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Item type	Article
Authors	Hamilton, K; Macken, W; McGarvey, C; Matthews, T G; Nicholson, A J
Citation	Pedestrian deaths in children--potential for prevention. 2015, 108 (1):8-11 Ir Med J
Publisher	Irish Medical Journal
Journal	Irish medical journal
Rights	Archived with thanks to Irish medical journal
Downloaded	7-Nov-2017 05:29:39
Link to item	http://hdl.handle.net/10147/559052

Pedestrian Deaths in Children - Potential for Prevention

Abstract:

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Abstract

The National Paediatric Mortality Database was reviewed for the six year period 1st January 2006 to 31st December 2011 and all pedestrian deaths extracted, after review of available data the deaths were categorized as either traffic or non-traffic related. There were 45 child pedestrian fatalities in the period examined. Traffic related deaths accounted for 26 (58%) vs. 19 (42%) non-traffic related. Analysis of the deaths showed there was a male preponderance 28 (62%), weekend trend 22 (49%) with an evening 16 (35%) and summer peak 20 (44%). The highest proportion of deaths occurred in the 1-4 year age group 24 (53%), with 13 (28%) due to low speed vehicle rollovers, mainly occurring in residential driveways 8 (61%). Child pedestrian fatalities are highly preventable through the modification of risk factors including behavioural, social and environmental. Preventative action needs to be addressed, particularly in relation to non-traffic related deaths i.e. low speed vehicle rollovers.

Introduction

Injury from road traffic incidents is a leading cause of child deaths worldwide¹. In Ireland, progress has been made in decreasing child road- related deaths and injuries in recent years; the number of paediatric pedestrian fatalities reduced by 50% between the timescales 1996-2000 and 2004-2010. National road safety campaigns, increased enforcement by the police and changed cultural attitudes to road safety in this period may account for this striking improvement². Young children lack the cognitive skills, attention and perception skills to interact safely with road vehicles³. Children may fail to⁴appreciate the danger associated with fast moving traffic and be unable to integrate speed and distance of vehicles⁵. Play activity places children in unsafe locations such as driveways⁶, and children are highly influenced by the behaviour of peers and heavily rely on adult supervision⁷.

Methods

The National Paediatric Mortality Register (NPMR) collects data on all paediatric deaths in the Republic of Ireland aged from 29 days to 16 years. The main sources of data are 1) The Central Statistics office (CSO) which provides death registration data; 2) Autopsy reports from Coroners; and 3) Notifications received from Emergency departments. All fatalities recorded on the National Paediatric Mortality Database from 1st January 2006 to 31st December 2011 were retrospectively reviewed and all road traffic related deaths examined to identify pedestrian deaths. Autopsy reports were then reviewed to determine the circumstances of the injury. Where autopsy reports were not available media reports were used to supplement information. Cases where the child was a passenger in a vehicle or a cyclist were excluded. The selected cases were then categorised as being traffic related or non-traffic related. Non-Traffic related deaths were considered to be deaths involving a vehicle that had occurred in an off-road setting (e.g. driveways, farmyards). To examine socioeconomic status each death was assigned a deprivation score based on where the child resided. Deprivation was categorised using the 2011 Pobal Haase-Pratschke Deprivation Index for small areas, which assigns a deprivation score to each of the 3,000+ electoral divisions(ED) based on Census 2011 data. The Index’s table of deprivation scores was used to assign the ED where the child resided to a category from extremely affluent to extremely dis-advantaged.

Results

For the six year period examined a total of 82 deaths were reviewed with 45 being identified as pedestrian deaths. On examination of death registration data in some cases insufficient information was provided to determine whether the child was a passenger in a vehicle, a pedestrian or a cyclist. Autopsy reports were available for 64% of cases, media sources were used to supplement information in 28% of cases. Examination of the NPMR database for 2006-2011 showed that the greatest proportion of deaths (age 1-14yrs) from external causes (37%) was attributable to road traffic accidents (RTAs).Head and neck injuries sustained during road traffic incidents accounted for the largest proportion of injury related deaths; 40% of children <10yrs and 32% of children 10-14yrs. In the period 2006-2008 pedestrian death rates increased (from 0.8 to 1.31 per 100,000 population aged 0-14yrs) however from 2009-2011 rates have continued to decline (1.06 to 0.41 per 100,000 population aged 0-14yrs). The mean age was 6.11years with the highest proportion of deaths occurring in the 1-4 year age group (53%), followed by the 10-14 year age group (29%) (Table 1).Analysis of gender shows there was a male predominance in these deaths with a ratio 1.6:1. However in the 13-16year age group there was a greater number of female deaths (5 girls vs. 2 boys). The majority of incidents occurred in the afternoon between 16:00 and 18:00 (31%).There was a weekend trend with 27% of deaths occurring on a Saturday and 9% on a Sunday. Examination of seasonal distribution showed that most incidents occurred in the summer months particularly in the month of July (22.2%), with 44% of deaths taking place between July and September. The most common vehicle type was a car (44%), followed by commercial vehicles (trucks and vans) which accounted for 29% of fatalities.

Socioeconomic status

Social deprivation scores were assigned based on the electoral district in which the child resided. Figure 1 shows the distribution of deprivation index scores. The scores for the pedestrian fatalities were compared with the National population figures. The majority of cases(78%) were in the middle of the scale with just over half (53%) of the pedestrian fatalities being classed as being ‘Marginally below average’, compared with 30% of the population and 25% being classed as ‘Marginally above average’, compared with 35% of the population.

Traffic and Non-traffic related deaths

A review of the circumstances of the incident revealed that 58% were traffic related and 42% were non-traffic related. Table 2 details the circumstances of the incident for each group. Children in the 10-16 year age group accounted for the highest proportion of traffic related deaths (42%).Over half (53%) of the traffic related deaths involved the child attempting to cross the road or darting out onto the road from behind a parked car. In the 1-4year age group 63% of the traffic related deaths involved a child at play. Children in the 1-4 year age group accounted for 84% of the non-traffic related deaths. Sixty eight per cent of non-traffic related deaths were due to low speed vehicle rollovers. The mean age for the rollover deaths was 21.7months. In all cases of rollovers the cause of death was due to head injuries sustained in the incident. In 81% of cases the incident took place outside the child’s residence. In 54% of cases the driver of the vehicle was a family member and the vehicle was performing a reverse manoeuvre. A weekend trend was apparent (69%) with a summer (46%) and late afternoon/early evening peak (46%). Table 3 gives a description of the rollover deaths in the six year period examined. There were 4 non-traffic deaths which resulted from farm incidents involving heavy machinery. In all cases the child was male and two thirds occurred in the summer months. In all four cases the child fell from a slow moving vehicle and was subsequently rolled over.

Discussion

Our study identified 45 fatalities with a striking male preponderance. This finding is supported by a number of studies in the literature that show an increased incidence among males^{5,8}, although some studies suggest an equal sex distribution⁹. In older children this sex discrepancy may be due to a higher incidence in males of unsafe road crossing behaviour and playing on roads¹⁰. In terms of age, the majority of deaths occurred in the 1-4 year-olds and this finding was most marked in the non-traffic related pedestrian deaths. This is in keeping with a recent review of the literature, which suggested a peak incidence of driveway injuries in children under five⁵ and is perhaps unsurprising given their stage of cognitive and perceptual development¹¹. Our study showed a second peak in incidence in the 10-14 year olds and reflects risk-taking behaviours in this age group. This study identified some temporal risk factors (weekends and summer months) and this is perhaps unsurprising considering the increased amount of time spent outdoors

and unsupervised during the summer months. Spring-summer time has previously been suggested to show an increased incidence of paediatric trauma deaths . There was a peak incidence of injuries in the early evening at a time when road traffic is heavier due to work and schools finishing for the day. In relation to psychosocial factors, the highest incidence of pedestrian deaths was in the marginally disadvantaged group (see Figure 1). This is in keeping with studies linking social deprivation to pedestrian fatalities . A review by Laflamme et al¹¹ identified 21 studies that found a positive correlation between social disadvantage and pedestrian injury. Pedestrians from poor neighbourhoods may be up to four times more likely to be involved in a collision, and this effect seems to be independent of factors such as population density, age, and education level⁵. Analysis of driveway rollover deaths showed that these are most common in young children aged 18 to 24 months and consistently involved reversing vehicles. Prior studies have shown a preponderance of reversing vehicles in rollover incidents . Reversal alarms and rear-view cameras are a new tool with the potential to³ make driveway reversing safer. No large-scale data are available in this area although early studies are encouraging¹.

In preventing pedestrian injuries and deaths, one important measure is school road-safety programmes. Although such interventions may improve children’s knowledge¹⁴, this does not necessarily translate into better road crossing behaviours¹⁵. Furthermore, education programmes may be unreliable as they can be overly dependent on the individual teacher delivering them⁶. Thus the development of better education programmes that effectively alter crossing behaviour remains essential. Simple knowledge¹¹, such as appropriate crossing location, has a big impact on injury severity and is amenable to classroom learning⁵. Safety training for children using virtual models represents an exciting new prospect in tackling this problem and avoids exposing children to physical traffic hazards¹. One well established risk factor for paediatric pedestrian injury is the built environment in which the injury occurs. A meta-analysis of previous studies established a direct link between the built environment and risk of pedestrian injury¹⁶. A number of environmental features (e.g. multiple family dwellings, lack of playgrounds, the presence of major roadways, increased traffic levels and roadside parking) are significant risk factors. In a resource-poor setting, built environment features such as lack of road markings are of relevance⁵. The environmental features that best improve pedestrian safety are the provision of playground/ recreation features and traffic calming²⁰. These relatively simple interventions have a significant and lasting impact on improving child pedestrian safety at a local level.

Injury is more likely in non-traffic incidents in environments that lack a physical barrier between the driveway and the play area, with shared driveways, and multiple parking spaces⁵. Adequate child supervision is also of paramount importance in combating the issue. A case-control study conducted in Peru identified the number of streets crossed en route to school combined with lack of supervision as the single best predictors of pedestrian injury¹⁷. Although parents are aware of the importance of educating their children in road crossing, observational research suggests that they rarely supply explicit instruction to their children when supervising road-crossing²². The use of headphones, which is thought²³ to decrease awareness of warning sounds, may represent a safety risk to pedestrians, and in particular adolescent males¹. The increased use of mobile phones could also have a negative impact on children’s road crossing abilities²⁴ as early research suggests they distract children to a significant degree and may increase their risk of collision¹. In conclusion, this study found potential for prevention in relation to pedestrian deaths in Irish children, particularly the need to reduce driveway deaths. Preventative measures should include education of parents and caregivers, separation of driveways from play areas (particularly on farms), adequate supervision of children and installation of object vicinity sensors in vehicles.

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Acknowledgements

The support of the Coroners society of Ireland and the CSO Vital Statistics department whose cooperation made this study possible.

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