Paediatric low speed vehicle run-over fatalities in Queensland

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ABSTRACT

Introduction Child pedestrian fatalities associated with motor vehicles reversing or moving at low speed are difficult to identify in surveillance data. This study aims to determine the incidence of fatalities associated with what is thought to be an under-reported and preventable fatal injury mechanism.

Methods The term low speed vehicle run-over (LSVRO) incidents encompasses pedestrian fatalities where vehicles run-over a child at low speed. Data were obtained for children aged 0–15 years in the Australian state of Queensland (January 2004–December 2008).

Results There were 15 deaths (12 boys and 3 girls) during 2004–2008 (rate:1.67/100 000). Over half were aged 0 and 1 years of age (n=8; 53.3%, rate: 14.67/100 000), and one quarter were 2 and 3 years of age (n=4, 27%, rate 7.46/100 000). There were no LSVRO deaths recorded among 10–15 year olds. Most (13/15) of the incidents occurred on private property, and only two occurred on a street/road. Almost half of the fatalities were caused by a four wheel drive (4WD) vehicle; large family sedans were involved in four fatalities, and heavy vehicles were involved in three deaths. In 11 of the fatalities, parents were the drivers of the vehicle involved (mothers 5; fathers 6). In nine, the vehicle involved was reversing before it came in contact with the child. Fatalities occurred in each of the Socio-Economic Indexes For Areas (SEIFA) levels.

Conclusion The unique data provided by the child death review team has signalled that LSVRO fatalities are a significant problem in Queensland. The Commission for Children and Young People and Child Guardian (CCYPCG) continue to collect data, which, when combined, will provide outcomes that will act as an impetus for promoting intervention and child advocacy.

INTRODUCTION

Low speed vehicle run-over (LSVRO) describes incidents where a pedestrian—usually a child—is injured or killed by a slow moving vehicle in either a traffic or non-traffic area.[1] LSVRO incidents were first described in 1980 in the USA,[2] and in the 1990s in the USA,[3–10] Canada,[11] UK,[12] New Zealand,[13 14] and Australia.[15 16]

A lack of common definition and inconsistent coding means LSVRO fatalities are not easily identified. Despite similarities, they are variously recorded as back-over, drive-over, low speed/velocity, slow speed, reversing injuries, driveway run overs/crush/injuries, infant pedestrians, non-traffic and roll overs. The true magnitude of LSVRO incidents is difficult to interpret due to differing time periods, jurisdictions, and data collection methods of reported cases. No specific coding mechanism is available to readily identify these events, and population data are rarely provided. Consequently, LSVRO incidents are probably under-reported.

In Australia, an average of nine children are fatally run over each year in Australia.[17] In 1996, the Queensland Council on Obstetric and Paediatric Morbidity and Mortality (QCOPMM) reported that, after pool drowning, LSVRO fatalities were the second biggest single cause of death from injury for children aged 1–4 years.[18] Queensland has significantly higher per population fatalities than the rest of Australia.[19] Over 6 years, 12 fatalities (0–5 year olds) occurred in Queensland (3.94/100 000 0–5 year olds), and 17 fatalities in New South Wales (3.26/100 000)[17] (table 1).

Combined preliminary data from the Queensland Health Admitted Patients Data Collection (QHAPDC) and the Queensland Injury Surveillance Unit (QISU) indicate that as many as 853 children sustained injury significant enough to be admitted to hospital from January 1999 to December 2008.

LSVRO incidents in Queensland were highlighted in a report from the Commission for Children and Young People and Child Guardian (CCYPCG) child death review team,[1] which recommended an investigation on ways to reduce LSVRO fatalities and injuries to children through research, education and consultation, and for mandatory requirements for dwellings.[17] Between 1 January 2004 and 31 December 2008, CCYPCG registered a total of 232 child deaths as a result of transport incidents in Queensland. Of these, 15 were due to LSVRO incidents.

Identifying LSVRO incidents

For LSVRO events, International Classification of Diseases (ICD)[20] coding identifies only the location, not the speed of the vehicle, nor does 'non-traffic' incidents from 'traffic' incidents give a true indication of LSVRO status, and so may not detect LSVROs in parking lots or school pick up zones. To help improve identification of LSVROs, the CCYPCG primarily classifies deaths according to their circumstances. Sometimes, in Police Reports of Death to a Coroner, LSVROs can be identified where the ICD code does not accurately reflect the circumstances of death.

Brison identified LSVRO deaths using ICD-9 codes,[21] specifically E 814-825, which separated incidents into 'traffic' and 'non-traffic'. For 33%, police and coroner's reports resulted in re-coding of 'traffic' to 'non-traffic'. Robertson and Nolan[16] used ICD-9 codes (specifically E820-E825) to identify factors associated with low speed non-traffic death circumstances in Victoria. They, too, had to use supplementary state coroner data to identify LSVRO fatalities.

Table 1 Run-over deaths of 0–5-year-olds by jurisdiction 2000/01 to 2005/06

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	Total
NSW	6	2	4	1	2	2	17
Queensland	1	1	2	4	4	0	12
WA	1	1	0	1	1	2	6
Victoria	2	0	2	3	0	1	8
SA	2	1	2	0	1	0	6
NT	1	1	0	0	0	0	2
Tasmania	0	0	0	0	0	0	0
ACT	0	0	0	0	0	0	0
Total	13	6	10	9	8	5	51

Table from Travelsafe Report, September 2007.[17]
ACT, Australian Capital Territory; NSW, New South Wales, NT, Northern Territories, SA, South Australia, WA, Western Australia.

The CCYPCG uses the ICD-10 to code underlying and multiple causes of death. While this classification system is useful in promoting international comparability in the analysis of mortality statistics, ICD-10 carries certain inherent limitations, particularly in regards to the identification of LSVRO incidents. To help overcome these limitations, the CCYPCG primarily classifies deaths according to their circumstances. Based on the information contained in the Police Report of Death to a Coroner (this form is provided by the Office of the State Coroner), CCYPCG is able to identify cases where the ICD-10 code does not accurately reflect the circumstances of death. This would ultimately have the outcome of inaccurate rate representation. Data provided by the Queensland Health Admitted Patients Data Collection (QHAPDC) shows that two thirds (n=10) of these fatalities would have been missed if relying on hospital data alone.[22]

Risk factors in LSVRO fatalities

Few studies include children over 5 years of age, therefore it is not known if LSVRO injury and death occur in older children. Robinson[16] and Murphy[23] reported on deaths in children up to 15 years, but the small numbers of deaths makes comparison difficult.

Dwelling types and specifically driveway design play a significant role in these often catastrophic events.[24 25] The installation of reversing cameras and sensors has been recommended,[24 26 27] as has supervision of children and ongoing education of drivers and parents.[16 24 25]

Purpose of this study

This study examines the incidence of fatal LSVROs in Queensland, Australia, and whether older children (aged 5–15 years) are involved, over a 5 year period, with the aim of determining risk factors that can inform injury prevention strategies. Epidemiological surveillance of both fatal and non-fatal LSVROs is essential, and adequate knowledge of the characteristics and associated risk factors is necessary to understand and describe the burden of injury.

METHODS

This is a retrospective analysis of 0–15-year-old children fatally injured in LSVROs between January 2004 and December 2008 in Queensland using CCYPCG data through police and coroner's reports. These data include age, gender, date and time of incident, date of death, day of week of incident, coroner's findings, cause of death (as per death registration), Accessibility/Remoteness Index of Australia (ARIA) incident, place of usual residence, Socio-Economic Indexes For Areas (SEIFA) status, direction of vehicle, type of vehicle (make and model in most cases), driver relationship to deceased, hospital attendance, and Aboriginal or Torres Strait Islander status. A text description provided additional information about the circumstances surrounding each individual event. The SEIFA is an analytical tool that enables investigation of the socioeconomic wellbeing of Australian communities and which identifies areas of advantage and disadvantage.

Ethical approval was obtained from: Children's Health Service District (Queensland), University of Queensland Human Ethics Committee, Mater Health Services Human Research Ethics Committee, Public Health Act, Director General Approval.

RESULTS

Demographic characteristics

LSVRO fatalities in children aged 0–15 years across Queensland from January 2004 to December 2008 accounted for 15 of 44 (34%)[28] pedestrian deaths in this age group. Table 2 shows the age and gender breakdown of the fatalities. There were 15 deaths (12 boys and three girls). The highest rate of deaths was in children under 2 years old (n=8, incidents=14.7/100 000), with no fatalities from 10–15 years. The majority of children killed were under 5 years (n=13, 86%, 4.8/100 000). Across all years, 87% were boys. Socioeconomic status was defined by SEIFA scales,[29] which are used by CCYPCG as a measure of advantage/disadvantage, and take into account variables such as income, education, and skills of the area in which the child resides. Fatalities were evenly spread across each of the levels in the SEIFA index, though the small numbers render comparisons difficult. Most of the LSVRO deaths occurred in rural areas (four in major cities, six inner regional, three outer regional, two remote), using the ARIA (designation of degree of remoteness[29]), and 87% (13/15) occurred on private property, while only two occurred on a street/road.

Vehicle type involved in fatalities is described in table 3. Almost half the fatalities (n=7) were caused by a four wheel drive (4WD) vehicle. Head injuries accounted for 10 of the fatalities, but cause of death of the others differed with vehicle type. In fatalities in 4WDs, six out of the seven were due to head injury. Sedans were involved in four, two of which were due to head injury, and two to head and chest trauma. Light commercial vehicles (LCVs) were involved in three deaths, two of which had multiple injuries and one a head injury. Five mothers and six fathers were driving. The vehicle was reversing in nine of the deaths, was moving forwards in five, and direction was not recorded for one.

All LSVRO incidents occurred between 8:00 and 20:00—six between 8:00 and 11, two between 11:00 and 15:00, and seven deaths occurred during the later afternoon/early evening (15:00 and 20:00).

Table 2 Gender/age representation

	Gender	
Age group	Male (n)	Female (n)
0–2 years	7	1
2–4 years	2	2
4–6 years	1 (4-year-old)	0
6–8 years	0	0
8–10 years	2	0
10–15 years	0	0

Table 3 Vehicle types involved in fatalities, January 2004 — December 2008

	4 wheel drive	Sedan	Heavy vehicle	Unknown vehicle
Head injury	6	2	1	1
Head and chest trauma		2		
Multiple injuries	1		2	
Total	7	4	3	1

DISCUSSION

In Queensland from 2004 to 2008, 34% of pedestrian deaths in children aged 0—15 years were from LSVROs, compared with Victoria in the period 1985 to 1995, where 15% of pedestrian deaths were LSVRO fatalities.[16] Similarly to New South Wales and Victoria, males predominated.[16 24] Fatalities did not seem to differ according to socioeconomic scores. The majority of children killed were under 5 years of age which is similar to New Zealand.[25] Such an age range is not surprising for this type of injury, as toddlers classically are quick, small and hard to see, and could be under the wheels of a car before a parent would know he or she was missing. The Queensland Department of Transport and Main Roads Registered Vehicle database[30] shows that 4WD and LCVs represent 35% of vehicles on Queensland roads. Perhaps the higher percentage of LSVROs in rural and remote areas could be explained by the larger type of cars used in the country, but with such small numbers, conclusions about this could be reached only with more detailed enquiry. However, we did show that 4WD and LCVs were more likely than any other vehicle to be involved, concurring with previous reports.[16 31]

In Victoria, children in rural, rather than urban, regions were more vulnerable to LSVROs[16] and our findings support this. Queensland has a higher percentage (48%) of its population in rural communities compared to NSW (28.9%) and Victoria (24.5%). This may be a significant contributing factor to Queensland's higher incidence rates for LSVROs; however, rural children in Queensland are at significantly higher risk of death due to the distances to major healthcare facilities[29] than their counterparts from the smaller states.

We concur with previous authors about four main areas for prevention of LSVROs: adequate supervision of children[23] and not leaving children unsupervised in a vehicle[32]; separation of driveway from play areas[16 23]; installation of reversing cameras and sensors[24 27]; and the education of parents and caregivers.[9 27] A specific, planned, nationwide programme about prevention of LSVRO incidents, based on these four strategies, is urgently needed.

Limitations

Due to low numbers the analysis for this paper is descriptive, and results are presented as tables and figures. Only data held by CCYPCG were used, as further data from police and coroners' records would have to be retrieved manually, and time precluded such data extraction. Further work would enable data such as the speed of the car involved, and nature of the injury that contributed to death, to be determined.

We have examined only fatalities that occur as a consequence of LSVROs. In order to determine the overall burden due to LSVRO incidents, it is also important that non-fatal incidents are investigated. Preliminary non-fatal data from QISU[33] suggests a much greater number of incidents and involvement of other vehicle types.

BENEFITS/DISADVANTAGES OF USING CHILD DEATH DATA

The CCYPCG now includes this specific cohort of deaths in their annual report, making data about LSVRO fatalities accessible.

What is already known on the subject

- Identification using ICD codes is not currently effective in capturing this injury mechanism.
- The true extent of this mechanism in deaths is probably under-reported.
- The 0-4 year old age group has been previously described as most at risk, and 4WD vehicles the most commonly involved.
- Queensland has the highest fatality rate in Australia.

What this study adds

- The child death review team analysis of combined data from police reports and coroners adds an insight into preventable childhood injury mortality.
- Preliminary figures from non fatal injury from this mechanism are reported indicating that this is a much larger problem than mortality data implies.
- LSVRO incidents also occur in places other than the driveway.
- Characteristics derived from the child death review data have acted as impetus for a state-wide education campaign.

The CCYPCG child death review is able to provide fields of data that would be otherwise unavailable (SEIFA of incident, direction of vehicle, type of vehicle, driver relationship to deceased and a text description, providing additional information about the circumstances surrounding each individual scenario). A custodian who collates such sensitive data from a number of sources, and then makes these data readily accessible to researchers, is a pioneering effort in database management. Complete data that have searchable detail are invaluable to interrogate otherwise unrecognisable injury mechanisms, as well as identify accurate incidence rates and causal risk factors. The challenge lies in linking such death data to injury data across other various databases.

Implications for future research

In their inaugural report in 2005, the CCYPCG made a recommendation to the Premier that the Parliamentary Travel Safe Committee investigate and report on ways to reduce fatalities and injuries to children from LSVRO incidents in Queensland.[1] Linkages with other datasets, which will be possible in the future, will allow existing death data on LSVRO incidents. Once in place, a retrospective study of non-fatal LSVRO incidents in Queensland children, from 1999 to 2008, will be undertaken. Such a review will provide a greater understanding of the circumstances surrounding non-fatal incidents. The effectiveness of intervention measures such as vehicle and property design changes and a state-wide education awareness campaign currently underway in Queensland will thus be able to be appropriately evaluated and implemented. In addition, such work will establish a reliable system of surveillance to readily identify LSVRO incidents and monitor them on an ongoing basis. This study will provide an impetus for promoting interventions for this preventable injury.

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