became all too apparent how easy it is for a young child to move from a place of safety to

6 The CYMRC also notes death from other causes occur when young children are able to wander, unknown to the caregivers, in an unsafe place (as in drowning, for example, which is discussed in the CYMRC’s Fifth Report).

a place of danger simply by crawling or walking through a doorway and then immediately being in the path of a moving vehicle. In at least five cases described in this work it appears children left the house in this manner and died while their parents or caregivers assumed they were safe indoors.

The context suggested that the risk of a young child being run over by a vehicle moving at low speed would be increased in circumstances where more vehicle movements occur, as in busy driveways, shared driveways and where there are many visitors. It was also noted that areas used by vehicles were also used by children for play as part of their routine daily activities. This is especially dangerous as vehicles can arrive and leave unexpectedly. Any increase in vehicle speed will further increase the risks.

## Socioeconomic factors

Local review also highlighted that each property presents different physical, social, family, vehicle, and owner factors. It was noted that 74 percent of cases occurred in Māori (48%) and Pacific (26%) families. However, it is important to emphasise the clear association between living in a poor neighbourhood, suffering high rates of injury of various types (Zarzaur et al 2010; Shaw et al 2005), and high rates of burglary, theft, and criminal damage (Graham & Stephens 2008).

Family income often determines the neighbourhood in which a family lives. Social mores, norms, conventions, and coping skills – including safety – are learnt from the people around them. Sociological factors have been shown to be associated with child pedestrian injuries; that is, social factors interacting together in a dangerous environment. This includes the type of housing, the degree of dependence on walking for transport, fenced-in yards, characteristics of public play areas and roads, and the amount of supervision available to the child at play (Schieber & Vegega, 2002) interacting with the knowledge of vehicle blind areas, environmental risk of child driveway injury, and safety-promoting behaviours. The Ministry of Health's commitment to jointly implement Whānau Ora with Te Puni Kokiri and the Ministry of Social Development provides opportunities to promote home safety.

## Issues and Recommendations

Young children are familiar with approaching cars and climbing in. Cars are also associated with pleasurable experiences, so few instincts or behaviours in the child protect them from the hazard of a vehicle's unexpected movement. Therefore, the protection of children in these environments has to come from other means. Some families have developed good routines, such as always making sure children stand in a particular place when a car is about to move, holding on to a particular door handle or tree, or always going inside. Other safeguards are needed.

CYMRC notes that three to five children die each year, mostly under the age of five years, from being run over by vehicles manoeuvring at low speed, especially in the driveways of their own home. In most circumstances, any one of the following four protective elements can protect a child from being run over:

- children being physically separated from areas where vehicles may move
- children being under direct adult supervision
- the driver seeing the child
- the driver being alert to the possibility of a child being close to the vehicle.

Typically, deaths only occur when these protective elements fail simultaneously.

## Vehicles and driver awareness

In New Zealand, messages to make drivers more aware of hazards have targeted drivers reversing vehicles. This is because when a driveway run over occurs, vehicles are generally moving in reverse (Murphy et al 2002; Nalder et al 2001). This has led to the development of strategies that focus on reducing blind areas using technological devices and improving driver awareness of limited rearward visibility.

The blind area around vehicles is much larger than is usually understood or appreciated by the driver. It is especially true considering drivers spend most of their driving time avoiding objects that are much taller than a small crawling child. Vehicle design affects the size of the blind area. It is interesting to note that some vehicle types are involved in low speed run overs more often than others. State Insurance Limited, a New Zealand personal and business insurance service, has developed a 'State Reversing Visibility Index,' which has tested over 204 vehicles. Only one was awarded the top rating of five stars. Surprisingly, 4WDs were rated higher than many family sedans, suggesting that driveway run overs can happen in any type of car, not just large 4WD vehicles. The Reversing Visibility Index highlighted that all cars will have some reversing blind spots (State 2010).

Innovations such as reversing cameras and sonar systems can alert a driver to the presence of a child but are not yet available in most vehicles and have not been fully evaluated. Although the installation of technological devices in vehicles shows promise, especially when devices are used together (Hurwitz et al 2010), there are a number of drawbacks. First, the cost of modifications can be prohibitive (Jones et al 2010). It seems unlikely that purchasing and installing these devices would be affordable for the population groups most affected by these tragedies. Second, the literature suggests that the efficacy of such devices is uncertain. For example, camera performance can be impaired due to environmental conditions; and these devices require drivers to actively look at the cameras, which they may not always do (Chambers 2007; Hurwitz et al 2010). Driveway mirrors have also been proposed but have not yet been evaluated. There is no alternative to drivers walking round a vehicle to ensure children are clear before they get in and drive.

Campaigns and strategies have also aimed to improve driver awareness of limited rearward visibility. A useful interactive kit known as 'the driveway run over kit' was first implemented by the Auckland region's Driveway Run Over Prevention Project. Safekids New Zealand has since developed the kit further to support the Safekids 2011 national focus on preventing child driveway run over injuries. (See the text box entitled 'The Safekids New Zealand Driveway Run Over Prevention Campaign'.)

Targeted awareness training should also consider the risk of forward blind areas. Table 5 shows that 32 percent of our cases occurred while driving forward, not backwards. If interventions focus mainly on reversing, the message may be lost that these deaths also occur when people are travelling forward (Chambers 2007; Byard et al 2009).

Keeping vehicles locked when they are not in use could also prevent a small number of deaths. Vehicles parked on a slope can be set in motion by a child playing within. Some deaths from other causes have also occurred when a child has been able to play inside a vehicle. Agran et al (1991) suggest that children should not be able to play unsupervised in a parked vehicle.

## Supervision

Direct supervision by adults is a potential protective strategy but inevitably at times this will fail, even for the most vigilant supervisors, so physical protective strategies are very important. Circumstances where supervision is more likely to fail include larger families, more than one

family living at one address, social gatherings or when children supervise children (Peden M et al 2008). It is especially important for adults to be vigilant in unfamiliar settings that may be less 'child friendly', where children may be more prone to wander and adults may be less alert to the potential hazards and consequences.

As Morrongiello reminds us, 'Lapses in caregiver attention have been implicated in research on a variety of types of child injuries' (2005: 536-537). Even more importantly, she adds that 'epidemiological data indicate that a child's risk of injury increases substantially when the child lives with a single caregiver, in a home with multiple siblings or with a substance-abusing caregiver, which are all characteristics that can be associated with a caregiver's decreased capacity to attend closely to a child's activities.

'Indirect evidence and professional opinion has led many to assume that ... inadequate supervision must be associated with increased risk of injury to children and increased supervision must serve a protective function and be associated with the prevention of childhood injuries' (ibid).

Morrongiello suggests there are two critical components of adequate supervision: (1) paying attention to the child's whereabouts and activities (via watching and listening) and (2) being in a state of readiness to intervene if necessary (having the capacity to know what to do when a child is in danger and being able to do what is then required). With this in mind, complete and sustained attention coupled with being in the closest possible proximity to the child equates to ideal supervision.

Defining what constitutes ideal supervision in the instances of driveway safety should be seen within the broader context of the child being in a safe environment. In the driveway run over literature, supervision has been measured in different ways. In one study supervision was determined according to checking behaviours and/or knowledge of the whereabouts of the child before moving the vehicle (Hsiao et al 2009), while in another study it was measured by the ability of the child to access or play on the driveway (Murphy et al 2002).

CYMRC data suggests that time of day might be important to consider as well, with special attention needed at the busiest family times for parents and caregivers. Messages directed towards supervision should not be separated from the context in which injuries occur. It is interesting to speculate that the relative infrequency of cases in public car parks may arise because of greater vigilance of supervision in this setting as well as less use for play.

It is essential to reiterate that children are extremely unpredictable, easily distracted, constantly exploring, move rapidly, and not cognitively able to judge the speed a vehicle is travelling at or the imminent danger they may be in.

## Safe play spaces

It is an implicit part of healthy development that preschool children actively explore, wander and become capable of new behaviours that may not be anticipated. A safe home environment needs to allow this developmental phase to occur with minimum risk. This special report highlights the risks from slow-moving vehicles but it is important to note that provision of safe secure play spaces can prevent death and injury from other causes such as drowning, falls and on-road vehicle deaths. The provision of safe, adequately fenced play spaces needs to be a priority for Housing New Zealand, other landlords and home owners.

## House and driveway design, including separation of driveways

A recently published case control study including both mortality and morbidity data examined whether or not features of the built environment may have a role in driveway incidents.

Shepherd et al (2010) noted the risk of injury was increased by:



- a driveway length greater than 12 metres
- exiting the driveway onto a local road
- driveways exiting onto cul-de-sacs
- more parking areas on the property accessed from the driveway
- driveways running along property boundaries.

A separate pedestrian pathway on the property was associated with a lower risk of injury.

The same study noted non-significant trends towards increased risk if driveways had more vehicle movements (eg, shared driveways). In the cases reviewed in this report, 30 percent of the time the driver was a visitor or neighbour. In properties where there are high numbers of vehicle movements onto and off the site, it becomes more important to provide barriers (fences) between places used by children and places where vehicles are driven.

Shepherd et al (2010) also identified the type of road the driveway exits onto as a factor in driveway run over incidents. *Guidelines for visibility at driveways*, published by Land Transport Safety Authority (LTSA) in 1993 were written for road-controlling authorities as guidelines that could be easily incorporated into their district plans and other regulatory documents. Although written in response to injury incidents occurring at a driveway-road junction (LTSA 1993), these guidelines do not address the design or injury issues further up the driveway. These design and environment issues identified for child driveway safety could be added to the existing documents.

Given the high proportion of low speed vehicle deaths that occurred on or around a home driveway, reducing the environmental risk through improvements to home and property design could be achieved by territorial authorities' and Housing New Zealand's roles and responsibilities (Chambers 2007). Their policies could include architectural, building and site layout guidelines in their district annual plans, documents, and educational materials produced for the public that promote driveway safety. This will influence future housing stock and, in the case of Housing New Zealand, housing for those in greatest need.

New Zealand literature consistently suggests that the use of a barrier, such as a fence, to separate the areas children access from areas where vehicles move, would be effective (Chambers 2007; Hsiao et al 2009; Hunter 2009; Murphy et al 2002; Roberts et al 1995). Fencing of domestic pools has been shown to be effective with a reduction from an average of 11 deaths per annum in New Zealand to two deaths (Pitt and Balanda 1991). However, implementation of such a strategy for driveways could be problematic. Driveway fencing would not prevent cases where the child accessed the driveway from the house-to-driveway interface, and may not prevent children from playing there. For housing which has direct access onto the driveway from a door, securely fitted gates or half doors (stable type) could be used. Such gates could work in a way very similar to stair gates, which are routinely recommended to reduce the risk from falls down stairs (ACC 2010).

Housing New Zealand has been identified as a key prevention partner. This is because Auckland-based research found Housing New Zealand was the landlord in a disproportionately high percentage of the properties where these injuries have occurred (Hsiao et al 2009; Murphy et al 2002). The ownership of properties was not established by CYMRC but, given the overlapping time period, some cases will be shared with those in the work published by Hsiao et al in 2009.

Given the evidence, an opportunity exists for Housing New Zealand to take a lead by considering more action to better separate driveways from the areas children inhabit. At-risk properties could be identified during property inspections, housing redevelopments, or asset acquisitions.



### **Improving design and environment in Housing New Zealand's homes to reduce incidents of slow speed run overs**

Shepherd et al (2010) recommend that their findings related to design and environment issues be incorporated into Housing New Zealand Design Guidelines, and used as advisory notes for Housing New Zealand project teams. Widespread retrofitting of properties is costly and would need to be staggered over a period of time, but it does seem that these findings could be fairly easily implemented over time. The ideal responses are listed below.

1. Establish speed reduction mechanisms (judder bars, for example) and warning signs, especially on longer driveways.
2. Avoid long driveways where possible.
3. The separation of children and driveways is important so there needs to be greater care in the design, layout and fencing of driveways and/or children's play areas. This could happen a number of ways. One way would be to develop formal driveway and parking areas on those properties currently utilising multiple areas for parking. This would reduce complex vehicle movement patterns. Another way would be to consider separating pedestrian access to the house and/or erecting fences and gates to separate children's play areas from vehicle movement on site.
4. Prioritise site alterations for those properties where the driveways exit onto local roads and cul-de-sacs as the Shepherd et al (2010) findings show these types of properties to be at greater risk.

### **National, systematic overview**

The cases included in this work were reviewed by a variety of organisations. All had the involvement of the Police and Coronial Services. The Police Serious Crash Unit does not routinely become involved in deaths that occur off road. In some cases, the death scene was a workplace so the Department of Labour had a role. The difficulty finding information about alcohol use contrasts with cases that occur on road, where alcohol levels are routinely collected from drivers involved in fatal injury crashes.

It is not clear who has the lead role for a systematic overview of injuries and deaths occurring off road caused by slow-moving vehicles. Most low speed run over deaths are classified as non-traffic and take place on private property, mostly residential. This then becomes an important home safety issue. Low speed run over injury could be addressed as part of ACC's emerging priority area of home safety. ACC, therefore, could take the lead in maintaining an overview of fatal and non-fatal slow speed run over cases, supported with information-gathering by the Serious Crash Unit.

## Recommendations

### Policy and legislation

The CYMRC makes the following recommendations:

- Territorial authorities should create and implement strategic policy, programmes and projects that will reduce the exposure of children to environments that provide a high risk of injury from moving vehicles. This will include introducing regulatory requirements for child safety and providing educational resources for the building sector and general public.
- Guidelines for driveway design need to be extended to consider the safety of children and others on the driveway itself. Work to achieve this needs to include New Zealand Transport Agency, Ministry of Transport and local government.
- Housing New Zealand should modify over time all of its current stock so that driveways are separated and children have safe play areas.
- Housing New Zealand should ensure that all new developments are constructed so that driveways are separated and children have safe play areas.
- ACC should be responsible for the systematic data collection on all low speed child run over injuries and mortalities, while the Police Serious Crash Unit should be responsible for a full site assessment of all low speed child run over deaths.
- Police, Ministry of Transport, Automobile Association, driving instructors, and road safety co-ordinators should include driveway safety in driver licensing training and testing.
- Te Puni Kokiri, the Ministry of Social Development, the Ministry of Pacific Island Affairs and the Ministry of Health should fund injury prevention via future Whānau Ora initiatives. Programmes where home visits occur – particularly in areas of high deprivation – provide opportunities for injury prevention.
- Police should be mandated to test for alcohol-related impairment whenever a child suffers a serious injury or fatality regardless of location.<sup>7</sup>

### All providers of health and other services

- All providers and services working with families should be familiar with the range of injury prevention driveway run over resources to educate caregivers, available both nationally and through their local Safekids New Zealand Coalition.
- Driveway safety messages that promote 'check, supervise, and separate' should be part of routine, anticipatory guidance given by services that carry out home safety assessments and Well Child consultations, and by early childhood education providers, schools, and parent education groups.
- Driveway safety should be part of all Well Child care, with special emphasis given at the Well Child nine-month child health assessment.<sup>8</sup>

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7 Currently Police only have a mandate to check for alcohol-related impairment in drivers in respect to on-road events.

8 Driveway safety messages and inspection are easiest during a home visit. Not all services do home visits for nine-month assessments so although developmentally this may be the best time, other opportunities may need to be taken up.

- Māori and Pacific health and social services should be lead partners in a campaign designed to communicate both the lethal risk posed by vehicles moving at low speed and the protective effects of interventions such as: environmental changes in domestic properties, improvements to vehicle visibility, and driveway safety behaviours.
- Landlords, including Housing New Zealand, should lead prevention activity aimed at separating driveways from areas of play. Changes to the Tenancy Act could be considered to support such action.
- The information collected through systematic monitoring of slow speed vehicle fatalities and the impacts of preventive campaigns should be used for research and ongoing audit for continuous improvement.

### **Community messages**

- Wherever possible, vehicle movements in close proximity to children should be reduced. For example, if you are a visitor you could decide to park on the roadside instead of driving up the drive. If you are the caregiver at home, you could place objects on the driveway to deter drivers from driving onto it or place a sign that children might be at play.
- Parents and caregivers need to place greater emphasis on the major risk cars at slow speeds pose for children. Many things that kill fewer children are seen as a greater hazard. Children often fear dogs, monsters and the dark – slow moving vehicles are much more dangerous.
- Busy times for parents and caregivers can make direct supervision of young children extremely hard. Supervise children but always have a second way to keep them safe from cars (eg, safe fenced areas for play).
- If there is no fence outside to keep children off driving surfaces, a child-proof doorway gate or half door should be in place.
- Cars should be kept locked with the windows closed and not regarded as a play area. Never leave keys in the ignition.
- All drivers should understand just how big the blind area is around their car.
- Always 'count the kids' before you manoeuvre, and make sure they are belted safely in the car or in a safe place away from the car.
- Slow down on driveways.

### **The Safekids New Zealand Driveway Run Over Prevention Campaign**

During 2011 and 2012, Safekids New Zealand will focus on preventing child driveway run over injuries. While there are a range of agencies involved in supporting road safety, there is not an identified lead agency to champion driveway safety and to support driveway run over prevention opportunities. Supported by a wide range of government and non-government agencies, Safekids New Zealand will lead the 2011–12 campaign work in this area.

#### **Aims**

1. Increase awareness of the prevention of driveway run overs to children, family, whānau and communities
2. Target high-risk communities

3. Promote key injury prevention behaviours to reduce the risk of driveway run overs
4. Promote key injury prevention behaviours to increase driveway safety
5. Explore opportunities to achieve environmental change

#### **Key messages**

1. Know where the kids are before getting in the car
2. Check for children before driving off
3. Supervise children around vehicles – always
4. Separate play areas from driveways

#### **Primary target audience**

The Safekids Campaign 2011–2012 will target workforces and practitioners who engage with infants, children, families, whānau and communities. The target audience will be inclusive of those working with children 0–14 years old, their families, whānau and communities. This includes:

- Māori injury prevention providers
- Pacific injury prevention providers
- ACC injury prevention consultants
- Well Child providers
- NZ Police including Police education officers, road policing and community safety teams
- Road safety co-ordinators
- Māori, Pacific and migrant injury prevention coalitions
- District health boards, particularly public health staff
- Injury prevention practitioners

#### **Secondary target audience**

- Public, community, family and whānau, parents, and children from 0–14 years of age
- Government agencies and decision-makers
- Other stakeholders including The New Zealand Automobile Association (AA), car rental schemes, and public sector landlords (eg, Housing New Zealand and local government)

#### **Key actions**

- Launch Safekids Campaign (July 2011) via mass media and public service announcements
- Deliver approximately 30 information and planning workshops nationally and support Safekids Coalition initiatives
- Disseminate completed data analysis, factsheets, resources and information packages to injury prevention workforces
- Evaluate the information and planning workshops

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