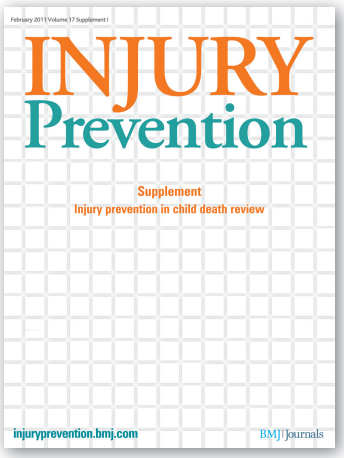
Injury Prevention



Contents

February 2011 Volume 17 Supplement I

Supplement
Injury prevention in child death review

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Injury prevention in child death review

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The death of a child is always a shocking and tragic event. But as human communities pass through the epidemiologic transition, infant and child mortality declines to a point where these events are also unexpected and perceived as fundamentally unnatural. Due to improvements in public health, immunisations, sanitation and basic medical care, most parents, in most parts of the world, can expect a child born in the early years of the 21st century to attain maturity. Thus, when a child does die, it is both profoundly disturbing and very likely to be sudden and unexpected—the consequence of violence, injury or another external cause.

FUNCTIONS OF CDR

Faced with a child death, communities are predictably interested in understanding what happened, especially for violent deaths of young children. Communities demand the assignment of an accurate cause and manner, with any evidence of intentional injury or criminal neglect addressed by law enforcement. This is the first level of death review: ensuring justice for child victims and safeguarding their survivors.

The formal, multidisciplinary process of child death review (CDR) was developed in the USA in the late 1970s as a direct response to this most basic task.[1] Communities became concerned that cases of inflicted injury and child homicide were being overlooked or misclassified. They reasoned that a process promoting information sharing among social services, law enforcement, child welfare, public health, and the medical examiner or coroner might reduce the risk of misclassified child abuse deaths.[2 3] National expansion of the CDR process was justified on the basis of this 'critical need for the systematic evaluation and case management of suspicious child deaths'.[1] As a result, there is now a CDR process in almost every US state and similar programmes in many other countries, including the UK, Canada, Australia, and New Zealand.[4–6]

Verifying that the cause and manner of death were properly assigned can be viewed as a primary function of CDR, but—in most jurisdictions—it is unlikely that this role, alone, would justify the time and effort expended by CDR teams. With the development and implementation of infant death investigation protocols, the risk of missing abusive infant fatalities continues to decline.[7] However, there is a secondary function that naturally arises in the CDR team: verifying that the agencies and institutions charged with child protection acted appropriately to safeguard the child. In this function, agencies represented in the CDR process can streamline information sharing, coordinate protocols, and troubleshoot lapses in oversight or communication. This process involves making existing systems function more accurately or efficiently. Federal law mandates this function in the USA for CDR teams organised through child protective services.[8]

Finally, there is a tertiary function of CDR that can, and should, extend its scope beyond the historical purpose and typical membership of the review team: a focus on prevention. In the mid to late 1990s, the US Maternal and Child Health Bureau and other national organisations called for this broader focus for CDR and expansion of reviews to all potentially preventable deaths.[9] The US Healthy People 2010 and 2020 goals include review by a child death review team of all deaths to children under age 18 that are due to external causes.[10] Thus, today, most CDR teams in the USA have broadened their membership, are reviewing deaths from many causes, and are asking "what could be done to prevent future deaths of this nature in our community?".

CDR AND PREVENTION

CDR remains an inherently local process, informed by understanding of local resources and contexts and drawing on the experience and reason of local professionals. An effective CDR includes the sharing of case records from multiple sources to create an understanding of the circumstances leading to a child's death that would not be captured or reported by any single source. In most cases, the desired end products are effective recommendations and actions 'to prevent deaths and to keep children healthy, safe and protected'.[4] To be clear, however, most CDR teams do not have adequate resources to conduct public health campaigns in support of prevention objectives. Their role is to accurately and completely understand the circumstances and risk factors leading to child death in their community, and to suggest likely points of leverage and catalyse actions where interventions might be both feasible and efficacious.

Because the majority of unexpected deaths after infancy are due to unintentional injuries or violence, the promise of CDR as a driving force in injury prevention has not been overlooked.[11] CDR findings have been used to clarify cause, manner, and intent of injury death[12] and to identify low volume, high lethality injury mechanisms.[13] In addition, CDR activity has kindled or supported injury related interventions across the spectrum of prevention, from individual case management to community education, organisational change, and policy advocacy.[14] The strength of the system is its specificity and inherent humanity; every death tells a story. But this granular, local and case based focus can dilute the apparent impact of the process. Interventions and policies catalysed by CDR may

never be recognised as such or systematically reported in the published literature.

GOALS OF THE SUPPLEMENT

In this supplement to *Injury Prevention*, we sought to capture the nature and breadth of CDR activities as these relate to injury prevention around the world. We asked authors to describe programmes that use CDR to inform or motivate their injury prevention efforts. But we wanted more as well: more than just enhanced case finding and risk factor analysis. Without translating CDR observations into actionable recommendations and working to see those recommendations enacted, CDR is reduced to a costly exercise in injury surveillance that discredits the child victims and their families whose stories unfold before the team. We wanted to see how CDR as a process moves from observation into action. To be successful in preventing deaths, this must be an acknowledged goal of the reviews, and the composition, function and resources of individual teams should be optimised to promote success in this vital activity.

Death review clearly adds depth and detail to vital statistics. Information crucial for prevention is simply not collected in national, state or local mortality datasets. A research group from British Columbia, Canada uses CDR data to show that the drivers responsible for child pedestrian fatalities in that jurisdiction had, on average, 10 previous driving violations.[15] From Queensland, Australia, Griffin *et al* document low speed vehicle run-over injury deaths, a class of paediatric death not readily captured in existing injury codes but clearly calling for specific preventive interventions.[16] From Texas, Parks *et al* document the surprisingly high proportion of child injury decedents with a previous history of child maltreatment.[17] In a small rural area of California, qualitative CDR data were used to surmount persistent concerns over 'small numbers' in the local epidemiology of child injury death. Kelleher and colleagues document how the process of eliciting and retelling the stories underlying these tragedies served to engage and motivate the partnerships required for sustained prevention activities.[18]

Brixey and colleagues move past the well documented struggles that characterise diagnosis and classification of sleep related infant deaths[19] to suggest that potentially modifiable risk factors for both sudden infant death syndrome (SIDS) and unintentional suffocation deaths are remarkably similar.[20] In Washington State, Quan and colleagues used CDR data to document the disproportionate risk of drowning among Asian immigrant youth, in open water and at unguarded public parks. Their data were used to inform policy development and carefully focused drowning prevention campaigns.[21] Covington introduces a multi-state CDR case reporting system which provides a resource for local and state teams and rolls-up local US reviews into a national perspective.[22]

Child death review is a worldwide activity, with countries developing their own brand of the process. In poorly resourced countries, 'verbal autopsy' methods have long been used to augment or complete vital statistics in order to understand the cause and manner of child deaths. Adding multidisciplinary review of these data with a focus on prevention is a logical evolution of the process. But death review needs to be tied, whenever possible, to stakeholders with the resources to act upon its findings. Reporting from Pasto, Columbia, Hardeman and colleagues provide a strong example from a middle income country that illustrates the importance of having an audience for surveillance findings.[23] With political will, CDR data were used to catalyse local prevention interventions.

We also asked authors to consider the process of CDR. What enhances or hinders an effective role in injury prevention? Schnitzer *et al* grapple with a controversial aspect of many CDR discussions, that of 'preventability'. Could this child's death have been prevented? As injury control practitioners, we'd like to answer yes in every case. But in many contexts, deciding that a death was preventable implies that someone could be blamed for failing to prevent its occurrence. This conflation of preventability and culpability ensnares many teams, perhaps especially those whose core membership is used to dealing with inflicted injuries and cases of child abuse. In their paper, Schnitzer *et al* attempt to elicit attitudes and beliefs thorough structured case studies presented to CDR teams.[24] There is an unpleasant dichotomy that either assigns blame (through poor supervision or neglect) or fatalistically dismisses the injury as an unpreventable tragedy. This tension may not be anticipated by practitioners approaching the process from a public heath background and represents an opportunity to reframe cases into a systems perspective. These same issues are highlighted by Sidebotham and colleagues as they describe the early experience of new child death review panels in the UK, struggling to focus on lessons learnt rather than an apportionment of blame.[25]

Finally, we consider internal processes that make CDR teams more or less effective in transmitting and promoting effective injury prevention interventions. Wirtz *et al* draw on their experience with thousands of CDR records, teasing out aspects of the written report or recommendation that promote uptake and action on a specific suggestion.[26] Their model for communication of these recommendations could be used broadly in the public health field, not solely in injury. Johnston and colleagues conclude the supplement with evidence that a collaborative process improvement model can be used to support CDR teams interested in improving their capacity to promote injury prevention through review and recommendation.[27] There is tremendous human energy that can be focused through the lens of child death review; the process improvement documented in Washington State, driven by the members of CDR teams themselves, speaks to the depth of talent and creativity behind that energy. We have much to learn from one another as we capitalise on the promise of child death review in injury prevention.

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Injury prevention in child death review: child pedestrian fatalities

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Injury prevention in child death review: child pedestrian fatalities

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ABSTRACT

Objective This article describes the epidemiology of child pedestrian fatalities in British Columbia using data generated by the province's Child Death Review Unit, to demonstrate the unique capacity of child death review to provide an ecological understanding of child mortality and catalyse evidence based, multi-level prevention strategies.

Methods All child pedestrian fatalities in British Columbia from 1 January 1 2003 to 31 December 2008 were reviewed. Data on demographics, circumstance of injury, and risk factors related to the child, driver, vehicle, and physical environment were extracted. Frequency of sociodemographic variables and modifiable risk factors were calculated, followed by statistical comparisons against the general population for Aboriginal ancestry, gender, ethnicity, income assistance and driver violations using z and t tests.

Results Analysis of child pedestrian fatalities (n=33) found a significant overrepresentation of Aboriginal children ($p=0.06$), males ($p<0.01$), and children within low income families ($p<0.01$). The majority of incidents occurred in residential areas (51.5%), with a speed limit of 50 kph or higher (85.7%). Risky pedestrian behaviour was a factor in 56.7% of cases, and 33% of children under 10 years of age were not under active supervision. Drivers had significantly more driving violations than the comparison population ($p<0.01$).

Conclusion Child pedestrian fatalities are highly preventable through the modification of behavioural, social, and environmental risk factors. This paper illustrates the ability of child death review to generate an ecological understanding of injury epidemiology not otherwise available and advance policy and programme interventions designed to reduce preventable child mortality.

Unintentional injuries among children are a substantial public health concern. Approximately 200 children die unexpectedly each year in British Columbia (BC), most the result of preventable injuries.[1] Preventable causes of child mortality are best understood from an ecological perspective, whereby health and well-being are influenced by the interaction of biological, behavioural, environmental, and social determinants, as well as the influence of family and community members, organisations, and public policy.[2 3] Most sources of information on child fatalities (eg, Vital Statistics data) are unable to provide insight into many of these factors, limiting their utility in the formulation of evidence based prevention strategies to reduce child deaths. Child death review has been described as a powerful tool in both understanding the epidemiology of child deaths and catalysing preventive action to reduce child mortality.[4] In BC, child death review provides the most comprehensive child death data currently available and is capable of generating the broad spectrum of data required for an ecological understanding of child mortality.

The Child Death Review Unit (CDRU), embedded within the BC Coroners Service, reviews the facts and circumstances of death for all children 18 years and younger in the province. The Unit's mandate is to better understand how and why children die, and to make recommendations for action to prevent future deaths and improve the health, safety and well-being of children in BC. Under section 48 of the *Coroners Act* (RSBC 2007), CDRU members are authorised to review coroner files, exercise powers of investigation, and seize additional information required to inform the review process.

This article describes the epidemiology of child pedestrian fatalities in BC using data generated by the CDRU. Our objective is to demonstrate the unique capacity of child death review to provide an ecological understanding of child mortality and catalyse evidence based, multi-level prevention strategies. Pedestrian fatalities are well suited to this purpose due to their multifaceted nature and position as a leading cause of injury related mortality among children.

METHODS

This retrospective review describes child pedestrian fatalities that occurred in BC from 1 January 2003 through 31 December 2008. The *Coroners Act* defines a child as anyone under the age of 19 years. A pedestrian death is characterised as death due to unintentional or unexpected injury while travelling by foot, including death resulting from complications reasonably attributed to the incident.

Each of the 33 cases was assigned to one of four CDRU case reviewers, a team of child death review specialists with expertise in paediatric medicine, child welfare, and injury prevention. Reviewers applied a novel review protocol to each case, which included 102 variables designed to capture data on child sociodemographics, place and time of injury, and risk factors related to the child, driver, vehicle, and physical environment. Review protocols were primarily completed using data extracted from the coroner's case file, which includes the coroner's investigative findings, autopsy and toxicology reports (if conducted), police records (including traffic analyst reports), and emergency medical records.

General ethnicity of the children was categorised according to current Census of Canada groupings. The term Aboriginal indicates children of First Nations, Métis, and Inuit ancestry. Involvement with the Ministry of Children and Family Development (MCFD)[i] refers to children who received provincial child protection and/or supportive child and family services during the course of their lifetime. Child socioeconomic factors collected during the review process included income assistance, parental unemployment, and family structure. The identification of families in receipt of income assistance at the time of their child's death was extracted from the Client Registry of the provincial Ministry of Housing and Social Development.

Demographic variables and risk factors pertaining to the driver were collected, including type and status of licence, driver error and toxicology at the time of the incident, and driver violation history. A 'full' driver's licence is defined as being free of the restrictions (such as limitations on passengers and driving hours) normally associated with the learner and novice stage of BC's graduated licensing programme. Driver's licence status was categorised as 'prohibited' (due to a driving suspension or ban ordered under the BC *Motor Vehicle Act* (RSBC 1996)) or 'valid' (free from prohibitions or suspensions). Driver violation history (since time of licensure in BC) for our sample and an age and sex matched comparison sample (n=500) was obtained from the FAST database of the Insurance Corporation of BC (ICBC), a provincial agency responsible for auto insurance, driver licensing, and vehicle licensing and registration. Driver violations include contraventions of either the *Motor Vehicle Act* and/or the *Criminal Code of Canada* (RSC 1985).

Following data collection, individual cases were presented to the CDRU team to ensure data accuracy and determine preventability. Preventability is defined as a death in which, with retrospective analysis, it is determined that a reasonable intervention at the individual, community or system level may have prevented the death through modification of one or more risk factors.

Statistical analyses on aggregate data were performed using SPSS 16.0 software. Descriptive frequencies were calculated to characterise child pedestrian fatalities in BC by person, place, time, and notable risk factors. Statistical comparisons against population data were performed for ethnicity, Aboriginal ancestry, income assistance, and driver violation history using z and t tests. Ethnicity and Aboriginal ancestry data for BC was obtained from the Statistics Canada 2006 Census of Canada. The relative frequency of income assistance in our sample was compared to average income assistance levels in BC from 2003 to 2008, provided by the Ministry of Housing and Social Development.

RESULTS

Demographic and socioeconomic factors

There were 33 child pedestrian deaths from 2003 to 2008, representing an average annual child pedestrian mortality rate in BC of 1.3 (0.24–2.09) deaths per 1 million population. Cases include 12 females and 21 males, with an average age of 11.1 years. Distribution of cases by age group and sex can be seen in table 1. Overall, 21.2% of children had involvement with the Ministry of Children and Family Development during their lifetime; 9.1% of the children were receiving services from MCFD at the time of their death. None of the children had hearing, vision or mobility impairment. No significant difference was identified between the ethnicity of the sample and the general BC population; however, results do indicate an over-representation of Aboriginal children among child pedestrian fatalities (z=1.56, p=0.06).

Table 1 Child pedestrian fatalities by sex and age group

Age group (years)	Female	Male	Total
<1	0	0	0
1–4	2	4	6
5–9	2	4	6
10–14	5	4	9
15–18	3	9	12
Total	12	21	33

A significantly greater number of families of child pedestrian fatalities were receiving income assistance (18.2%) than would be predicted based on the average income assistance levels in BC of 2.5% (average for years 2003–2008; z=5.21, p<0.01). Additionally, 12.1% of children had at least one parent unemployed and 27.3% were in a single parent family.

Time, location, and physical environment

The majority of injuries occurred in the afternoon (12:01–18:00; 48.5%) or evening (18:01–24:00; 39.4%) hours, and on the weekend (45.4%). Fatal incidents most often occurred during summer (36.4%), particularly in the month of August (21.2%). The majority of fatalities occurred during daylight hours (57.6%), on dry roads (69.7%), while the vehicle was on a straight section of road (84.8%). Incidents occurring within 1 km of the child's home accounted for the largest proportion of cases, 54.5%. Close to half of the incidents took place in suburban areas (45.5%), followed by rural (33.3%) and urban (21.2%) settings. Most injuries occurred on roadways (75.8%); the remainder occurred on a driveway (12%) or sidewalk/shoulder (12%). The majority (51.5%) of incidents occurred in residential areas.

Driver visibility was limited in 54.5% of cases, most commonly due to darkness, roadside objects (such as parked cars), and vehicle configuration. In 66.7% of cases, no signage of any kind was present near the scene. A pedestrian crossing sign was present in 12.1% of cases, and speed limit signage was present in 6.1% of cases. A shoulder, sidewalk or crosswalk was available for pedestrian use in 36.4%, 24.2%, and 15.2% of cases, respectively.

Distribution of cases by posted speed limit in kilometres per hour (kph) at the site of injury is provided in table 2. Pedestrian incidents were most frequent in areas with a posted speed limit

Table 2 Posted speed limit at site of injury in kilometres per hour (kph)

	kph	Total	%
Posted speed limit	30	2	6.1
	40	0	0.0
	50	13	39.4
	60	8	24.2
	70	1	3.0
	80	3	9.1
	90	0	0.0
	100	1	3.0
	N/A (non-traffic)	5	15.2
	Total	33	100.0

[i]MCFD is responsible for regional and province-wide delivery of services and programmes that support positive and healthy outcomes for children and their families, such as family and early childhood development, services for children and youth with special needs, child and youth mental health and child protection.

of 50 kph (39.4%) or 60 kph (24.2%). Among incidents occurring on roadways in residential areas, 85.7% of cases took place in areas with a posted speed limit of 50 kph or higher.

Child factors

Most (54.5%) children were walking at the time of the incident (table 3). Children were also likely to be crossing traffic (30.6%), and a large proportion, 57.6%, were engaging in risky behaviour (table 3). Most children (75.8%) were in the company of others at the time of injury, including 30.3% being accompanied by an adult. Among children under 10 years of age, only 33% were under active supervision (ie, within sight and reach) of an adult at the time of the incident; in the remaining cases, an adult was either not present at the scene (25%) or was distracted and momentarily beyond sight and reach of the child (41.7%). The children themselves were known to be distracted in 27.3% of cases. Toxicological examination of the child was completed for 45.5% of cases, with positive results for alcohol in 12.1% and tetrahydrocannabinol (THC) in 9.1% of cases.

Driver and vehicle factors

Drivers included eight females and 25 males, significantly more males than would be predicted from BC population rates ($z=2.79$, $p<0.01$). The average age of drivers was 40 years (range 17–85). Most drivers had been driving for more than 10 years (66.7%) and most were driving with full (84.8%) and valid (97.0%) licences.

Most drivers (63.6%) were alone in the vehicle at the time of the incident, and none of the vehicles were over occupant capacity. The largest proportion of drivers was more than 10 km from home (36.4%).

Driver error was found in 36.4% of cases, with 12.1% of drivers committing more than one error at the time of the incident (table 4). Toxicological testing or roadside breath examination was performed on 21.2% of drivers; just one was found to have blood alcohol content above the legal limit (blood alcohol content >0.08%) for operating a motor vehicle. Additionally, 12.1% of drivers were found to be in violation of the British Columbia *Motor Vehicle Act*. Criminal charges were issued against 30.3% of drivers.

A large majority of drivers, 81.8%, had at least one prior driving violation, significantly more than the age and sex matched comparison sample of drivers, 65.0% of whom had a prior violation ($z=1.79$, $p=0.37$; table 4). On average, drivers involved in a child pedestrian death had 9.7 (0–45) previous violations on their driving record, significantly more than the comparison sample of drivers, who had an average of 2.7 (0–24) previous violations ($t(531)=8.36$, $p<0.01$). The most common previous violation was speeding (66.7%), followed by failure to wear a seatbelt (42.4%). Additionally, 51.5% of drivers had previously had their licences suspended or prohibited.

The most common vehicle type was car (48.5%), followed by pick-up trucks (24.2%). All incidents taking place on driveways (ie, non-traffic incidents) involved sport utility vehicles or pick-up trucks. Most of the vehicles (75.8%) underwent mechanical inspection following the incident. Mechanical problems were identified in four vehicles but were determined to be non-contributory.

Table 3 Child's activity at the time of injury

		Total	%
Activity	Getting in/out of vehicle	1	3.0
	Jogging/running	5	15.2
	Rollerblading	1	3.0
	Skateboarding	2	6.1
	Standing	5	15.2
	Tobogganing	1	3.0
	Walking	18	54.5
Risky behaviour	None	14	42.4
	Cross against traffic signal	1	3.0
	Cross into oncoming traffic	7	21.2
	Dart into roadway	1	3.0
	Emerge from between parked cars	1	3.0
	Exit vehicle in middle of roadway	1	3.0
	Fail to use available crosswalk	2	6.1
	Playing 'chicken'	3	9.1
	Walk/play on roadway	3	9.1

Table 4 Driver errors, violations, and charges at time of fatal incident, and previous driving violations on record

		Total	%
Error at time of incident	None	21	63.6
	Aggressive driving	3	9.1
	Fail to yield	2	6.1
	Driver distraction	6	18.2
	Disobey traffic signal	2	6.1
	Unknown	3	9.1
	Speeding	5	15.2
Violation at time of incident	None	29	87.9
	Impaired driving	1	3.0
	Driving while prohibited/suspended	1	3.0
	Driving without due care	1	3.0
	Passing on right	1	3.0
Criminal charge at time of incident	None	23	69.7
	Dangerous driving causing death	8*	24.2
	Failure to stop at scene	1	3.0
	Impaired driving causing death	1	3.0
Previous violations	None	6	18.2
	Speed	22	66.7
	Fail to wear seatbelt	14	42.4
	Disobey stop sign/traffic control	7	21.2
	Fail to display insurance/license class	7	21.2
	Impaired driving	3	9.1
	Driving without due care/consideration	3	9.1
	Cross double line	2	6.1
	Fail to yield	2	6.1
	Follow too close	2	6.1
	Fail to produce licence/registration	2	6.1
	Noise	2	6.1
	Unsafe reverse	2	6.1
	Driving contrary to restrictions	1	3.0
	Driving without insurance	1	3.0
	Fail to signal	1	3.0
	Fail to stop after collision	1	3.0

*In one case, this initial charge was reduced on plea to fail to stop at scene and driving while prohibited.

Preventability

The majority (94%) of child pedestrian fatalities were determined to be preventable. One death was determined to be not preventable due to the absence of modifiable risk factors. Preventability could not be determined in one case due to insufficient information.

DISCUSSION

Child death review provides the most comprehensive child death data currently available in BC. Whereas injury data provided by

other sources are typically limited to information on incident and in-hospital treatment only (eg, Discharge Abstract Database; Vital Statistics), child death review is a multi-agency process that systematically collects data concerning the biological, behavioural, environmental, and social determinants of injury over the child's life course. Child death review is therefore capable of generating the broad spectrum of data required for an ecological understanding of preventable child mortality, which recognises individual, community, and societal factors that interact at different levels to influence child health and well-being.[2 3]

Child pedestrian incidents are a leading cause of injury related death for Canadian children; each year in Canada over 2400 child pedestrians are seriously injured and approximately 30 are killed.[5] In order to alleviate this unnecessary burden, more detailed epidemiologic data on child pedestrian injury is greatly needed to support evidence based decision making concerning policy, programme and environmental interventions.[6]

The results of this study provide a comprehensive picture of the epidemiology of child pedestrian fatalities in BC that can be translated into the improvement of injury prevention programmes and policies.

Vulnerability of Aboriginal children and families of low socioeconomic status

The study results indicated that 12.1% of child pedestrian fatalities in BC were of Aboriginal descent, despite comprising only 4.8% of the population. While Aboriginal children appear to be over-represented among child pedestrian fatalities, a larger group and age adjusted population data are required to determine the significance of Aboriginal ethnicity. Evidence indicates that Aboriginal/Indigenous peoples suffer from increased injury related morbidity and mortality relative to the general population, in large part because of underlying socioeconomic factors.[7–11] Despite the high incidence rates, research on injury epidemiology and prevention in these communities is relatively limited. The CDRU is a rare source of comprehensive data on Aboriginal child mortality, which can be shared with Aboriginal communities to support the development and delivery of local strategies and programmes that increase awareness and reduce risk factors associated with child pedestrian injury.

In our sample, a significant number of families were receiving income assistance, indicating a low socioeconomic status (SES). Previous work has demonstrated that low SES is associated with an increased risk of child pedestrian death: children in the lowest SES bracket have four times the risk of those in the highest bracket.[12–18] Factors known to contribute to this increased risk include lack of recreational space to play, poorly equipped schools and libraries, and walking for transport (vs being chauffeured).[5 15 19–21] Injury prevention experts have identified the need to gain a clearer understanding of the causal sequence linking poverty with pedestrian injuries.[6] The CDRU is in a unique position to investigate the relationship between child pedestrian injury and poverty, the findings of which can be used to catalyse the development of policy solutions to reduce socioeconomic inequalities of injury, such as the provision of recreational space and road safety infrastructure in low income neighbourhoods.[13 15]

Environmental risks in residential neighbourhoods

This review identified a high incidence of child pedestrian fatalities on residential streets, the vast majority of which involved a posted speed limit of 50 kph or higher. Environmental risk factors associated with the increased likelihood of child pedestrian injury in residential neighbourhoods include inadequate play areas, increased traffic, faster average speed, and lack of driver visibility due to a high degree of curbside parking.[20] Child pedestrian injury is lower in neighbourhoods with traffic calming measures in place, such as low speed limits, speed bumps, traffic circles (roundabouts), and restrictions on traffic volume in residential areas.[20] Speed limits are important due to the implications on vehicle speed and corresponding severity of injury should a pedestrian incident occur; evidence has found a sevenfold greater risk of children being hospitalised for pedestrian injury in residential neighbourhoods with an average vehicle speed of 50 kph compared to 30 kph.[22] The unique ability for child death review to describe child pedestrian fatalities in the context of residential speed limits and other environmental factors supports the need for greater emphasis on the establishment of safe play areas and traffic calming measures in residential neighbourhoods across BC, most notably the reduction of residential speed limits to 30 kph.

Risky pedestrian behaviour and adult supervision

Child pedestrians are uniquely vulnerable due to their immature level of physical, sensory and cognitive development, leading to potential errors in judgement, decision making, and impulse control.[5 23] Risky behaviour, or lack of inhibitory control, is one of the strongest predictors of child pedestrian injuries and fatalities.[24 25] We observed risky pedestrian behaviour in 57.6% of our sample, the most frequent actions being crossing or darting into oncoming traffic and walking or playing on the roadway. Although pedestrian education and skill building programmes have demonstrated improvements in safety attitudes and awareness, these interventions have not had a measurable effect on child injury rates.[20] Given the developmental vulnerability involved and limited effectiveness of child pedestrian education as an isolated strategy, adult supervision is critical to ensuring that young children navigate traffic safely. The CDRU is the only agency that systematically collects data on adult supervision among fatal childhood injuries. Results of this review show that only 33% of children below 10 years of age were under active supervision (ie, within sight and reach) of an adult at the time of the fatal incident. This finding strongly supports the need to raise awareness of child pedestrian injury and improve supervision practices among parents and caregivers in BC.

Driver violation history

Results of this study indicate a significantly greater propensity for drivers involved in a fatal incident to have had previous violations, in addition to a significantly higher average number of violations. This is strong evidence that driver violation history is associated with an increased risk of fatal pedestrian injury. We are aware of only one prior study that explored the relationship between specific driver violations and child pedestrian fatalities, in which similar conclusions were drawn regarding the predictive nature of driver violation history.[26] The ability to integrate violation history and other driver related risk factors with upstream injury determinants is a testament to the multi-agency collaboration (in this case, with ICBC) inherent in the child death review process. Implications of these findings include the need for continued improvements to the province's management of high risk drivers and implementation of driver awareness and education programmes that address pedestrian safety.

Vehicle configuration

The majority of non-traffic fatalities reviewed for this study involved pick-up trucks and sport utility vehicles. Non-traffic

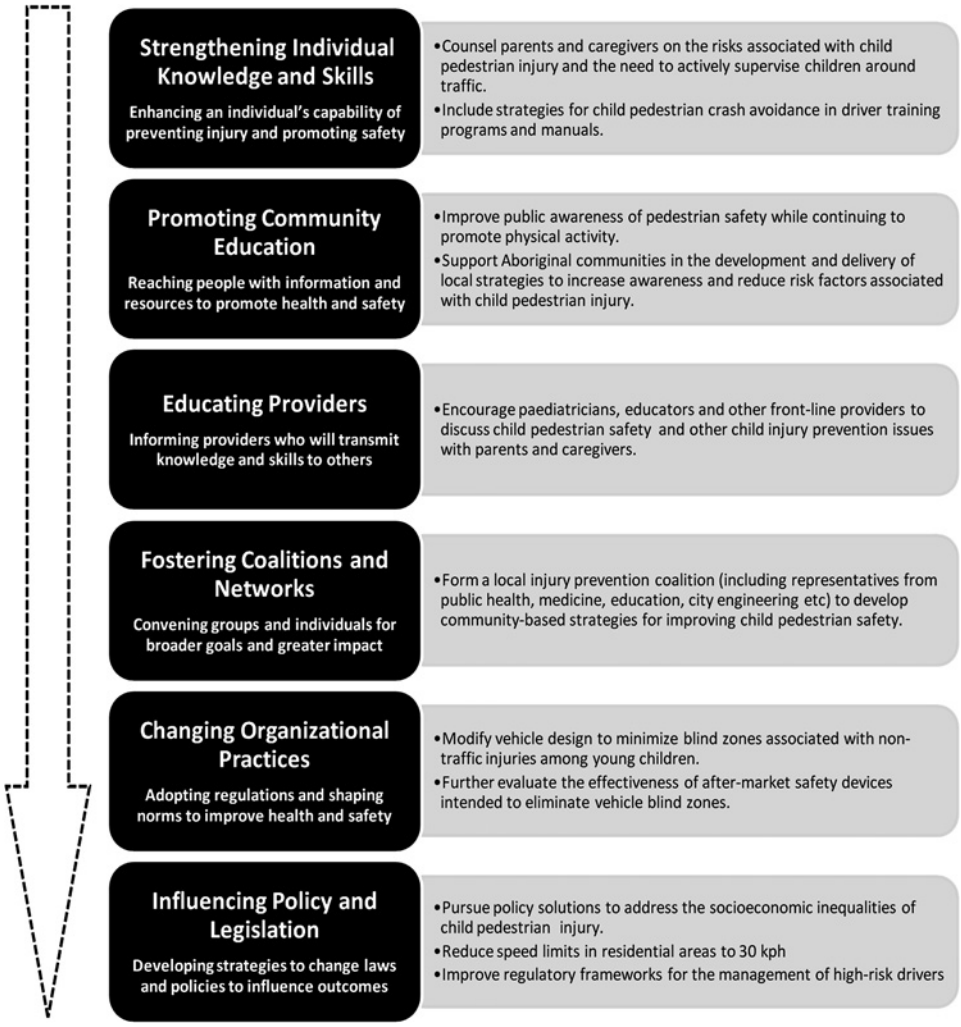

Figure 1 Recommendations for the prevention of child pedestrian fatalities across the Spectrum of Prevention.

incidents typically involve unsupervised young children struck by reversing vehicles with large blind spots. The configuration of pick-up trucks and sport utility vehicles contributes to poor driver visibility, placing young children at particular risk due to their physical development. The capacity for targeted prevention of non-traffic pedestrian fatalities in BC and Canada is limited by poor surveillance of the problem. Child death review is one of the few sources of non-traffic death data and can be utilised to support prevention strategies such as legislative changes for automobile manufacturing or recommendations for after-market safety devices intended to eliminate the blind zone.

RECOMMENDATIONS

The mission of the CDRU is to better understand how and why children die and to translate this knowledge into preventive action aimed at improving the health, safety and well-being of all children in BC. CDRU recommendations are informed by the best and most promising practices for prevention and are developed using the Spectrum of Prevention, a valuable framework for promoting a comprehensive approach to prevention that includes six interrelated levels of strategy development.[27] An example of this framework applied to recommendations for preventing child pedestrian fatalities is provided in figure 1.

The CDRU will be using the results of this study as the foundation for a special report on child pedestrian fatalities. The special report will conduct further examination of trends in rates and risk factors related to child pedestrian fatalities and will issue formal recommendations designed to strengthen pedestrian safety policies, programmes, and partnerships in BC.

What is already known on the subject

- Lack of adult supervision is a key risk factor for child pedestrian fatalities.
- Most child pedestrian fatalities occur within 1 km of the child's home.

What this study adds

- Previous driver violations may be associated with risk involvement in a fatal pedestrian incident.
- Aboriginal children and children within low income families appear to be particularly vulnerable to pedestrian injury.
- Child death review generates an ecological understanding of preventable child mortality and is a powerful tool for advancing evidence based, multi-level strategies to promote and protect child health and safety.

LIMITATIONS

The *Coroner's Act* defines a child as 18 years and under. This definition is not universal, with many other agencies defining a child as 19 years of age and under, limiting our ability to make direct comparisons against other groups or the general population. Another limitation stems from the small sample size. Despite the rich data available on the 33 cases, we were unable to conduct the inferential statistics that would allow for identification of disparate patterns of risk factors underlying child pedestrian death in different age groups—for example, young children versus teenagers.

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Contributors I assure you that all authors included on this paper fulfil the criteria of authorship. I also assure that there is no one else who fulfils the criteria who has not been included as an author.

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Paediatric low speed vehicle run-over fatalities in Queensland

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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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History of maltreatment among unintentional injury deaths: analyses of Texas child fatality review data, 2005–2007

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History of maltreatment among unintentional injury deaths: analyses of Texas child fatality review data, 2005–2007

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ABSTRACT

Objective This report examines unintentional injury deaths among children with and without a history of child maltreatment.

Methods Data are from reviews of 1192 unintentional injury deaths occurring among children in Texas during 2005–2007. The study examined differences in child demographic characteristics, injury mechanism, and supervisor status at time of death between children with and without maltreatment history by using descriptive statistics and χ^2 tests. Separate analyses compared characteristics of asphyxia, drowning, and poisoning deaths.

Results In 10% of the unintentional injury deaths that were reviewed, the child had a history of maltreatment. The prevalence of a history of maltreatment was highest among black decedents and lowest among white decedents. Prevalence of a history of maltreatment was highest among infant decedents and lowest among youth decedents, ages 10–14 years. Among deaths where there was no maltreatment history, 54% were due to motor vehicle related incidents, whereas 51% of deaths among children with maltreatment history were caused by drowning, asphyxia, and poisoning. Supervisors of child decedents with a history of maltreatment were significantly more likely to have been alcohol impaired (6.9% vs 1.6%; $p<0.0005$), or asleep (12.1% vs 6.6%; $p=0.03$) at the time of death. Differences between child decedents with and without maltreatment history were observed in infant sleep surface in suffocation deaths, location and barrier type in drowning deaths, and substance type in poisoning deaths.

Conclusions These data show that the mechanisms and circumstances surrounding unintentional injury deaths among children with a history of maltreatment differ from those without a history of maltreatment. This underscores the need for appropriate interventions to prevent unintentional and intentional injuries in families with a history of maltreatment.

Child maltreatment (CM), including physical, sexual, and emotional abuse and neglect, is often a recurring phenomenon. Drake *et al* determined that maltreatment recurrence among low income children from a US midwestern metropolitan area was 48% within 3 years and 62% within 7.5 years after the initial maltreatment report.[1] Only a limited number of studies exist regarding the proportion of CM associated deaths occurring among children with a history of maltreatment. Such research is critical in identifying modifiable risk factors associated with child deaths. One study of maltreatment history among child deaths reported that a history of child protective service (CPS) intervention was associated with a higher rate of homicide victimisation.[2] They also found higher rates of unintentional injury child deaths among families that had contact with social or CPS. Two major limitations of these studies are sample selection biases due to the use of child abuse registry data and the fact that many social and CPS cases were found to have been opened after the death of the child.

Child deaths related to maltreatment are often underreported because of inadequate investigation or lack of information sharing between investigators from multiple agencies. In addition, reporting systems such as vital statistics typically fail to capture the role of maltreatment in child deaths.[3–6] Therefore, associations between a history of CM and other causes, manners, and mechanisms of death largely have been unexplored in previous epidemiologic studies. Child fatality review (CFR) is a system that has the potential to address these limitations in reporting CM related deaths.

In 1995, legislation mandating formation of the state CFR team committee was passed in Texas, and counties were authorised to form local and regional CFR teams (CFRTs).[7] CFRTs are multidisciplinary, multiagency groups that review child deaths at a local level and identify prevention strategies to reduce incidence of preventable child deaths.

CFR data are the only source of statewide data for analyses on selected factors associated with child death, including history of CM documented before the death of the child. This paper examines the mechanism and other circumstances surrounding child deaths due to unintentional injury among children with and without maltreatment history that were reviewed by CFRTs in Texas.

METHODS

CFR in Texas begins after a CFRT receives a death certificate from the Office of Vital Statistics at the Texas Department of State Health Services. An approximate 2 year lag exists between when a child death occurs and when a CFRT meets to review the circumstances surrounding the death.

Sixty-four CFRTs in Texas cover 189 (74%) of 254 counties in the state. CFRTs review deaths of children (aged <18 years) occurring in Texas. Because of the volume of deaths in certain jurisdictions and because teams are composed largely of volunteers, they do not review all deaths. Thus, case selection is dependent upon multiple factors, including

geographic area where the death occurred, total number of deaths, access to multiple data sources, and frequency of local team meetings. In metropolitan areas with high rates of child fatalities, deaths resulting from homicide and suicide are prioritised for review. The proportion of all child deaths occurring during 2005–2007 and reviewed by CFRTs ranged from 35% in 2005 to 57% in 2007; however, the demographic distribution of the reviewed deaths is similar to that of all child deaths, indicating adequate representativeness for epidemiologic analyses. Across teams, the proportion of deaths within the jurisdiction that were reviewed varied widely from 14–100%.

Using a standardised data entry form, local teams enter data into a multistate database developed by the National Maternal and Child Health Center for Child Death Review. The form collects standardised information regarding the child decedent and their primary care giver and supervisor; information regarding the incident and ensuing investigation; and cause of death information, including the official manner and primary cause of death. Information collected also includes circumstances of the incident, and any acts of omission or commission leading to death, including child abuse, neglect, and suicide; services to family and community as a result of death; prevention initiatives resulting from the review; review meeting process; and an accompanying narrative. Texas has participated in the multistate data collection since 2006, beginning with entry of 2005 child death data. Data used for these analyses are from reviews of child deaths occurring during 2005–2007. There were 5307 child deaths reviewed during this time period. This study focuses on the 1192 deaths due to unintentional injury.

We examined differences in demographic characteristics and circumstances surrounding unintentional injury child deaths between those with and without a history of CM. Descriptive statistics showing prevalence of selected sociodemographic and other risk factors were calculated and χ^2 tests were performed. Fisher's exact tests were used for analyses with limited cell sizes. All sample sizes and percentages are based on valid responses only. Missing values were excluded on a list-wise basis. Data were analysed by using SAS version 9.2.

Race and ethnicity variables were combined into a single variable with four categories: white, black, Hispanic, and other. Age was categorised into five groups: infants (<1 year), 1–4 years, 5–9 years, 10–14 years, and 15–17 years. Income level is an estimate based on the local context and costs of living in the community. Economic indicators such as education, social service enrolment, and health insurance type are used in determining a care giver's income level. If no concrete evidence exists regarding income, it is coded as 'unknown'. A dichotomous variable for history of CM was created by combining multiple variables. Children who had an open CPS file, a history of maltreatment from a CPS record check or other source (eg, police record or medical record), or whose caregiver had a documented history of CM perpetration were identified as having a history of CM. A caregiver was defined as the person(s) responsible for care, custody, and control of a child the majority of the time. Documentation of caregiver CM history was measured by presence of past CPS referrals/substantiations of child abuse/neglect, and/or documentation of abuse/neglect in law enforcement reports or medical records.

Data regarding mechanism of injury leading to death were obtained from death certificates. Categories for mechanism included motor vehicle and other transport; fire, burn or electrocution; drowning; asphyxia; weapon, including body part; animal bite or attack; fall or crush; poisoning, overdose, or acute intoxication; exposure; undetermined; other; and unknown. For the purpose of analyses, animal bite or attack and exposure were collapsed and combined with 'other' and undetermined was combined with 'unknown'.

We also examined differences in the status of the child's supervisor at the time of death by CM history. A child's supervisor was defined as the person(s) responsible for care and control of the child at the time of the incident leading to death.

Circumstances of asphyxia, drowning, and poisoning deaths were examined in detail due to adequate number of observations for subgroup analyses. Types of asphyxia deaths were compared between the CM history and no CM history deaths. In addition, for the subpopulation of infants, sleep surfaces were also compared for the two groups, with and without CM history. Sleep surfaces reported included crib, adult bed, couch/sofa, bassinette, waterbed, playpen, chair, floor, car seat/stroller, other, and unknown. Bassinette, waterbed, playpen, chair, floor, and car seat/stroller were combined into the 'other' category due to small numbers. Location of and barriers in place at the time of drowning deaths were compared between the CM history and no CM history groups. Drowning locations included open water (eg, lake, river, ocean, etc), pool/hot tub/spa, bathtub, bucket, well/cistern/septic tank, toilet, other, and unknown. Bucket, well/cistern/septic tank, and toilet were combined with 'other'. For poisoning deaths, substance type was examined. Substance types were prescription and over-the-counter medications, cleaning products, alcohol, illicit drugs, and other. Other poisonous substances included plants, pesticides, antifreeze, other chemicals, herbal remedies, carbon monoxide, other gases, and otherwise unspecified substances.

RESULTS

Demographics

During the 3 year period from 2005 to 2007, 1192 unintentional injury child deaths were reviewed. The largest proportion of reviewed unintentional injury child deaths were among Hispanics (41%), followed by whites (38%) and blacks (19%). A greater proportion of reviewed unintentional injury deaths were among boys (63%) than girls and the majority (30%) were among youth ages 15–17 years. There were no significant socioeconomic differences in children with and without a history of CM (table 1).

The proportion of children in each age group with a history of CM ranged from 7% among children ages 10–14 to 27% among infants <1 year old.

Mechanism of external injury leading to death

Overall, the majority of unintentional injury deaths among children were motor vehicle related. The proportion of deaths due to this cause differed by CM history, with more than half (55%) of unintentional injury deaths among children without a history of CM being due to motor vehicle related injuries, and one third (33%) among children with a history of CM being due to motor vehicle related injuries ($p<0.0001$). Drowning, asphyxia, and poisoning accounted for the majority (51%) of deaths among the group with a history of CM. Children with a history of CM experienced significantly more asphyxiations ($p=0.07$), poisonings ($p=0.001$), and deaths of unknown mechanism ($p=0.03$) (table 2).

Supervisor and caregiver characteristics

Supervisors of children with a history of CM were significantly more likely to have been alcohol impaired (6.8% vs 1.6%; $p<0.0005$) or asleep (12.0% vs 6.6%; $p=0.03$) at the time of the child's death, compared with supervisors of children with no history of CM.

Table 1 Demographic characteristics of Texas unintentional injury child fatalities reviewed by child fatality review teams, 2005–2007 (n=1192)

	Total No. (%)	No CM history No. (%)	CM history No. (%)	p Value
Total	1192 (100)	1075 (90.2)	117 (9.8)	NA
Race/ethnicity (data missing=26)				0.15
White	442 (37.9)	402 (38.2)	40 (35.7)	
Black	223 (19.1)	195 (18.5)	27 (25.0)	
Hispanic	473 (40.6)	427 (40.7)	44 (39.3)	
Other	27 (2.3)	27 (2.6)	0 (0)	
Sex (data missing=9)				0.26
Male	740 (62.6)	673 (63.1)	67 (58.3)	
Female	443 (37.4)	394 (36.9)	48 (41.7)	
Age (years) (data missing =1)				
<1	190 (15.9)	159 (14.8)	31 (26.5)	0.001
1–4	307 (25.8)	277 (25.8)	30 (25.6)	0.98
5–9	158 (13.3)	138 (12.9)	20 (17.1)	0.20
10–14	180 (15.1)	172 (16.0)	8 (6.8)	0.01
15–17	356 (29.9)	328 (30.5)	28 (23.9)	0.14
Caregiver income (data missing =1142)				0.79
Low	5 (10.0)	4 (10.5)	1 (8.3)	
Medium	17 (34.0)	14 (36.8)	3 (25.0)	
High	28 (56.0)	20 (52.6)	8 (66.7)	

CM, child maltreatment.

Circumstances of deaths

Though none were statistically significant, examination of circumstances surrounding deaths due to asphyxia, drowning, and poisoning revealed several differences between child decedents with and without a history of CM.

Asphyxia

The leading cause of child death due to asphyxia was suffocation. Among child decedents with a history of CM, all 16 suffocation deaths occurred among infants. Among these 16 infants who died due to suffocation, the sleep surface for infant decedents with a history of CM was more often (19%) a couch/sofa as compared to infant decedents with no history of CM (11%) (table 3).

Drownings

Twice as many child decedents with a history of CM drowned in the bathtub compared to child decedents with no CM history (24% vs 12%) (table 3).

Poisonings

In addition to the higher overall prevalence of poisoning as a cause of child death among children with a history of CM, more children with a history of CM were poisoned by prescription medications (31% vs 26%) and alcohol/illicit drugs (46% vs 41%) than children with no history of CM (table 3).

DISCUSSION

These data show that 10% of child decedents who had a history CM victimisation or whose caregivers had a history of CM perpetration are represented among child deaths. Among child decedents with a CM history, certain groups might be especially important to target. Substantial demographic differences exist between child decedents with and without a history of CM.

Examination of the differences in the mechanism of injury leading to death between children with and without CM history reveals a potential focal point for future research and intervention. Mechanisms of injury among children with a history of CM were commonly forms of unintentional injuries that are highly preventable (suffocation, drowning, and poisoning). Thus, more than half of the reviewed child deaths may have been preventable through increased and adequate age appropriate supervision and modification of the home environment. Overall, the high proportion of deaths among children with a maltreatment history or where the caregivers had a history of perpetrating maltreatment suggests the need for appropriate prevention interventions for parents/guardians that help to promote safe, stable, and nurturing family relationships.

Motor vehicle related deaths may result from a variety of scenarios, including lack of/improper use of restraint in a vehicle or lack of supervision leading to a child being hit or rolled over by a motor vehicle. These scenarios may not be independent of CM history, especially neglect. Thus, we felt this was plausible and important to examine. However, in our analyses, the hypothesised relation did not emerge.

The most obvious limitation of these data results from failure to review all child deaths. A particularly problematic issue is the prioritisation of deaths due to external causes (eg, unintentional injuries and violent victimisation) for CFRT review in larger metropolitan areas. Review of deaths due to medical causes may also reveal interesting differences in circumstances depending upon CM history. Another major limitation of the CFRT data is the frequency of missing or unknown values. Missing values might represent non-reporting of information by persons under investigation after the death (eg, parents/caregivers or medical personnel), which might occur differentially, depending upon circumstances surrounding child deaths. For example, if a criminal investigation is pending after a suspicious death, information, particularly that pertaining to a caregiver's or supervisor's status or actions at the time of a child's death, might be more likely to be withheld than if a death were deemed to be due to natural causes. Missing and unknown values might also result

Table 2 Comparison of circumstances of unintentional injury child deaths by maltreatment history, Texas, 2005–2007

	Total No. (%)	No CM history No. (%)	CM history No. (%)	p Value
Overall	1192 (100)	1075 (90.2)	117 (9.8)	
Mechanism of death				
Motor vehicle related	627 (52.6)	588 (54.7)	39 (33.3)	<0.0001
Fire/burn	62 (5.2)	53 (4.9)	9 (7.7)	0.20
Drowning	196 (16.4)	171 (15.9)	25 (21.4)	0.13
Asphyxia	150 (12.6)	129 (12.0)	21 (18.0)	0.07
Weapon	18 (1.5)	17 (1.6)	1 (0.9)	0.54
Poison	59 (5.0)	46 (4.3)	13 (11.1)	0.001
Other	65 (5.6)	60 (5.6)	5 (4.3)	0.55
Unknown	15 (1.3)	11 (1.0)	4 (3.4)	0.03
Supervisor status at time of child's death*				
Absent	106 (8.9)	100 (9.3)	6 (5.1)	0.13
Alcohol impaired	25 (2.1)	17 (1.6)	8 (6.8)	<0.0005
Distracted	86 (7.2)	73 (6.8)	13 (11.1)	0.09
Drug impaired	14 (1.2)	11 (1.0)	3 (2.6)	0.15
Asleep	85 (7.1)	71 (6.6)	14 (12.0)	0.03
Caregiver prior child death	13 (1.1)	10 (0.9)	3 (2.6)	0.13
Caregiver caused/contributed to child death	260 (22.0)	214 (19.9)	46 (39.3)	<0.0001

CM, child maltreatment.
*Categories are not mutually exclusive.

Table 3 Comparison of circumstances of unintentional deaths by maltreatment history, Texas, 2005–2007

	Total	No CM history	CM history	p Value
Child asphyxia deaths (<18 years)	150 (100)	129 (86.0)	21 (14.0)	
Cause				0.74
Suffocation	101 (67.3)	85 (65.9)	16 (76.2)	
Strangulation	12 (8.0)	11 (8.5)	1 (4.8)	
Choking	16 (10.7)	15 (11.6)	1 (4.8)	
Unknown	21 (14.0)	18 (13.9)	3 (14.3)	
Infant suffocation deaths (<1 year)	96	80 (83.3)	16 (16.7)	
Sleep surface				0.74
Crib	8 (8.3)	7 (8.8)	1 (6.3)	
Adult bed	50 (52.1)	43 (53.7)	7 (43.8)	
Couch/sofa	12 (12.5)	9 (11.2)	3 (18.7)	
Other	3 (3.1)	3 (3.8)	0 (0)	
Unknown	23 (24.0)	18 (22.5)	5 (31.2)	
Child drowning deaths (<18 years)	196 (100)	171 (87.2)	25 (12.8)	
Location of incident				0.48
Open water	36 (18.4)	32 (18.7)	4 (16.0)	
Pool, hot tub, spa	106 (54.1)	94 (55.0)	12 (48.0)	
Bathtub	26 (13.3)	20 (11.7)	6 (24.0)	
Other	24 (12.2)	21 (12.3)	3 (12.0)	
Unknown	4 (2.0)	4 (2.3)	0 (0)	
Child poisoning deaths (<18 years)	59 (100)	46 (78.0)	13 (22.0)	
Substance type				0.90
Prescription medication	16 (27.1)	12 (26.1)	4 (30.8)	
Over-the-counter medication	4 (6.8)	3 (6.5)	1 (7.7)	
Cleaning product	0 (0)	0 (0)	0 (0)	
Alcohol/illicit drugs	25 (42.4)	19 (41.3)	6 (46.2)	
Other	14 (23.7)	12 (26.1)	2 (15.4)	

CM, child maltreatment.

from failure to obtain or record information during the official death scene investigation conducted by police, CPS, medical examiners, or coroners. An additional limitation is reliance upon CPS records for much of the maltreatment history data. These data likely under-represent minor forms of maltreatment and those that do not result in physical injury.[8]

Efforts to improve completeness and accuracy of Texas data in the multistate system are needed for examining more closely and decreasing potential biases. Such recommendations should be made while maintaining sensitivity to the largely volunteer nature of the local teams as well as the workload of investigative officials. One recommendation is to conduct training with local teams on the importance of completeness in data abstraction and accuracy in data entry. Any request to increase the amount of data collected by teams should be balanced with potential increases in burden on local teams. Thus, a second recommendation is to establish a minimal set of data elements to be collected by the case report form. In addition, training with officials involved in child death investigations is recommended, with particular attention to observing and recording circumstances surrounding death that are captured in the database. Such training can involve minimal additional effort on the part of investigators, yet potentially result in substantial improvements in data quality.

Another improvement to the CFRT process that can enhance data quality and representativeness is to institute a hierarchy by which deaths are reviewed. For example, our analyses could have been enhanced if all cases in which a history of

What is already known on this subject

- Child maltreatment (CM), including physical, sexual, and emotional abuse and neglect, is often a recurring phenomenon with estimates of recurrence ranging from 48% within 3 years to 62% within 7.5 years after the initial report.
- Child deaths related to maltreatment are often underreported as a result of inadequate investigation, lack of information sharing between investigators from multiple agencies, and failure to capture the role of maltreatment in child deaths.
- Associations between a history of CM and other causes, manners, and mechanisms of death have been largely unexplored in epidemiologic studies.

What this study adds

- Child fatality review (CFR) is an existing system that has the potential to address the aforementioned limitations in reporting CM related deaths.
- On the basis of analyses of the Texas CFR data, a large proportion of deaths were among children with a history of maltreatment victimisation and whose caregivers had a history of maltreatment perpetration.
- These analyses demonstrate the utility of the data for epidemiologic analyses on one risk factor captured in the CFR team data. Recommended improvements to the processes of child death review and data entry will enhance data quality and enable use of more sophisticated analytic approaches.

CM occurred had been reviewed. Prioritising review of deaths according to cause of death (eg, external causes only) can result in comparable data across teams as well as a complete picture of the circumstances surrounding deaths with the greatest potential for intervention. This recommendation does not preclude review of all child deaths where feasible for teams, but does standardise the reviews by teams in jurisdictions where too many deaths occur for all to be reviewed.

Despite the limitations and recommended improvements, CFRT data are a unique, rich data source that provides detail regarding circumstances of child deaths. These data are critical for public health prevention efforts as a link between vital statistics and CPS data. The analyses presented here demonstrate utility of the data for epidemiologic analyses of one of multiple risk factors captured by the CFRT data. Improvements to processes of child death review and data entry will enhance data quality and result in fewer missing data, thus enabling use of more sophisticated analytic approaches.

Competing interests None.

Ethics approval This study was conducted with the approval of the Centers for Disease Control and Prevention.

Contributors All authors listed shared in the work of the actual research: study design, statistical analyses, and reporting of the data. The article was written by SEP, with the order of authors listed corresponding to the actual time spent on contributing to article content.

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Role of a child death review team in a small rural county in California

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Role of a child death review team in a small rural county in California

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ABSTRACT

Humboldt County is one of California's most rural counties. Located in far Northern California, it is 6–7 h by car from the nearest major urban areas of San Francisco and Sacramento. In landmass it is one of the largest of the California counties, about the size of Rhode Island. In 1991, the Humboldt County Public Health Branch began a Fetal Infant Mortality Review programme. Because of the county's small size, the Fetal Infant Mortality Review process was combined with the review of child deaths through age 17. Responding to a high proportion of cases of child deaths due to unintentional injury, the team developed a workgroup to explore injury prevention strategies. Funding was identified to hire a coordinator who formed a Childhood Injury Prevention Program and developed a strategic plan. The plan prioritised both motor vehicle/traffic safety related injuries and general childhood injury. Funding was obtained for child passenger safety and youth safe driving programmes. The Childhood Injury Prevention Program also collaboratively addressed other injury prevention areas, including water safety. As a small, rural county in California, committed safety advocates from multiple agencies were able to utilise the child death review process to guide injury prevention efforts. Case reviews provided the motivation and quantitative and qualitative data to design programmes and implement interventions that addressed specific unintentional injuries causing child deaths and injuries in Humboldt County.

BACKGROUND AND HISTORY OF TEAM DEVELOPMENT

Humboldt County is one of California's most rural counties. Located in far northern California, it is 7 h by car to the nearest major urban areas, San Francisco and Sacramento (figure 1). The County encompasses 2.3 million acres, 80% of which is forestlands, protected redwoods, and recreation areas. It is bound on three sides by similar rural counties and on the west by the Pacific Ocean. In landmass it is one of the State's largest counties, about the size of Rhode Island.[1] Humboldt County is small in population and ranks 35th of 58 counties in the State. The California Department of Finance estimated the 2009 population at 132 713 with 54% of residents living in outlying, unincorporated areas (State of California, Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001–2010, with 2000 Benchmark, Sacramento, California, May 2010).

In 1991 Humboldt County became one of 11 counties in California to establish a Fetal Infant Mortality Review (FIMR) programme. Because of the county's small size, the Public Health Branch chose to combine the FIMR process with the review of child deaths through age 17, creating a multi-agency FIMR and child death review (CDR) team. In some smaller areas the CDR process is facilitated by law enforcement agencies where prevention may not always be a primary focus. The combined FIMR/CDR team located in the Humboldt County Public Health Branch allowed for increased community representation with an emphasis on prevention based strategies.

The primary objectives of the FIMR/CDR team are: to maintain data and analyse trends in fetal, infant, and child deaths; to facilitate prompt, coordinated, inter-agency, multidisciplinary response to child death; to make recommendations for interventions at all levels of the spectrum of prevention[2]; to increase public awareness of preventable measures regarding childhood deaths; and to submit annual reports on team findings.

Formal team protocol was developed in 1992 and is revised as needed. Team membership is closed and includes professional representatives from the following disciplines and agencies: Coroner, Law Enforcement, District Attorney's Office, Child Welfare Services, Medical Providers, Mental Health Branch, Drug & Alcohol Services, Probation Department, Schools, Emergency Medical Services, Indian Child Welfare, and community based children and family agencies. The role of members is specifically outlined in the protocol. Other professional guests are invited on an individual basis if they have direct case specific information or particular subject expertise. No guest or member is permitted to participate if there is a personal or non-professional connection to the case being reviewed. While FIMR and other monies cover a portion of the team coordinator position, no other funding sustains the team. Member participation is voluntary with the support of their agency. The team meets monthly for 2 h and reviews two to four cases each time.

INJURY PREVENTION AND THE ROLE OF THE CDR TEAM PROCESS

One of the major initiatives emerging from this joint review process was a comprehensive response to the high proportion of deaths due to unintentional injuries. In fact, unintentional injuries are the leading cause of child death in Humboldt County. From 1991to 1999, 157 children, youth, and young adults ages 0–24 died and 1578 were hospitalised as a result of unintentional injuries and intentional firearm injures (Humboldt County Childhood Injury Prevention Strategic Plan, September 2002). Unintentional injuries accounted for 71% of all

Figure 1 Map, State of California – Humboldt County highlighted, 2010.

injury deaths and 80% of injury hospitalisations among 0–24 year olds. For the years 1995–1997, Humboldt County ranked 46th worse out of California's 58 counties in unintentional injuries to 0–24 year olds.[3]

The FIMR/CDR team played a critical role in the surveillance and identification of common risk factors contributing to unintentional injury deaths. As a direct result of team efforts, public health professionals were able to design injury prevention interventions and programmes to address the leading causes of unintentional injury for young people in Humboldt County. The qualitative information gathered by the team enriched the analysis of common risk factors beyond what could be gleaned from quantitative sources. Small numbers and unstable rates have always posed a challenge to understanding fully the impact of childhood injury and death, and case reviews provided an institutionalised method of gathering additional data on all child deaths that occurred in the county. The FIMR/CDR team also created a linked, coordinated network of stakeholder agencies and organisations devoted to preventing injury to young people in the county.

By 1995, the FIMR/CDR team had documented unintentional injury as the leading cause of deaths for children age 1–17 (Humboldt County Fetal Infant Mortality and Child Death Review Annual Report, April 1995). During 1993–1994, 51% of child deaths were from unintentional injuries, with 46% of these deaths from motor vehicle crashes. The report recommended a focus on seat belt and car seat safety. This trend continued, and a review of the FIMR/CDR database from 1991 to 2009 shows that in 1997, 21 out of 23 children age 1–17 died from intentional and unintentional injury causes. That year this small county lost two children from homicide and two from suicide, while 17 children were killed from unintentional injuries, including: a 2-year-old who died when a cement mixer she was playing on fell over and crushed her; a 12-year-old who died from hanging when he slipped and fell while climbing a tree; and the deaths of two young girls from a sand cave collapse. Four other children died from drowning, and six cases involved motor vehicle crashes, including: the death of a child who was in the back of a truck that rolled down a hill and off an embankment; a child who was in a booster seat that was incorrectly installed; and two children who died in separate crashes who were in child safety seats that were not attached to the vehicles.

Details revealed during reviews motivate individuals in a way that data and research can not. The use of the sentinel case review process is a powerful tool for understanding complex situations related to child death and is an important aspect of a full child health monitoring and response system. By examining a story of real life and death, the process reveals graphic situations that are a call to action. For example, it was the case of a 1-year-old child who was killed in a motor vehicle crash that was actually responsible for the original team recommendation to develop an unintentional childhood injury subcommittee. Secured in a car seat, the seat was not attached to the home-made bench where it had been placed. The other family members escaped with minor injuries (Humboldt County FIMR/CDR Team Minutes, 4 February 1998).

Shortly after this review, the team developed a childhood unintentional injury prevention subcommittee. A collaborative of law enforcement and health and human service providers were identified that were committed to reducing the rate of unintentional injuries among children. With support from the team and the newly formed subcommittee, funding was obtained in 2001 to hire a coordinator to develop the Public Health Branch's Childhood Injury Prevention Program (CIPP).

The programme's immediate goal was to develop a strategic plan, and staff utilised the four components of the public health approach to address the issue of unintentional injury among youth: surveillance, risk factor identification, intervention/evaluation, and implementation. The programme established a multi-agency coalition, compiled local data on injuries and deaths from ages 0–24, conducted a community assessment, reviewed FIMR/CDR team findings, and researched effective interventions. During the community assessment, a number of issues emerged as common to childhood injuries: (1) a lack of education/knowledge about, access to, and appropriate use of safety equipment; (2) a lack of adult supervision/neglect; and (3) alcohol and other drug use by parents/caregivers (Humboldt County Childhood Injury Prevention Strategic Plan, September 2002).

These themes had also surfaced during the case review process and reinforced the importance of addressing contributing risk factors when developing interventions. Based on the CIPP's review of effective practices, recommendations for prevention activities were developed and incorporated into the plan. Using prioritisation criteria, the plan was divided into two parts—motor vehicle/traffic safety related injuries, and general childhood injury. The top three priority motor vehicle/traffic safety areas were: child passenger safety; driving under the influence; and youth/young adult driving and passenger safety. Drowning was identified as the top general childhood injury problem area.

CHILD PASSENGER SAFETY

Having identified child passenger safety as the top priority, the Public Health Branch applied for and received grant funding

from the State traffic safety agency to begin a Child Passenger Safety programme. The relationship between the CDR team process and injury prevention activities in this small rural county continued to be critical. Team recommendations provided the foundation for the development of the programme. Case reviews of unrestrained children who died in crashes or were ejected for lack of restraints, incorrect seats for the age of the child, and little use of booster seats underscored the need for parent education, distribution of child safety seats, and community-wide education regarding child passenger safety laws. Together with the effective interventions cited in the strategic plan, including those from the Task Force on Community Preventive Services,[4] the programme identified three key goals: (1) to provide parent education on the proper use of child safety seats; (2) to distribute low cost child safety seats to community members; and (3) to support community-wide education and enforcement around the proper use of child safety seats.

The programme responded by creating a multi-agency Child Passenger Safety Coalition, designing a child safety seat parent education and distribution programme, training over 100 individuals to become child passenger safety technicians, and conducting regular 'inspection station' events throughout the community to ensure proper installation of child safety seats.

As of 2006 outside funding had ended, but based on the continuing review of child deaths, the Public Health Branch recognised child passenger safety as an ongoing injury prevention priority and identified funding within the Branch to maintain the programme.

YOUTH DRIVING SAFETY

In 2005, the Public Health Branch began work on another top priority identified by the Strategic Plan—youth driving safety. Although teen drivers and occupants were disproportionately involved in preventable car crashes, no ongoing resources existed within the Public Health Branch to address the issue. Drivers aged 16–19 made up 4% of licensed drivers in Humboldt County, yet they were involved in >10% of collisions that occurred between 2000 and 2004 (California Department of Motor Vehicles, 2005 and Statewide Integrated Traffic Records System, 2005). In 2006, grant funding from the State traffic safety agency supported the development of a youth driving safety programme. Again, the combination of data provided from the CDRs and the literature review on effective injury prevention interventions guided the design of the programme. This led to the development of the following key programme goals: (1) to conduct community-wide education for teens and parents focused on causal factors for local crashes involving young drivers; (2) to work closely with law enforcement on community-wide education; (3) to conduct regular seat belt use surveys at local high schools; and (4) to develop high school appropriate curriculum on the importance of seat belt use and other safe driving habits.

In 2009 the Youth Driving Safety Program received an Award of Excellence from the California Office of Traffic Safety. FIMR/CDR team recommendations played a critical role in the development of the programme, influenced the building of the collaborative, and enhanced the success of the programme.

WATER SAFETY

Qualitative team data proved vital for the development of other effective injury prevention activities, including water safety. To address this issue, the top non-motor vehicle related injury area identified by the Strategic Plan, CIPP Coalition partners acted upon team recommendations to create a life jacket loan programme (County of Humboldt, FIMR/CDR Team Recommendations Report, 2005–2006). These efforts prompted community support for a water safety coalition that has conducted community education and awareness activities and created a series of water safety public service announcements. The life jacket loan programme has expanded to six sites near the many rivers and the ocean, where families can check out life jackets.

DATA

Though local numbers are small and require cautious interpretation, Humboldt County's death rate due to unintentional injury has declined since the start of the injury prevention programme in 2002. Between 2002–2004 and 2003–2005, the death rate fell from above 30.0 per 100 000 children and youth, ages 0–24, to just above 15.0 (University of California San Francisco Family Health Outcomes Project Data Title V Indicator Template 2002–2005).

According to data reported by the University of California San Francisco's Family Health Outcomes Project, Humboldt County's rate of non-fatal injury hospitalisations for ages 15–24 showed a statistically significant improvement between 1995–1997 and 2004–2006. Specifically for motor vehicle crashes, the rate of non-fatal injuries fell significantly (UCSF, Health Status Indicators, 2009). We cannot attribute these documented improvements directly to the CDR process alone, but in a small rural county like Humboldt where the CDR is so integrated into the community and county public health branch, it is likely that these efforts played a critical role in our successes.

CONCLUSION

The connection between FIMR/CDR team findings and resulting actions taken by the Public Health Branch demonstrate the potential impact of team reviews on injury prevention activities for small, rural counties. Conducting multi-agency

What is already known on this subject

- Child Death Review Teams may offer a more accurate surveillance system of child abuse and neglect, especially when combined with existing CAN reporting systems.
- Child Death Review Teams yield valuable data for recommendations on preventable deaths to be addressed within local communities.

What this study adds

- The Child Death Review Team process enables small rural communities to develop interagency partnerships and engage in long-term solutions to address infant, child and adolescent causes of death.
- Child Death Review Team findings can provide rich qualitative data and the motivation needed to engage a rural community in the development of injury prevention programs.

reviews of every death involving a child age 17 or younger is a valuable practice for public health programmes of any size. Since the early 1990s, the Humboldt County FIMR/CDR team has proven to be a powerful tool in the prioritisation and development of injury prevention programmes in the county. Using qualitative information from case reviews, small numbers and unstable rates were never barriers to proceeding with injury prevention efforts. The review process has played a critical role in understanding child deaths and allowed for increased knowledge of risk factors. This information has enabled the team and injury prevention coalition members to design and implement specific, localised interventions more effectively.

Much of the success of the CDR process lies in the implementation of recommendations, a community-wide responsibility. It requires the ongoing commitment of multiple agencies and organisations, and the continuing cycle of reviews has firmly engaged community members and human service providers. These relationships have strengthened both the review process and the resulting collaboratively developed programmes, and have enabled injury prevention programmes and activities to continue, especially during challenging economic times.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

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Use of child death review to inform sudden unexplained infant deaths occurring in a large urban setting

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Use of child death review to inform sudden unexplained infant deaths occurring in a large urban setting

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ABSTRACT

Objective To illustrate the benefits and utility of the child death review (CDR) reporting system when examining risk factors associated with infant death occurring within two subgroups of sudden unexpected infant deaths (SUID)—unintentional suffocation and sudden infant death syndrome (SIDS)—in a large urban county in Wisconsin.

Design Retrospective CDR data were analysed, 2007–2008, for Milwaukee County, Wisconsin.

Patients or subjects Unintentional suffocation and SIDS infant deaths under 1 year of age in Milwaukee County, Wisconsin, 2007–2008, with a CDR record indicating a death in a sleep environment.

Main outcome measure Study examined demographic characteristics, bed-sharing, incident sleep location, position of child when put to sleep, position of child when found, child's usual sleep place, crib in home, and other objects found in sleep environment.

Results Unintentional suffocation (n=11) and SIDS (n=40) classified deaths with CDR data made up 18% (51/283) of all infant deaths in Milwaukee County from 2007 to 2008. The majority of infants who died of unintentional suffocation (n=9, 81.8%) or SIDS (n=26, 65.0%) were black and under the age of 3 months. Bed-sharing was involved in most of the unintentional suffocation deaths (n=10, 90.9%) and the SIDS deaths (n=28, 70.0%). All unintentional suffocation deaths (n=11, 100%) and the majority of SIDS deaths (n=31, 77.5%) took place in a non-crib sleeping environment.

Conclusions The study demonstrates how CDR provides enhanced documentation of risk factors to help steer prevention efforts regarding SUID deaths in a community and reaffirms infants in an unsafe sleep environment have an increased risk of death.

INTRODUCTION

Sudden unexplained infant deaths (SUID) account for approximately 4600 infant deaths annually in the USA.[1] The SUID category includes, but is not limited to, deaths due to unintentional suffocation and sudden infant death syndrome (SIDS).[1] An analysis of death certificates across the USA found the rate of fatalities attributed to accidental suffocation and strangulation in bed in the first year of life quadrupled between 1984 and 2004.[2] Investigators have noted that some increase in unintentional suffocation deaths may represent a shifting of classification and reporting of deaths within the SUID group, with fewer deaths reported as due to SIDS and more attributed to unintentional suffocation or unknown cause.[2–4] This shift may reflect efforts over the last two decades to adhere more strictly to SIDS as a diagnosis of exclusion, and more thorough case investigations revealing unintentional suffocation as a more appropriate cause of death.[2] The SUID classification and reporting challenges also reflect the overlap that exists regarding the risk factors for these events. Identifying these risk factors across the spectrum of SUID events is an essential first step in understanding where best to place prevention resources targeted at reducing the burden of SUID deaths within a community.

In 2008, Milwaukee County, Wisconsin had a SIDS rate of 0.85 per 1000 live births, whereas the USA as a whole had a SIDS rate of 0.57.[5] These rates prompted community advocates to question why rates are higher in the Milwaukee area. This study demonstrates the utility of the child death review (CDR) reporting system by examining Milwaukee County CDR records from 2007 to 2008 to quantify and describe infant deaths in two SUID subgroups with overlapping risk factors—unintentional suffocation, and SIDS. The goal of CDR is to identify areas of prevention aimed at protecting the health of children in a community by analysing the circumstances surrounding the death of a child. By using CDR case review information, this study was able to more fully identify and describe the risk factors associated with unintentional suffocation and SIDS deaths than if death certificate information had been used alone.

CDR teams are multidisciplinary review teams seeking to understand the circumstances surrounding the death of a child. Team members typically include the medical examiner/coroner office, child protective services, law enforcement, public health, paediatricians, district attorneys, school districts, mental health professionals, and others relevant to a specific case. Each of these members brings unique information about the child death to the review meeting. Wisconsin CDR teams are based at the local level in individual counties or multiple counties who share resources. The multidisciplinary review of child deaths allows for comprehensive data collection, capturing demographics, risk factors, and information about the circumstances. Wisconsin participates in the National Center for Child Death Review's Case Reporting System (CDR reporting system), a web-based system collecting comprehensive information from CDR meetings.[6] A person from each local team is designated to enter the data from the

meetings. Cases are entered into the CDR reporting system where built-in skip patterns prompt the data entry person for information based on the manner and cause of death taken from the death certificate. A data dictionary is provided to all teams to assist with data entry and defining terms.[7] Following data entry, this web-based system allows teams to query 33 different standardised reports organised by cause of death to track local trends. The data collected are used to inform community based prevention.

METHODS

We queried the CDR reporting system for all infant deaths (<1 year of age) from 1 January 2007 to 31 December 2008 occurring in Milwaukee County. The Milwaukee County CDR team reviews all childhood deaths reported to the medical examiner's office. We examined all the unintentional suffocation and SIDS deaths within the time reference; the analysis included information from the auxiliary CDR data field 'death occurring in a sleeping environment'.

Demographic information used in the analysis included gestational age in weeks, race, and family income status. Incident circumstances analysed included: position of the child at time of sleep and position of child when found (on back, on stomach, on side, unknown), usual sleep place (adult bed, couch, crib, other), and incident sleep location (adult bed, couch, crib, other), whether a crib was found in the home (yes/no), and objects found in the sleep environment (pillow, mattress, wall, blankets, comforter, other). Objects found in the sleep environment pertain to the object(s) that were found to contribute to the death. For example, in the case of 'mattress', this may mean that the child was pressed into or wedged into the mattress. The occurrence of bed sharing was noted in the CDR reporting system as 'Child sleeping on same surface with persons(s) or animal(s)' with responses categorised as with adults, with other children, with animal(s), unknown, or a combination of these.

Frequency counts were tabulated using the CDR reporting system data via export at the Wisconsin Department of Health Services. SAS version 9.1 was used for analyses. The Wisconsin Child Death Review project is approved by the Children's Hospital Institutional Review Board in Milwaukee.

RESULTS

The CDR reporting system contained 203 infant deaths in Milwaukee County during 2007–2008, representing 72% of all infant deaths that occurred within the county. There were 52 unintentional sleep environment deaths comprising 11 unintentional suffocation deaths and 40 SIDS deaths. One additional infant sleep environment death was classified as 'undetermined whether injury or medical condition'; this case was excluded from the analysis.

The majority of infants who died of unintentional suffocation (n=9, 81.8%) or SIDS (n=26, 65.0%) were black (table 1); Milwaukee County population was 25% black during the reference period.[8] Income level was known in 28 of the SIDS cases, of which 96% (n=27) lived below the federal poverty level. Of the 11 unintentional suffocation deaths, income level was known in seven of the cases; 86% (n=6) lived below the poverty level. During the study interval, 13% of families in Milwaukee County lived below the poverty level.[8] Most of the infants who died of unintentional suffocation with known gestational ages were born full term, while most of the SIDS cases were born prematurely (table 1). The majority of children were 3 months of age or less at time of death, regardless of gestational age and regardless of whether the cause of death was identified as SIDS or unintentional suffocation.

Table 1 Race, gestational age, and age at time of death of unintentional suffocation and SIDS deaths, Milwaukee County Wisconsin, 2007–2008

N (%)	Unintentional suffocation (n=11)	SIDS (n=40)
Infant race		
White	1 (9.1)	11 (27.5)
Black	9 (81.8)	26 (65.0)
Unknown	1 (9.1)	3 (7.5)
Gestational age (weeks)		
≤37	3 (27.3)	18 (45.0)
>37	5 (45.5)	16 (40.0)
Unknown	3 (27.3)	6 (15.0)
Age at time of death (months)		
<1	1 (9.1)	10 (25.0)
1–3	5 (45.5)	22 (55.0)
4–6	2 (18.2)	6 (15.0)
7–9	2 (18.2)	2 (5.0)
10–11	1 (9.1)	0 (0.0)

SIDS, sudden infant death syndrome.

Characteristics of unintentional suffocation deaths

Within the CDR reporting system, sleep location was recorded in all unintentional suffocation deaths. All unintentional suffocation deaths took place in a non-crib sleeping environment, with 54% of the deaths occurring on a couch. A non-crib sleep environment was the child's usual place for sleep in at least 10 of the 11 cases (table 2). Approximately half of the children (n=6, 54.5%) reportedly were placed on their back to sleep, but only three children were found on their backs (27.3%) after the incident (table 2). Although the usual sleep environment and incident sleep location was not a crib in all incidents, the majority (n=6, 54.5%) did have a crib in the home (table 2). Additionally, at least one object (eg, blanket, pillow, adult, or child) contributed to the obstruction of the child's airway in all 11 cases. Bed sharing was involved in almost all unintentional suffocation deaths (n=10, 90.9%) (table 2). The majority of bed sharing was done with adults only (n=8, 72.7%).

Characteristics of SIDS deaths

Within the CDR reporting system, sleep location was recorded in all SIDS deaths. A non-crib sleep environment was the incident location for most deaths (n=34, 85.0%) (table 2). A crib was noted as the usual sleep environment for one fifth of the infants (n=9, 22.5%); however, a crib was present in the home for over half of the infants (n=23, 57.5%) (table 2). The majority of infants dying of SIDS were placed on their backs when put to sleep (n=29, 72.5%), while at least seven infants (17.5%) were not placed on their backs and, at a minimum, 12 (30%) were found not on their back after the event (table 2).

Additionally, 17 of the infants were reported to have fully or partially obstructed airways due to the presence of a pillow, blanket, other bedding, other children, an adult, or a combination of these items. Of the infants with an unobstructed or unknown status of their airway, 25 were compromised in their sleeping environment with one or more of these objects or persons. Bed sharing was an identified factor in 70% of SIDS deaths. SIDS deaths included adult only bed sharing (n=13, 32.5%) and bed sharing with adults and children (n=14, 35.0%) (table 2).

Table 2 Characteristics of infant unintentional suffocation and SIDS deaths in Milwaukee County Wisconsin, 2007–2008

N (%)	Unintentional suffocation (n=11)	SIDS (n=40)
Incident sleep location		
Crib	–	6 (15.0)*
Adult bed	5 (45.5)	25 (62.5)
Couch	6 (54.5)	2 (5.0)
Other		7 (17.5)
Position of child when put to sleep	–	
On back	6 (54.5)	29 (72.5)
On stomach	3 (27.3)	4 (10.0)
On side	–	3 (7.5)
Unknown	2 (18.2)	4 (10.0)
Position of child when found		
On back	3 (27.3)	25 (62.5)
On stomach	4 (36.4)	7 (17.5)
On side	3 (27.3)	5 (12.5)
Unknown	1 (9.1)	3 (7.5)
Child usual sleep place		
Adult bed	6 (54.5)	20 (50.0)
Couch	1 (9.1)	1 (2.5)
Crib	–	9 (22.5)
Other†	3 (27.3)	4 (10.0)
Unknown	1 (9.1)	6 (15.0)
Crib in home	6 (54.5)	23 (57.5)
Objects in sleep environment‡		
Pillow	3 (27.3)	8 (20.0)
Blankets	–	11 (27.5)
Comforter	–	5 (12.5)
Mattress	4 (36.4)	9 (22.5)
Wall	3 (27.3)	–
Other	–	4 (10.0)
Bed sharing	10 (90.9)	28 (70.0)
With adult only	8 (72.7)	13 (32.5)
With children only	2 (18.2)	1 (2.5)
With adults and children	–	14 (35.0)

*Child was sleeping in same crib with twin.
†Includes car seat/stroller, mother's chest, bouncy chair, reclining swing, futon.
‡List is not mutually exclusive.
SIDS, sudden infant death syndrome.

DISCUSSION

Improving child death data

The public health model of prevention emphasises the use of data to inform community interventions. Using the CDR reporting system data to identify and target the modifiable risk factors for SUID deaths is a logical prevention approach. Shapiro-Mendoza and colleagues have identified what contributing risk factors can be obtained from death certificate text information for both SIDS and unintentional suffocation infant deaths.[2 9] Many of their findings are similar to what this study reveals for risk factors based on the Milwaukee CDR data. However, contributing information is often not listed on the death certificate, being absent in almost 80% of the SIDS cases reviewed in the national study conducted by Shapiro-Mendoza *et al*.[2 9]

Locally, it is the policy of the Milwaukee County Medical Examiner's office to conduct a death scene investigation by a trained investigator for all deaths occurring in a sleeping environment following the National Association of Medical Examiners' recommendations using an internally developed standardised form.[10] The lack of nationwide and worldwide standardisation of how SUID cases are investigated and reported, including the documenting of contributing factors, supports the call for a national SUID registry. The Center for Disease Control's (CDC) SUID Initiative calls for a uniform national approach for SUID cases. The CDC recently began a pilot study examining the CDR reporting system as the platform for an SUID registry.[11] This SUID registry may answer many of the questions regarding a possible diagnostic shift from SIDS deaths to suffocation deaths.

Our study illustrates the advantages of using the CDR reporting system as a registry for SUID deaths compared to an analysis of death certificates. In the CDR reporting system, the data are entered into a web based system and can be retrieved in real time by local CDR teams. The CDR reporting system promotes standardisation of data collection, and helps to move local public health prevention efforts towards data and evidence based programming in a more timely fashion than death certificates alone.[9 12] Electronic death certificate data are available in Wisconsin as a tool to tabulate broad categories of deaths and basic demographics. However, the level of detail available is not adequate to understand fully the circumstances of the death and, subsequently, identify prevention strategies. The majority of information available on electronic death certificates relates to demographic variables of the decedent. The paper copy of the death certificate provides more information about the circumstances of the death, but availability of the paper copy is limited due to confidentiality and feasibility concerns. Additionally, there is often a cost associated with obtaining a paper copy of the death certificate.

This project also provided an opportunity to learn how to improve the CDR reporting system, to ease the process of manipulating and extracting data, identify key contributory factors, and clarify terminology. Expanded definitions in the CDR data dictionary would remove ambiguity, allowing teams to input data more consistently. Identifying clear, universally agreed upon definitions for SUID cases would also bring greater standardisation to the process. Current CDR data sources include all SUID deaths (whether defined as SIDS or undetermined cause) under the SIDS category, while asphyxia is a separate category. Once asphyxia is chosen as the cause of death, the data entry skip patterns embedded in the CDR reporting system do not allow for the entry of risk factors found in the SIDS data field. SIDS risk factors, such as the presence of secondhand smoke or overheating, also relevant to asphyxia, become unavailable for electronic entry. The skip patterns ease data input, but also limit the functionality of collecting valuable data across cause of death categories. The addition of a child developmental assessment field would also be helpful—for example, knowing if a child has reached the stage of being able to roll to their side or prone when initially placed on their back would aid in the evaluation of sleep related deaths. The CDC supported SUID Case Registry Pilot project, based on the CDR reporting system, will benefit from addressing these concerns.

Using data to inform prevention

Using CDR reporting system data to understand the burden of SUID deaths in Milwaukee County rather than relying on death certificate data alone will improve prevention efforts. The SUID cases presented here represented 18% (51/283) of all infant deaths in Milwaukee County from 2007 to 2008, a size worthy of prevention efforts aimed at reducing infant mortality in the Milwaukee community.

There is an increasing awareness that an unsafe sleep environment increases an infant's risk for SUID events. Although both prone sleeping and a shared sleeping surface are risk factors for unintentional suffocation, their presence independently does

not exclude SIDS as a cause of death.[13] The CDR reporting system data allows for a more robust evaluation of SUID events regardless of SUID subtype. Local prevention efforts can be more appropriately tailored using data from this analysis. The 'Back to sleep' campaign initiated in the early 1990s by the American Academy of Pediatrics and National Institute of Child Health and Human Development led to a 50% decline in SIDS cases in the USA by identifying a 'modifiable' risk factor, the prone sleeping position.[14] Providing public health education in a targeted fashion to change caregiver practice dramatically reduced prone sleeping. Unfortunately, our analysis identified that at least 20% of the infants were placed in a position other than on their backs prior to sleep. Nationwide, SIDS occurs at a rate of 99.4 per 100 000 live births in blacks compared to a rate of 55.4 per 100 000 live births in whites.[15] Similar disparities were identified in Milwaukee. These national and local findings indicate the need to re-emphasise the importance of a culturally appropriate 'Back to sleep' message in the Milwaukee community.[16]

As the decline in SIDS deaths has levelled off,[17] other modifiable risk factors have emerged as possible reasons for the lack of further decline in deaths. Bed sharing is identified in 75% (38/51) of all the infant deaths we reviewed. The majority of these deaths occurred within the first 3 months of life. Bed sharing is now well described as a risk factor for SUID.[18–21] This analysis also found that 54% of the unintentional suffocations in Milwaukee County occurred on a couch. The benefits of standardisation of collection and subsequent use of this local CDR data, layered with the national and international findings regarding the risk of couch sleeping and bed sharing, can be shared with the Milwaukee community in an attempt to promote education regarding these modifiable risk factors further.

Programmes aimed at ensuring families have available a crib in which their child can sleep safely are a logical prevention approach. Using CDR reporting system data, we found over 40% of the environments did not have a crib present as a sleep option. Unfortunately, our CDR data also support the findings of other studies[22] that the existence of a crib does not ensure the device will be used, as only 20% of the families who had a crib chose to use the device on the day of the infant's death. Programmes providing cribs to the community will have to explore ways of influencing adult behaviour such that the device is used. The data also indicate the need to expand the current outcomes research on community crib access programmes such as the S.I.D.S. of Pennsylvania's Cribs for Kids programme.[23] For families continuing to bed share with their infant, efforts should be focused on evaluating harm reduction strategies directed at decreasing the risk of SUID while bed sharing.

Limitations

Milwaukee began using the CDR National Reporting System in June 2009, therefore the data used for this study are the result of reviewing data previously collected by the medical examiner's CDR team and retrospectively entered into the CDR National Reporting System. We anticipate that prospective CDR review of sleep environment cases will enhance data collection and limit incomplete or missing data. In addition, classification of cases may have changed over the course of our study period due to the evolving diagnostic criteria of SUID and SIDS and by the presence of two different Milwaukee County medical examiners over the study period. The Milwaukee County medical examiners also did not preclude the use of 'SIDS' as a cause of death in cases where a sleep environment risk factor was noted during the investigation. Lastly, CDR data and death certificate data were not directly linked, so we could not fully explore the benefit of CDR review over matched death certificate data alone.

What is already known on this subject

- Unsafe sleep environment increases an infant's risk of sudden unexplained infant death (SUID).
- The child death review (CDR) reporting system makes it possible to collect information about the sleep environment surrounding infant deaths.

What this study adds

- CDR reporting system data will enhance death certificate data by providing supplemental information on the sleep environment that will inform the cause of death.
- This study demonstrates the ability and value of CDR to reveal the risk factors for SUID deaths regardless of whether they are classified as unintentional suffocation or sudden infant death syndrome (SIDS).
- Bed sharing is reaffirmed as a common risk factor for SUID deaths.

CONCLUSION

This analysis demonstrates the utility of using information from the National Child Death Review Data System as a method of more fully understanding risk factors for infant death, while providing an example of how the CDR reporting system may serve as a national SUID registry. Additionally, we have documented data on potentially modifiable risk factors that can be used to inform prevention practices in a local community with a high rate of SUID. The use of local data can help inform questions and diffuse conflicts of opinion about what is occurring in one's own community. With local data as a foundation, it should become easier to develop relationships between diverse partners in prevention, engage appropriate community leaders, and ultimately develop supportive and appropriate prevention messages that are aimed at the goal of CDR—to prevent future childhood death and injury.

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Competing interests None.

Ethics approval This study was conducted with the approval of the Children's Hospital of Wisconsin Institutional Review Board.

Contributors All authors take responsibility for the reported research. All have participated in the concept and design, analysis and interpretation of the data, creation of the manuscript and have approved the manuscript in its final form as submitted.

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Analysis of paediatric drowning deaths in Washington State using the child death review (CDR) for surveillance: what CDR does and does not tell us about lethal drowning injury

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Analysis of paediatric drowning deaths in Washington State using the child death review (CDR) for surveillance: what CDR does and does not tell us about lethal drowning injury

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ABSTRACT

Background Drowning is second cause of paediatric injury death in Washington State. Child death review (CDR) data provide the unique opportunity to identify regional risk factors and opportunities for drowning prevention.

Methods CDR teams' data for drowning deaths of children <18 years between 1999 and 2003 were analysed for victim and event characteristics, and existing prevention/protective factors. A working group made data driven recommendations. Subsequent interventions were noted.

Results Drowning death rates were significantly higher among Asian Pacific Islander children (3.3 per 100 000). Disproportionately, 32% of deaths involved families with prior child protective services (CPS) referrals. Most deaths (73%) occurred in open water; the proportion in open water increased from 42% of <5-year-olds, 83% of 5—9-year-olds, to 90% of 10—17-year-olds. Thirty per cent drowned at parks; 29% drowned in residential settings. Pre-drowning activity for 42% was swimming or playing in the water. Alcohol and drug use were low. Neglect/poor supervision was considered a factor in 68% (21/31) of the deaths of children <5 years of age. State CDR recommendations led to the development of a drowning prevention campaign targeted to an Asian American community, intra-agency changes resulting in reinstatement of lifeguard staffing and addition of lifejacket loaner programmes, collaboration with state commissions to enforce a state pool fencing ordinance, and model legislation prohibiting swimming in dangerous waterways.

Conclusion CDR data collection and review process was an effective surveillance tool. It identified specific regional high risk groups and sites for drowning prevention and led to recommendations and implementation of effective local and state injury prevention interventions.

Drowning is the second major cause of unintentional injury death in children aged 1—17 years in the USA and Washington State.[1] Although decreasing significantly since 1990, in 2003, overall Washington State drowning death rates for children ages 0—19 remained higher than national rates, 1.6 versus 1.4 per 100 000.[1 2] This prompted Washington State's Child Death Review State Advisory Committee to establish a Drowning Workgroup to review its drowning deaths to identify drowning prevention opportunities.[3]

Child death review (CDR) is a process by which local communities collect and report detailed uniform information about the unexpected death of any child. For each child's death they review reports from multiple agencies, including police, prehospital care, and child protective services; promote communication between local health jurisdictions, law enforcement, social services, and medical providers; and develop prevention strategies.[4—6] With small numbers of local cases, state teams often report their findings and recommendations on the internet.[6] Few peer reviewed CDR reports have focused on a specific injury or evaluated outcomes.[5]

Washington State's CDR Drowning Workgroup, which included all authors, conducted an in-depth review of 5 years of paediatric drowning deaths. Our goal was to describe use of this CDR drowning dataset as a surveillance tool, identifying specific drowning prevention needs and providing data driven prevention activities both locally and state-wide.

METHODS

Research design

This was a retrospective case series.

Case selection

Cases comprised children <18 years of age who resided in Washington State and died between 1 January 1999 and 31 December 2003 due to intentional and unintentional drowning as determined by the medical examiner or coroner. We excluded drownings due to motor vehicle, aeroplane crashes, and electrocution.

Setting

Washington State forms the northwest corner of the USA; its western border is the Pacific Ocean with >3000 miles of coastline; its southern border is the Columbia River; it has >120 rivers, 29 major lakes (1000—80 000 acres), and countless numbers of low country and alpine lakes.

Data sources

Between 1999 and 2003, child death review teams (CDRTs) existed in 38 of 39 counties in Washington State. Teams reviewed deaths within a year of the death, using local information from medical examiners/coroners, death scene investigations, medical records, law enforcement, emergency medical services, public health records, medical records, social services, and other sources.

Instrument

Teams used a standard data form developed by the Washington State Department of Health (DOH) and the Department of Social and Health Services. It included information about the child, including

family and medical history, characteristics of the drowning event, who was supervising, substance use associated with the drowning victim or supervisor, prior involvement of child protective services (CPS) with the family, and specific drowning prevention questions, including the presence of a locking gate around pools and ponds or of a lifeguard, and whether the child was supervised, wore a lifejacket or had taken swimming lessons.[6] Teams also determined whether a death was preventable 'if a reasonable medical, educational, social, legal or psychological intervention could have prevented this death from occurring'. 'A reasonable intervention is one that would have been possible given the known conditions or circumstances and the resources available.' Neglect was defined as actions or omissions resulting in injury to or creating a substantial risk to the physical and/or mental development of a child.

Teams completed reviews and submitted data electronically to Washington State DOH.

To estimate the completeness of the CDR data, for the same period and age group, we counted all drowning deaths in all counties using the International Classification of Diseases, 10th revision (ICD-10) codes W65-W74, V90-92, X71, X92,Y21 in the death certificate data, Washington State DOH, Center for Health Statistics. Drowning rates were calculated for gender, age group, and race by dividing the number of drowning deaths from the death certificates by state population estimates for those specific groups. Frequencies and rates were generated using Stata statistical software.[7] Confidence intervals (CIs) for rates were estimated using exact Poisson methods.[8–10] To compare rates of different groups, exact Poisson regression based on mid p values was used with significance at $p<0.05$. Trends were analysed using Joinpoint 3.0.

RESULTS

Death certificate data

Death certificate data identified 127 children aged 0–17 years with drowning as the primary cause of death for the period 1999–2003. Drowning rates were highest in those aged 15–17 and 0–4 years (2.6 and 2.5 per 100 000, respectively). Male drowning rates were three times the female rates (2.5 vs 0.8 per 100 000) and represented 76% of the deaths (table 1).

Most (67%) child drowning deaths involved Non-Hispanic whites. However, whites (1.5 per 100 000, 95% CI 1.2 to 1.9) and Hispanics (1.4 per 100 000, 95% CI 0.7 to 2.4) had the lowest death rates. Drowning rates were significantly higher among Asian-Pacific Islander children (3.3 per 100 000, 95% CI 1.9 to 5.3), who comprised 13% of the deaths but only 7% of the state population of children ages 0–17 (table 1).

Almost all death certificate deaths (n=122, 96%) were determined to be unintentional by the medical examiner or coroner; two were intentional (one suicide, one homicide); three were of undetermined manner. No drowning deaths occurred in the county that lacked a CDRT.

Table 1 Demographic characteristics of drowning victims based on death certificate data, ages 0–17 years, 1999–2003 (n=127)

	Number of deaths (%)	Rate per 100000 (95% CI)	Exact Poisson regression p value
Overall drowning rate	127 (100)	1.7 (1.4 to 2.0)	
Gender			
Male	97 (76)	2.5 (2.0 to 3.0)	p<0.05
Female	30 (24)	0.8 (0.5 to 1.2)	Ref
Age groups			
Age <1	5 (4)	1.3 (0.4 to 2.9)	
Age 1–4	40 (31)	2.5 (1.8 to 3.4)	p<0.05
Age 5–9	17 (13)	0.8 (0.5 to 1.3)	
Age 10–14	31 (24)	1.4 (1.0 to 2.0)	Ref
Age 15–17	34 (27)	2.6 (1.8 to 3.6)	p<0.05
Race/ethnicity			
White, non-Hispanic	85 (67)	1.5 (1.2 to 1.9)	Ref
Black, non-Hispanic	8 (6)	2.2 (0.9 to 4.3)	
Native American, non-Hispanic	5 (4)	3.4 (1.1 to 7.9)	
Asian/Pacific Islander, non-Hispanic	16 (13)	3.3 (1.9 to 5.4)	p<0.05
Hispanic	13 (10)	1.4 (0.7 to 2.4)	

Highlights from the CDR data

Of the 127 drowning deaths, 73% (93) were reviewed by Washington CDRTs. Reviewed and non-reviewed deaths (n=34) were similar in age, gender, and race. Before 2003, 81–90% of all drowning deaths were reviewed. In 2003, only 43% of the deaths were reviewed. In July 2003, several teams stopped meeting as state funding of CDR teams ceased.

Water location

Most drowning deaths (73%) occurred in open waters (table 2). Most bathtub (63%) and pool/hot tub deaths (76%) involved children <5 years. The proportion of drownings in open water

Table 2 Characteristic of drowning events, 1999–2003 (n=93)

	Total number (%)	Ages 0–4 N	Ages 5–14 N	Ages 15–17 N
Body of water				
Open water	68 (73)	13	27	28
Lake	26 (28)	1	10	15
River	24 (26)	5	10	9
Ocean/Sound	7 (7)	1	3	3
Pond	6 (7)	4	2	0
Creek	3 (3)	2	1	0
Gravel pit or irrigation canal	2 (2)	0	1	1
Swimming pool	14 (15)	11	3	0
Bathtub	8 (9)	5	2	1
Wading pool or hot tub	3 (3)	2	1	0
Place of drowning				
Public park	30 (32)	2	12	16
City park	9 (10)	0	3	6
State or county park	21 (23)	2	9	10
Residential	29 (31)	25	3	1
Child's	18 (19)	14	3	1
Relatives	7 (8)	7	0	0
Friends	4 (4)	4	0	0
Other (includes rivers, ocean, lakes)	30 (32)	4	16	10
Missing	4 (4)	0	2	2
Pre-drowning activity				
Swimming	25 (27)	1	11	13
Playing near the water	21 (23)	13	6	2
Playing in the water	14 (15)	2	6	6
Bathing/bathtub	8 (9)	5	2	1
Boating	7 (8)	2	0	5
Rafting or inner tubing	4 (4)	0	3	1
Playing on Ice	2 (2)	0	2	0
Unknown	12 (13)	8	3	1
Illicit drugs or alcohol	9 (10)	2 (caregivers)	2	5
Supervision				
Unsupervised	4 (4)	–	4	–
Supervised by teen or child	16 (17)	5	2	9
With friends, siblings; ages unknown	7 (8)	0	4	3
Unknown	11 (12)	0	2	9

Source: Washington State Department of Health child death review database.

increased with age, from 42% of <5-year-olds, 83% of 5–9-year-olds, to 90% of 10–17-year-olds.

Place of injury

Twenty-eight children (30%) drowned at a residence. Thirty (32%) drowned in a city, state, or county park (table 2). Data were not routinely collected as to whether the drowning occurred in a designated swim area or when lifeguards were on site.

Pre-drowning activity

While the most common pre-drowning activity was swimming or playing in the water (n=39, 42%), playing near the water led to 23% of the deaths (table 2).

Swimming pool deaths

Most swimming pool, wading pool or hot tub related deaths (14/17, 83%) occurred in private residences. Although the presence of a fence was not a routinely collected variable, at 14 residences, only two had a locked gate but with a gap in the fence that a child could squeeze through. For the remaining pools, two had an unlocked gate, eight had no gate, and for two the presence of a gate or if it was locked was unknown. The three non-residential pool drownings occurred in a lifeguarded public pool, at an unlifeguarded fitness centre, and a city park, where lifeguard presence was unknown. No deaths occurred in apartment or condominium pools.

Known risk factors

Older adolescents

Those aged 15–17 years represented 31% of the cohort. Almost all (28/29, 98%) drowned in open water. Most (62%) were swimming or playing in the water. Only five were boating. Twelve (41%) were with friends at the time of their drowning. Five (17%) tested positive for alcohol or illicit drugs.

Alcohol or drugs

Only 10% (9/93) of drownings involved alcohol and/or illicit drugs; most (7/9) were adolescents. Two children <5 years were supervised by parent/care provider who was noted to be impaired by alcohol/drugs at the time of the drowning.

Chronic health conditions

In the 12% of children with chronic disorders, seizure disorders (n=5) were the most common; others had developmental delay, attention deficit disorder, autism or diabetes.

Supervision

Of the 38 who were not in the care of an adult, three were unsupervised; seven children aged <12 years were with other children. Seventeen were 13–17-year-olds with siblings or peers. For four drownings, a lifeguard was present at a swimming pool (one) and lake parks (three).

CPS history

Nearly one third—30 (32%)—of the children's families had a history of prior referrals to CPS; 25 had had at least one CPS investigation.

Preventive factors

Three children were wearing a lifejacket when they drowned (one wore a lifejacket that did not fit; two were in rivers). Only one of the seven children in boats wore a lifejacket. Six children had previous swimming lessons; only 28% (26/93) were reported to be able to swim.

Team assessment

Local CDR teams concluded that 85% of the deaths were preventable. Teams found no intentional or indeterminate deaths, but cited neglect as a factor in 68% (21/31) of children <5 years. Of these, 10 families had at least one CPS referral in the past. The teams noted these deaths were generally isolated acts of neglect due to inadequate supervision rather than a pattern of neglect.

Impact of CDR reviews

Based on these findings, the Drowning Workgroup made five recommendations to guide drowning prevention across the state[3] (box 1).

Each recommendation included specific strategies to guide CDR teams, such as life jacket loan programmes to increase lifejacket use or incorporating open water risk into swimming instruction at pools to raise risk awareness. Importantly, the list represented consensus and priorities among state drowning prevention leaders.

CDR drowning reviews led to local strategies. High drowning rates in Asian American children prompted a drowning prevention campaign in one region's large Vietnamese American community. Reviewing several years of data, one CDRT recognised an annual swimming related drowning death risk at a specific body of water. This led to legislation in 1999 closing that body of water to swimming, set a state-wide precedent for municipal control of recreational water use, and resulted in zero deaths in those waters subsequently (figure 1).

CDR analysis also led to statewide interventions. It was critical in showing the legislature and governor that significant drowning events occurred at times and places at parks that had previously had lifeguard services before budget cuts. In showing the overrepresentation of various minority groups it established the lack of lifeguard services as an important health disparities issue and the need for a more comprehensive prevention effort on the part of the state. Specifically, it led to adding a risk manager position to the Washington State Parks Agency, and installation of a lifejacket loaner programme and reinstatement of lifeguards at some parks (figure 2). In addition, CDR specific data on inadequate fencing drove collaboration with Washington State's Building Code Council to regulate, educate, and enforce housing code compliance and coordination functions.

DISCUSSION

The CDR process was a valuable surveillance tool for drowning injury. Analysis of 5 years of CDR data identified the need to: (1) target two specific risk groups among Washington State children—racial/ethnic minorities, specifically Asian/Pacific Islander Americans, and children whose families had prior

Box 1 Child death review Drowning Workgroup: drowning prevention recommendations

1. Increase lifejacket use and supervision of children and adolescents in or near the water.
2. Create physically safe water environments.
3. Encourage policies and regulations that emphasise water safety.
4. Raise community and personal awareness of child and teen drowning risk factors and prevention/safety strategies.
5. Support standardised drowning death investigation procedures and improve data collection efforts.

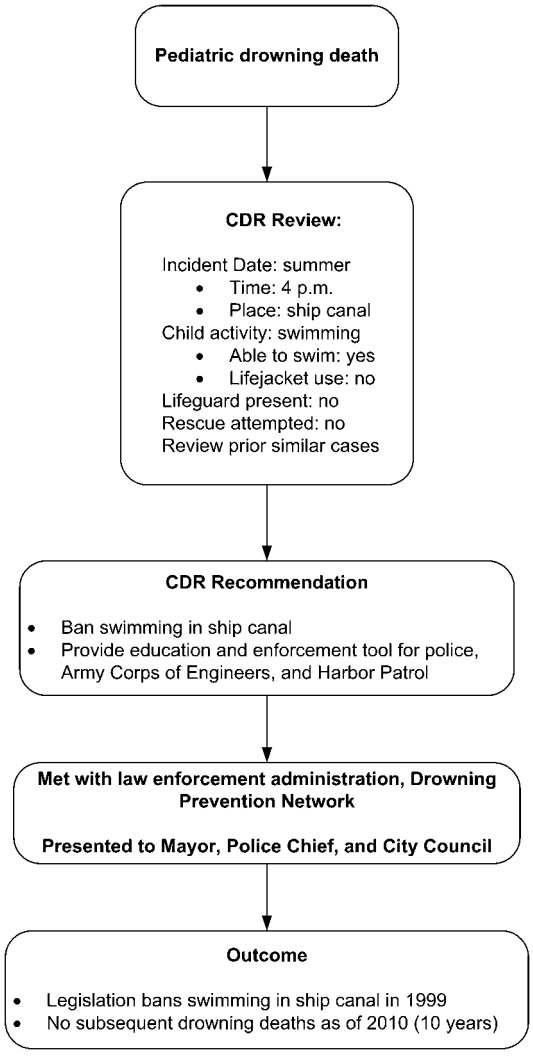

Figure 1 Example of local child death review (CDR) action: process to results.

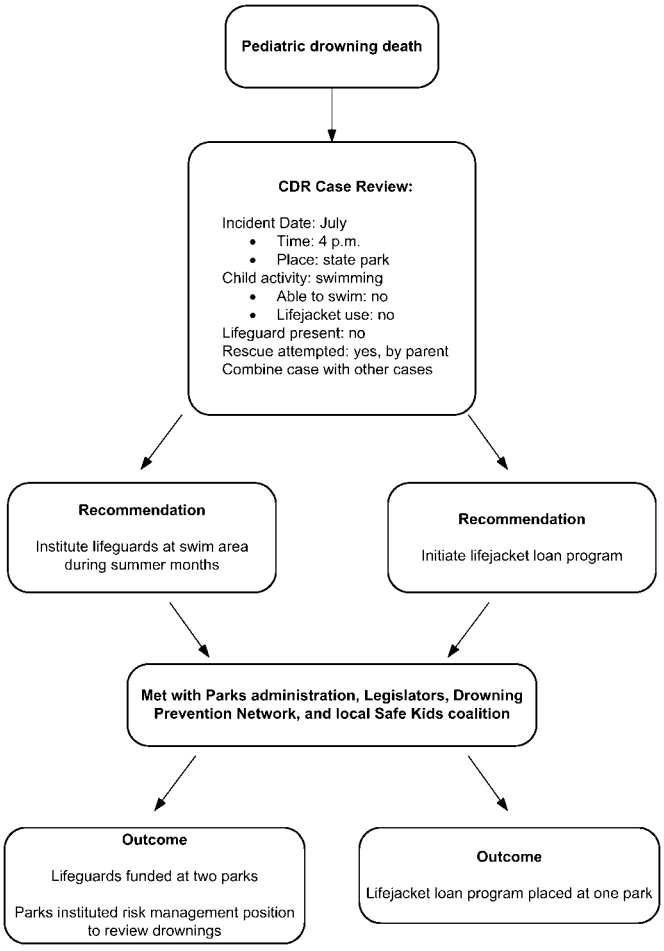

Figure 2 Examples of state child death review (CDR) actions: process to results.

involvement with CPS; (2) focus on open water settings and activities; and (3) collaborate with city, county, and state parks as key agencies. Moreover, CDR data provided evidence which contributed to subsequent practice or policy changes in several state and local agencies that oversee recreational water use and sites, and may have had an effect on drowning deaths. Furthermore, data suggest these actions may have saved lives.

Limitations

One limitation is that not all drownings were reviewed. However, the majority was reviewed, having characteristics similar to unreviewed drownings. Small numbers often hampered statistical significance. However, detailed data on individual circumstances had qualitative value, especially when coupled with local knowledge. Missing data primarily occurred in variables assessing protective factors such as the status of pool fencing, swimming ability, and use of designated swim areas in open water. Improved data collection might improve with education addressing these newer concepts with CDRTs and the agencies that collect the data. Improved data collection is needed to develop and monitor prevention programmes.

Although supervision was considered negligent in so many deaths, CDR review provided little insight into assessing supervision. Subsequently, key domains of supervision have been delineated.[11] CDRT could better evaluate supervision by adding data variables that assess the caretaker's attentiveness, alertness, and proximity to the child. However, CDR assessment of parental drug and alcohol use was an important step to identify and codify key components of supervision.

Major strengths

This CDR review demonstrated CDRT's unique access to and ability to integrate key data across the entire Haddon matrix. It provided critical data about the host, the injury event, and the environment critical to identifying, developing, and monitoring prevention efforts. Revised in 2010, CDR case reports collect injury specific data.[12] Other more commonly used data sources for surveillance do not meet the definition of "Public Health Surveillance as the ongoing, systematic collection, analysis, and interpretation of data (eg, regarding agent/hazard, risk factor, exposure, health event) essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control."[13] Death certificate data, the most commonly used surveillance tool, provides only basic demographic data which become available 2 or more years after the death. Newspaper clipping data are always incomplete[14] (table 3).

Host factors

Racial/ethnic disparities

Other studies have identified increased drowning risk among non-white US children.[15 16] Between 1995 and 2003, Asian

Table 3 Comparison of drowning prevention variables among different datasets used for surveillance

Key variables	CDR	Death certificate	Newspaper clippings
Victim characteristics			
Age	+	+	+
Gender	+	+	+
Race	+	+	±
Ethnicity	0	0	0
Substance use	+	0	±
Chronic illness (mental, medical, seizure history)	+	0	0
Site characteristics			
Type of water	+	+	+
Location setting (residential, park, etc.)	+	±	+
Supervision			
Supervising person	+	0	±
Age	+	0	0
Presence	+	0	0
Impairment (alcohol, drugs, etc.)	+	0	0
Distraction	+	0	0
Prevention measures			
Pool barriers (fencing, gate, etc.)	+	0	0
Pool alarm	+	0	0
Life jacket use	+	0	0
Rescue equipment	+	0	0
Swimming ability	+	0	0
Lifeguarded presence	+	0	±
Signage	+	0	+
Determination of intent	+	0	0
Determination of preventability	+	0	0
CPS involvement	+	0	0
Primary cause of death	+	+	±

CDR, child death review; CPS, child protection services.
+ = present; 0 = not present; ± = sometimes present.

Pacific Islander children and especially Asian males >5 years of age had higher unintentional drowning rates than whites in the USA.[1] However, in another study, Asian American children had the lowest mortality rates for all injuries, including drowning.[17] The drowning experience of Asian American children in this state identifies the need for ongoing state surveillance. In Canada drowning risks may be explained by significant differences in water use among new immigrants.[18] CDR teams could identify ethnicities, assess the immigrant status of families, and determine if ethnicity is a proxy for new immigrant status. This level of specificity is needed to develop culturally and linguistically appropriate prevention interventions.[19]

CPS data

Although this study could not calculate drowning risk among families with CPS involvement, this group appeared over-represented. While we do not have data on the percentage of Washington State children whose families ever had a referral to the CPS, in 2003 the CPS reported that they had accepted referrals for 2% of the population of children (20 per 1000).[20] Although this is the first description of this association with drowning injury, concomitant Washington State CDR reviews showed similar or even higher proportions of CPS referrals in other injury deaths.[21 22] As previously reported, these families represent a high risk group for targeted injury prevention interventions.[23]

Pre-existing conditions

Among injury surveillance systems, only CDRTs can identify past history and pre-existing disease. As a surveillance tool for known risk factors, CDR analysis showed the prevalence of pre-existing seizures (6%) remains unchanged from older reports in this region.[20] Increasingly, larger numbers of children with disabilities and chronic diseases comprise the paediatric population and are a group for whom injury risk needs to be identified.

Event factors

Pre-drowning activities

This CDR analysis showed the need for a state-wide focus on non-boating related open water drowning prevention for children. It was able to accomplish this by having access to descriptive data from the scene unavailable in death certificate data. Unlike the young child, school aged children and adolescents meant to be in the water, swimming or wading. Prevention tactics are needed to address these activities. The relatively low rate of alcohol use (7/29, 24%), similar to previously reported rates in 15–19-year-olds in Western Washington, suggests that drowning prevention efforts for teens should not focus solely on decreasing alcohol use.[23]

Environmental factors

Identification of risk sites

Most drowning deaths occurred in open waters. Even among those children aged <5 years old who typically drown in swimming pools in other states, as many drowned in open water as in swimming pools in this state. Case death rates are highest for open water settings compared to swimming pool or bathtub settings in this region.[24]

Importantly, by aggregating teams' data, CDR analysis identified specific open water risk sites across the state. More children died at park settings than swimming pools. The high proportion in park settings may reflect greater use of these sites for family water recreation, especially by low income groups, including racial and ethnic minorities who have greater drowning risk. This identified the need to make these sites safe for wading and swimming. CDR surveillance added to a concomitant review of drownings at Washington State's parks that recommended changes to the infrastructure and culture of prevention/safety within the state's park agency to environmental changes at park beaches, and reinstating lifeguards at heavily used parks[25] (figure 2). Representatives from agencies where drownings occur would be key to include in CDRTs to help start and monitor drowning prevention initiatives.

Pool drowning deaths—although a relatively small burden of injury, and almost exclusively involving young children in this state—are preventable with appropriate fencing.[26] Recently, Washington State's Building Code Council legislated a statewide requirement for isolation (four sided) fencing of new residential pools and spas, with options of alarms and various covers. This CDR evaluation identified drownings in residential pools that had fencing but which was inadequate or had non-working gates. This highlights the need for education, enforcement, applying laws to existing pools and not just new pools, and further work with building code programmes.

Future directions

Presently, with budget cuts, only 18 (46%) Washington State counties fund local CDRTs. In counties with small numbers and types of cases, it may take years to fully depict and comprehend local drowning risks and patterns. Unfortunately, many CDRTs terminated when just beginning to assemble enough local data to take those next steps towards policy, system, environmental or organisational changes. The diminished number of reviews

What is already known on this subject

- Child death review (CDR) data provide detailed, integrated data from multiple sources.
- CDR data have the potential to identify needed prevention efforts.

What this study adds

- CDR evaluation has a unique role in identifying new risk groups for drowning in this state: Asian American children and families with prior CPS referrals.
- CDR evaluation identified specific risk sites for drowning death: open water, specifically city, county, or state parks.
- CDR evidence based recommendations led to prevention efforts at the community, agency, and legislative/policy changes.

and reduction in data significance has and will impact what could be translated to prevention of future injury and deaths throughout the state. State and county systems will be left to respond and react to individual cases or clusters of cases instead of better and more regional data. Funding CDRTs as a statewide surveillance tool protects a large population since most of the drowning interventions that have been developed, especially for open water, affect adults as well as children.

CONCLUSION

In conclusion, CDR data and review process was an effective surveillance tool, providing identification and insight into regional risk factors for drowning and opportunities for prevention. Its unique database led to effective local and state injury prevention strategies. The changing demographics of American society will require greater attention to new groups and their risk for injury, such as diverse communities and children with pre-existing conditions. To improve drowning injury prevention and evaluate its effectiveness, continued and enhanced CDR surveillance is needed. CDR programmes are key to comprehensive and effective injury programmes at local and state levels.

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Contributors All authors were members of the Drowning Working Group of the WA CDR.

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The US National Child Death Review Case Reporting System

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The US National Child Death Review Case Reporting System

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ABSTRACT

The National Child Death Review Case Reporting System (NCDR-CRS) was developed in the USA to provide child death review teams with a simple method for capturing, analysing, and reporting on the full set of information shared at a child death or serious injury review. The NCDR-CRS is a web based system currently being used by 35 of the 50 US states. This article describes the purpose, features, limitations, and strengths of the system. It describes current and planned efforts for the dissemination of the data to inform and catalyse local, state, and national efforts to keep children safe, healthy, and alive.

A comprehensive review of a child's death requires the sharing of case records from multiple sources on the wide ranging set of circumstances leading up to and causing a child's death. An effective review requires using this information to improve systems and prevent deaths. Capturing all of the information from review using reports from multiple sources and in a format useful for analysis and prevention is the purpose of the National Child Death Review Case Reporting System (NCDR-CRS). This is a passive epidemiologic surveillance system. It allows for the 'ongoing systematic collection, analysis, and interpretation of data essential to the planning, implementation, and evaluation of public health practice closely integrated with the timely dissemination of these data to those who need to know'.[1] Most importantly, the system can help to identify the aetiologic or causal factors in deaths of children so that communities can reduce or eliminate exposure to those factors as the basis for prevention.[2]

DEVELOPMENT OF THE NCDR-CRS

When the National Center for Child Death Review (NCCDR), based at the Michigan Public Health Institute (MPHI), was funded in 2002 by the US government[i], a major project objective was to explore the feasibility of building a standardised reporting tool for local and state child death review (CDR) teams. NCCDR found that 44 of 50 states had a case reporting tool for CDR; however, there was little consistency in the type of information that was being collected and analysed. Thirty CDR leaders from 19 states volunteered to design and test a case reporting system. NCCDR managed the system design and software development. It was originally proposed that the system would be a minimal dataset, capturing only the final outcomes of a case review. The 30 volunteer designers argued instead for a system that would capture the whole story of a child's death or serious injury, such that the version in use today contains over 1700 data elements.[3]

Thirty-five states are now enrolled in this web based system and have entered more than 84 000 reviewed child deaths. The database primarily reflects a period of review between 2005 and 2009. Table 1 provides a summary of the types of cases entered as of December 2010.

PURPOSE AND OBJECTIVES OF THE NCDR-CRS

The purpose of the system is to provide CDR teams with a simple method for capturing, analysing, and reporting on the full set of information shared at a child death or serious injury review, so that the information can be used at the local, state, and national levels to inform improvements in child safety and prevent deaths.

The objectives of the system are to:

1. Permit local and state CDR teams to systematically collect comprehensive information on every child death or serious injury reviewed including:
   - Child, family, supervisor, and perpetrator
   - Incident place, events, and emergency response
   - Investigation actions
   - Risk and protective factors by cause of death
   - Further detail on acts of omission or commission contributing to the deaths, on sleep related infant deaths and on consumer product related deaths
   - Services needed, provided or referred
   - Recommendations for and actions taken to prevent deaths
   - Factors affecting the quality of the case review
2. Enable local and state CDR teams to easily analyse and report on their CDR findings
3. Enable child health and safety advocates to access aggregated state and national CDR findings to inform child health and safety prevention policies and practices.

SYSTEM FEATURES

NCDR-CRS is a web based reporting structure, built using MS-ASP.net. Data entered into the system is stored on secure servers at MPHI.

The system is child based, and can capture identifiable data on the child, but not identifiable for others involved in the death incident. Extensive data

[i]The Center, including the development and management of the NCDR-CRS, is funded in large part by the Maternal and Child Health Bureau of the Health Resources and Services Administration of the US Department of Health and Human Services.

Table 1 Summary of cases entered into the National Child Death Review Case Reporting System; 1995–2010.* N=84 122

	Number	%
Age of child		
Under age 1	45 339	53.9
Ages 1–4	10 065	12.0
Ages 5–9	4 954	5.9
Ages 10–14	6 513	7.7
Ages 15–17	11 761	14.0
Over 17 years old	2 257	2.7
Missing	3 233	3.8
Total	84 122	100.0
Gender of child		
Male	49 579	58.9
Female	33 360	39.7
Missing	1 183	1.4
Total	84 122	100.0
Race of child		
White	52 047	61.9
African American	21 233	25.2
Native Hawaiian	452	0.5
Pacific Island	263	0.3
Asian	1 498	1.8
American Indian	1 232	1.5
Alaska native	2	0.0
Multiracial	1 318	1.6
Missing	6 077	7.2
Total	84 122	100.0
Ethnicity of child		
Yes, Hispanic/Latino	12 568	14.9
Not Hispanic/Latino	55 266	65.7
Missing	16 288	19.4
Total	84 122	100.0
Official manner of death		
Natural	44 362	52.7
Accident	19 682	23.4
Suicide	3 004	3.6
Homicide	5 555	6.6
Undetermined	5 511	6.6
Pending	907	1.1
Missing	5 101	6.1
Total	84 122	100.0
Official cause of death		
External—motor vehicle	10 849	12.9
External—fire, burn, electrocution	1 672	2.0
External—drowning	2 724	3.2
External—asphyxia	5 283	6.3
External—weapon	5 951	7.1
External—animal bite	46	0.0
External—fall or crush	655	0.8
External—poisoning	1 346	1.6
External—exposure	153	0.2
External—undetermined	642	0.8
External—other	1 381	1.6
External—unknown	151	0.2
Medical—prematurity	15 450	18.4
Medical—congenital anomaly	6 597	7.8
Medical—SIDS	4 873	5.8
Medical—cancer	2 064	2.5
Medical—cardiovascular	2 036	2.4
Medical—other	14 419	17.1
Medical—undetermined and unknown	1 413	1.7
Undetermined if medical or external injury	2 207	2.6
Missing	4 210	5.0
Total	84 122	100.0

*22 596 cases (26.9%) were migrated from prior state reporting systems. Majority of cases (76%) were entered after 2004.

elements are included that address risk factors for most major causes of injury death.

Access to the system is allowed upon the signing of a data use agreement between a state and MPHI and confidentiality statements for all registered users in a state. Users log into and have access to the secure system via passcodes, depending upon one of three levels:

- Level 1: individual team users can enter, edit, print, and delete cases and download identifiable data only for the cases reviewed by their team
- Level 2: state level users can enter, edit, print, and delete cases and download identifiable data for cases reviewed by teams in the state[ii].
- Level 3: NCCDR staff can print and download de-identified data for all cases in the system by state

There is a paper form available that mimics the web system, but the web system was developed using a complex system of skip patterns to speed the data entry process. A data dictionary is available via paper and is also linked as a help feature to every data element in the web system.

Thirty-two standardised reports are available for downloading and/or printing at the local and state level. These reports are created using real time data. The reports cover all major causes of deaths and serious injuries. Local and state users are able to download local data at any time into their own software for further analysis. A data code book accompanies the system.

States are able to migrate case reports from archived CDR databases into the NCDR-CRS. A number of states have already done this. Some customisation is available at minimal costs for states. For example, users in Georgia are presented with an additional screen to help them track the state agencies involved in the case and recommended systems improvements.

The system is free to all users. The NCCDR staff enrols users and provides training and help desk support. MPHI programmers and IT staff maintain the system's functionality and servers.

LIMITATIONS OF THE DATA

There are a number of ways in which this system is unlike typical public health surveillance or vital statistics data. Most obvious is that the case reporting system does not usually include all child deaths occurring in specific jurisdiction and thus cannot be compared one to one with vital statistics data; rates cannot be calculated nor can the data be assumed to be a representative sample of all deaths without detailed analysis. Secondly, the data cannot be compared state to state, and sometimes even team to team within a state, because of variation among teams in the types and timing of death reviews. Third, there can be large differences in the quality of data between teams and states, especially for states new to the system. At first many users leave a large proportion of questions unanswered and data fields blank. We have found that this improves with time. CDR teams can use the form as a quality

[ii]A few states have elected not to have access to case identifiers from local reviews.

improvement tool. They find that not knowing the answer to an important question such as 'were there working smoke detectors in a fire death' has them gathering this information for their next fire death review.

Some teams also do not routinely access the data dictionary to ensure consistent meaning. NCCDR attempts to work with users to encourage compliance with the data dictionary, but is aware that some states have developed their 'own' definitions for a term. There are also a number of relatively subjective data elements, such as 'was this death preventable?' or 'did an act of omission contribute to the death?'. These questions were intentionally included in the tool to encourage discussion, but may be problematic for certain types of analysis. Fourth, the original reporting source for specific data elements is not specified—so that it is not known which agencies contributed information, although the types of agencies participating at the review can be entered for each case. As such the system does not have a primacy rule for selecting the best answer to a question and instead relies on the CDR teams to determine primacy when there is dispute among agencies. The system cannot determine if the team or the person entering the data selected an answer.

STRENGTHS OF THE DATA

Despite the limitations, the case information provided by local and state CDR teams provides valuable information on the complexities involved in many child deaths, and much of this information is not available from any other single source. For example, data entered on infant sleep related suffocations describe with whom, on what surface, and where the child was sleeping at the time of the death. This can be cross matched with detailed information on the child's supervisor to better understand the circumstances of these deaths. With pool drowning deaths, data record how the child entered the pool area, what barriers they may have breached, and why those barriers were not working. Box 1 describes the type of data that could be entered for a teen motor vehicle crash. For all deaths, comprehensive information on caregivers, supervisors, and perpetrators can help describe specific risks to children and improvements to help persons acquire resources to better protect their children.

DISSEMINATION OF THE DATA

Ideally, any review findings should be easily disseminated for use by government, organisations, and the public to keep children alive. However, the NCDR-CRS is first and foremost a system for use by local and state CDR teams and programmes. This is in keeping with the fact that CDR is best as a local process—people closest to the death event coming together to share the story of the death in order to keep other children safe from harm. In fact, according to the terms of the data use agreements with participating states, the data entered into the system is the property of these states. NCCDR only serves as the custodian of the data.

Most local teams are not accessing the data download feature, relying instead on the standardised reports. They are able to generate up to 32 of these, incorporate them into an annual report template, and thereby produce a report on their CDR findings and process to share with their community.

Most states participating in the system are downloading their data on an annual basis and generating extensive annual reports on all deaths reviewed or specialised reports on specific types of deaths such as suicides or drownings[iii]. Most states have legislation requiring that reports on state CDR be presented annually to state agencies, legislators and/or governors. Some states are now linking their CDR data to their birth, death, and other records for more enhanced analysis.

Box 1 What the case reporting system can tell us about a teen motor vehicle death

Child's demographic information
Age; sex; education and employment; disabilities, health, substance abuse, mental health, delinquency, and child maltreatment and family violence histories.

Child's primary caregivers (up to two)
Age; sex; income; education and employment; primary language spoken; on active military duty; disabilities, health, substance abuse, mental health, delinquency, and child maltreatment and family violence histories; prior child deaths.

Supervision
If needed and for person responsible for supervision: age; sex; income; education and employment; primary language spoken; on active duty in military; disabilities, health, substance abuse, mental health, delinquency, and child maltreatment and family violence histories; prior child deaths; specific impairments at time of supervision.

Incident
Time, place, emergency response, child's activity at time, number of other deaths.

Investigation
Types of investigators, persons declaring cause of death, types of forensic tests conducted, reviews of child protective services records.

Manner and primary cause of death
Information on crash circumstances
Number and types of vehicles involved in crash, position of child, collision type, primary causes of crash, driving conditions, location of crash.

Information on drivers, occupants, pedestrians
For child, child's driver and other drivers involved in crash: licence status and violations to graduated licensing regulations; for all vehicles in crash: number of total occupants, teen occupants and teen deaths; protective measures—for example, seat belts needed, present, used, used incorrectly or not used.

Information on acts of omission or commission
Types of acts contributing to the death and information on the perpetrators of these acts (same as for supervisor).

Services used, needed, referred or recommended as a result of the death

Recommendations on actions to prevent other deaths
Includes a wide range of options—including education, environmental modifications, legislation, product safety; status of implementation of recommendations.

Information on the case review
Attendees, issues preventing a comprehensive review, summary of outcomes.

[iii]Annual reports from most states can be accessed at http://www.childdeathreview.org/

Aggregated multi-state, de-identified data analysis generated by NCCDR staff is available to federal agencies and other researchers in accordance with the NCCDR data dissemination policy. Recently a number of agencies in the US government have shown interest in accessing the data to inform national policy. For example, a request has been made to generate data on the circumstances in child passenger deaths which may explain why caregivers fail to use child passenger seats. One federal agency is interested in comparing the number of child maltreatment deaths identified through this reporting system to the number generated in the federal child abuse reporting system. Mental health agencies are interested in access and compliance issues for prior and current mental health services in suicide deaths. A federal childcare licensing agency is interested in analysing unintentional deaths occurring in licensed day care centres. Federal child welfare has requested data on the quality of supervision in all injury deaths to understand the role of supervision and caregiver neglect in these deaths.

The US Centers for Disease Control and Prevention (CDC) are funding two projects to utilise the case reporting system as a means to better understand sudden unexplained infant deaths (SUID) and violent deaths. In the former, an expanded version of the case report tool that includes additional questions on SUID deaths is being piloted in seven states with support to ensure the review of 100% of all SUID deaths. Their data are being shared with the CDC as the pilot for a national SUID Case Registry. Data on violent deaths is being matched with data from states participating in the CDC's National Violent Death Reporting System.[4] This probabilistic match will inform both the National Violent Death Reporting System and CDR as to the completeness of their violent death data and enrich understanding of these deaths. The US Maternal and Child Health Bureau is funding a secondary data analysis of infant sleep related deaths, using NCDR-CRS data from over 3000 SUID deaths in nine states, to understand the risk factors in these deaths.

A number of non-federal researchers have also made enquiries as to the availability of the data for research purposes. A formal application must be submitted and approved by the NCCDR Data Dissemination Committee for access to the de-identified database. Part of the application is agreement on the limitations of the data for surveillance purposes. The committee includes representatives from participating states and members of the NCCDR National Steering Committee. Data are not available from NCCDR that counts specific data elements by an individual state—for example, '100 of the 1000 deaths are from New York'. Requests for state identified data are rarely approved and if so must be approved by the participating states through a separate process.

FUTURE DIRECTIONS

Efforts will continue to enrol the remaining 16 states into the NCDR-CRS and to improve data quality. Especially important are: increasing the completeness of information, reducing inconsistencies in interpreting definitions, providing training and technical assistance for all users, and enhancements to the software to allow for customisation and automatic pre-population of data from agency case records. Most importantly, efforts will continue to assist child death review teams to interpret and use their data to prevent child deaths and to keep all children safe and healthy.

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Assessment of caregiver responsibility in unintentional child injury deaths: challenges for injury prevention

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Assessment of caregiver responsibility in unintentional child injury deaths: challenges for injury prevention

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ABSTRACT

Most unintentional injury deaths among young children result from inadequate supervision or failure by caregivers to protect the child from potential hazards. Determining whether inadequate supervision or failure to protect could be classified as child neglect is a component of child death review (CDR) in most states. However, establishing that an unintentional injury death was neglect related can be challenging as differing definitions, lack of standards regarding supervision, and changing norms make consensus difficult. The purpose of this study was to assess CDR team members' categorisation of the extent to which unintentional injury deaths were neglect related. CDR team members were surveyed and asked to classify 20 vignettes—presented in 10 pairs—that described the circumstances of unintentional injury deaths among children. Vignette pairs differed by an attribute that might affect classification, such as poverty or intent. Categories for classifying vignettes were: (1) caregiver not responsible/not neglect related; (2) some caregiver responsibility/somewhat neglect related; (3) caregiver responsible /definitely neglect related. CDR team members from five states (287) completed surveys. Respondents assigned the child's caregiver at least some responsibility for the death in 18 vignettes (90%). A majority of respondents classified the caregiver as definitely responsible for the child's death in eight vignettes (40%). This study documents attributes that influence CDR team members' decisions when assessing caregiver responsibility in unintentional injury deaths, including supervision, intent, failure to use safety devices, and a pattern of previous neglectful behaviour. The findings offer insight for incorporating injury prevention into CDR more effectively.

INTRODUCTION

Child death review (CDR) is a process that involves a multidisciplinary team of professionals sharing information to better understand the circumstances surrounding the death of a child. Almost every state in the USA has a CDR program; some states have one state-level team, while other states have multiple CDR teams serving local or regional communities.[1 2] CDR team members typically include representatives from law enforcement, medical examiner/coroners' offices, public health, medicine, social services, the courts, and emergency medical technicians or other first responders. At a review, team members share information from their agency about the child, the family, and events leading to the child's death. The goals of the review are to fully understand the circumstances of the child's death, more accurately classify cause and manner of death, and identify risk factors as well as prevention strategies.[3]

Most unintentional injury deaths among young children result from inadequate supervision or failure to protect the child from potential hazards in the home environment.[4] Documenting these and other factors that contribute to a child's fatal unintentional injury, as well as identifying the potential contribution of child neglect to the death, is a component of CDR in most states. This is done to ensure accurate classification of cause and manner of death, as well as to improve agency response to specific deaths, and provide input for prevention. Nevertheless, reaching agreement on the role of caregiver responsibility and child neglect is often a challenge for CDR team members due to the influence of changing social norms and lack of standards of minimally adequate care or appropriate supervision that can objectively be applied to every situation.[5]

Several additional factors contribute to the challenge CDR team members face when examining the circumstances of a child's death and reaching consensus on adequacy of supervision and whether neglect was involved. Fundamentally, definitions of child neglect differ across states, disciplines, agencies, and purpose (eg, criminal or civil legal proceedings, public health surveillance, or research). There is also disagreement on conceptual aspects of neglect definitions, specifically whether they should be parent focused—parent or caregiver fails to act, resulting in harm to a child—or focused on a child's needs not being met, regardless of parental (in)action or other contributory factors such as cultural beliefs or financial resources.[6] Furthermore, a number of attributes are often considered when determining child neglect. These attributes might be found explicitly in neglect definitions or implicitly in legal or agency interpretations, and include poverty, intent, child age, and chronicity (whether similar risk to the child has been documented in the past).

Although one of the strengths of CDR is the different perspectives the participating agency and professional members bring to the review, the different agency definitions of neglect, lack of consistent standards for determining adequate care and supervision, and changing social norms all likely contribute to the challenge of reaching consensus when it comes to agreeing on the extent to which a child's caregiver was responsible for the fatal unintentional injury and documenting whether the death was neglect related or not.[7]

These same issues have led to the suggestion that child neglect might better be classified along a continuum with options on one end ranging from a momentary lapse in parenting that results in harm to a child, to the other end—a parent who deliberately acts in a manner that puts their child at risk.[6] Unfortunately, CDR team members are typically asked to determine whether inadequate supervision or neglect contributed to the death without the opportunity to incorporate uncertainty or contributing factors in their classification.

The purpose of this study was twofold. First, we wanted to assess CDR team members' categorisation of the extent of caregiver responsibility for a child's fatal unintentional injury based on vignettes that described the circumstances of the injury. We also sought to determine whether adequacy of supervision, social norms, and other attributes commonly considered when classifying child neglect would influence the CDR team members' categorisation of whether the unintentional injury death was neglect related or not.

METHODS

We surveyed CDR team members to assess their classification of 20 vignettes that described the circumstances of a child's unintentional injury death. Study participants were asked to document the extent to which they believed the child's caregiver was responsible and the death was neglect related. The choices provided were: (1) caregiver not responsible/not neglect related; (2) some caregiver responsibility/somewhat neglect related; (3) caregiver responsible/definitely neglect related. Respondents were given the option to provide additional comments for each vignette.

The 20 vignettes were presented in 10 pairs. The first vignette in each pair (vignette a) included at least one attribute typically considered when categorising a child death as neglect related. These attributes included adequacy of supervision (vignettes 1, 5, 6, 8, 9), social norms regarding the use of safety devices (vignettes 2, 4, 10), and social norms regarding infant sleep environment (vignettes 3, 7). Poverty was included as an additional attribute in vignettes 7, 8, and 9. Changes in the second vignette of the pair (vignette b) were highlighted in bold and represented different or additional attributes that might influence the CDR team member's classification of caregiver responsibility/neglect. These included chronicity (vignettes 1, 7), adequacy of supervision (vignettes 2, 3, 10), poverty (added in vignettes 5 and 6, removed in vignettes 8 and 9), and child age for operating an all terrain vehicle (ATV) (vignette 4). Intent was included as an additional attribute in vignettes 6 and 7. By pairing the vignettes in this way, we sought to determine if the additional attribute or change in detail from the first vignette to the second resulted in a change in the CDR team members' classification of caregiver responsibility and whether the death was not, somewhat, or definitely neglect related. Each vignette is reproduced in full and the attributes of interest included in the first vignette and changed in the second are specified in table 1.

Although the vignettes were hypothetical, they were realistic, represented common causes of unintentional injury death among children, and contained information commonly available and discussed during CDR team meetings.

The data were collected using SurveyMonkey, an internet based survey tool (http://www.surveymonkey.com). In addition to the vignettes, respondents completed demographic information including their age, gender, professional affiliation, and details of their CDR experience.

The survey was available for completion between 1 September and 11 December 2009. CDR coordinators in 11 states were contacted and invited to participate. These 11 states were chosen to represent states with different programme attributes (eg, local CDR teams versus only a state level team). All CDR coordinators agreed to participate and were asked to forward an email to all CDR team members in their state. This email, from the Director of the National Center for Child Death Review, provided an explanation of the study, ensured participant confidentiality, and contained a link to the survey. Up to four reminder emails were sent to state coordinators; once a survey was completed by someone in their state, no additional reminders were sent.

Data were downloaded from SurveyMonkey and analyses were completed using SAS for Windows version 9.1. Fischer's exact test was used to determine if there was a significant difference in classification of neglect across each vignette pair. Respondents who did not respond to any vignette were dropped from the analysis. The study was exempted from review by the University of Missouri Health Sciences Institutional Review Board.

RESULTS

A total of 294 people from five states initiated the survey; seven did not respond to any of the vignettes, leaving 287 respondents who provided data for analysis. Although all 11 state coordinators agreed to participate and multiple reminders were sent, CDR team members from only five states completed the survey. Because the invitation to participate was forwarded from the state coordinator, and the number of people to whom the email was forwarded is not known, we are unable to calculate an accurate response rate. The 287 respondents represent the most common professions serving on CDR teams, and most reported serving on CDR teams in local jurisdictions for 3 years or more (table 2).

The respondents' assessments of caregiver responsibility for each of the paired vignettes are presented in table 3. For 18 (90%) vignettes, a majority of respondents assigned the caregiver at least some responsibility for the child's death. The exceptions to this were vignettes 4a and 10a. Vignette 4a described the death of a 15-year-old in an ATV crash with the goal of assessing the extent to which social norms regarding helmet use in an adolescent of legal age (15) to ride an ATV would influence classification of whether the death was neglect related. Comments provided by respondents indicated a hesitancy to assign responsibility to the parents given the child's developmental age and the sentiment that adolescents do what they want and parents cannot watch them all the time. Vignette 10a assessed social norms regarding the use of a smoke detector by describing the death of two children in a fire caused by faulty wiring in a rental residence without a smoke detector. Respondent comments for vignette 10a indicate that respondents thought the landlord was responsible for the faulty wiring and should have provided smoke detectors.

A majority of respondents classified the caregiver as definitely responsible for the child's death in eight (40%) of the vignettes—1a, 1b, 2b, 5a, 5b, 6a, 6b, and 7b. Vignette 1a assessed adequacy of supervision by describing an infant left without adult supervision in a bathtub and its pair, 1b, assessed chronicity by adding a prior Child Protective Services (CPS) substantiation. Vignette 2b assessed social norms regarding incorrect use of a car seat (from vignette 2a) with the addition of an impaired caregiver. Vignettes 5a and 5b assessed the adequacy of supervision in children who were left alone at night with the addition of poverty in 5b. Vignettes 6a and 6b assessed adequacy of supervision by describing an infant being left alone in

Table 1 Text of vignettes, mechanism of injury and attributes addressed in each vignette pair

Mechanism of injury	Vignette pairs	Attribute addressed
Drowning	1a) 10-month-old infant in bathtub with 4-year-old sibling. Bathtub contains 10 inches of water; mother supervising until doorbell rings. Mother leaves to answer door, states she was only gone for 5 min. Returns to find infant face down in tub, cause of death = drowning. 1b) 10-month-old infant in bathtub with 4-year-old sibling. Bathtub contains 10 inches of water; mother supervising until doorbell rings. Mother leaves to answer door, states she was only gone for 5 min. Returns to find infant face down in tub, cause of death = drowning. **Mother had prior Child Protective Services (CPS) substantiation on 4-year-old, 3 years ago**.	Adequacy of supervision (distracted caregiver) *Attribute added*: Chronicity (prior CPS report)
Motor vehicle crash	2a) 2-car collision, 1-year-old child strapped into car seat, but car seat was not tethered (buckled) to the car. During collision, child's car seat is ejected from the car and the child is killed. Child's father is driving, he sustains minor injuries. During the investigation, it was determined that he was not responsible for the crash, and he was not impaired at the time of the crash. 2b) 2-car collision, 1-year-old child strapped into car seat, but car seat was not tethered (buckled) to the car. During collision, child's car seat is ejected from the car and the child is killed. Child's father is driving, he sustains minor injuries. During the investigation it was determined that he was not responsible for the crash, **but the father's blood alcohol concentration (BAC) was tested and result was BAC of 1.5 (0.8 is legal limit)**.	Social norms regarding use of safety devices (incorrect use of car seat) *Attribute added:* Adequacy of supervision (impaired caregiver)
Suffocation	3a) 4-month-old infant is put to sleep at midnight in a double bed with mother and father, and is found by mother at 05:00 unresponsive, under father's chest. Infant sleeps with parents to facilitate breastfeeding. Cause of death determined by the medical examiner to be suffocation due to positional asphyxia. 3b) 4-month-old infant is put to sleep at midnight in a double bed with mother and father, and is found by mother at 05:00 unresponsive, under father's chest. **Father had 'a couple' beers before bed**. Cause of death determined by the medical examiner to be suffocation due to positional asphyxia.	Social norms regarding infant sleep environment *Attribute added:* Adequacy of supervision (impaired caregiver)
All terrain vehicle (ATV) crash	4a) 15-year-old riding ATV (4-wheeler) on private (parent's) property, runs into a fence and dies of massive head injuries. Child was not wearing a helmet when found, but his parents had purchased a helmet with the ATV and insisted that the child wear the helmet whenever he was riding the ATV. The legal age for riding an ATV in this state was 15 years old. 4b) **12-year-old** riding ATV (4-wheeler) on private (parent's) property, runs into a fence and dies of massive head injuries. Child **was wearing a helmet** when found, his parents had purchased a helmet with the ATV and insisted that the child wear the helmet whenever he was riding the ATV. The legal age for riding an ATV in this state was 15 years old.	Social norms regarding use of safety devices (helmet) *Attributes added*: Age Legal mandate
Fire	5a) Child playing with lighter—ignites bedding in child's bedroom. Two children die from smoke inhalation. Fire occurred at 02:00. During the investigation it was learnt that the single mother left her children alone for the first time while she went to her night shift job. Her babysitter cancelled at the last minute. If mother misses her job, she will be fired. Mother asked a neighbour in an adjoining apartment to listen for the children. 5b) Child playing with lighter—ignites bedding in child's bedroom. Two children die from smoke inhalation. Fire occurred at 02:00. During the investigation it was learnt that the single mother left her children alone for **'just a few minutes' while she went to QuikMart 1 block away to buy cigarettes. Mother returned to find the apartment building engulfed in flames**.	Adequacy of supervision (absent caregiver) *Attribute added:* Poverty
Hyperthermia	6a) 7-month-old infant left alone in back seat of closed, locked car on 80°F day in parking lot. Dies of hyperthermia. During the investigation it was learnt that on this day, the mother, who usually took the infant to daycare, had an early appointment at work and asked father to drop the child off at daycare on his way to work. The father was a surgeon at city hospital and as soon as he set out he received a call from the hospital telling him he was needed immediately for an emergency surgery. He drove directly to hospital, forgetting infant in back seat. Mother called father late in the afternoon to ask how daycare drop off was. Father immediately ran to car and discovered the infant, unresponsive. 6b) 7-month-old infant left alone in back seat of closed, locked car on 80°F day in parking lot. Dies of hyperthermia. During the investigation it was learnt that on this day, the mother **borrowed a neighbour's car to drive to her hair appointment. She called to get a babysitter, but neither her mother nor her boyfriend were available. She put the infant in the back seat, and drove to her hair appointment. She opened the front car window an inch so air can get into the car; and parked the car in front of the salon so she could keep an eye on it. Her appointment lasted 2 h. When she returned to car, she found the infant deceased**.	Adequacy of supervision (absent caregiver) *Attributes added*: Poverty Intent

Continued

Table 1 Continued

Mechanism of injury	Vignette pairs	Attribute addressed
Suffocation	7a) 4-month-old infant is put to sleep at midnight in a double bed with mother and 2 toddlers, and is found by mother at 05:00 unresponsive, under a toddler's chest. During the death investigation, it is noted that there is not a crib in the house and the mother reports not being able to afford a crib for the baby. Cause of death determined by the medical examiner to be suffocation due to positional asphyxia. 7b) 4-month-old infant is put to sleep at midnight in a double bed with mother and 2 toddlers, and is found by mother at 05:00 unresponsive, under a toddler's chest. During the death investigation, **it is noted that the mother has received a crib and safe sleep information from the Safe Cribs programme in her community; however, the crib is full of blankets and stuffed animals and has not been used by the infant. Mom has symptoms of post-partum depression and has been reported to CPS by neighbours for inadequate supervision of the toddlers**. Cause of death determined by the medical examiner to be suffocation due to positional asphyxia.	Social norms regarding infant sleep environment Poverty *Attributes added*: Chronicity Intent
Poisoning	8a) 3-year-old toddler playing quietly with toys in living room; mother cleaning the bathroom. Toddler wanders into the kitchen and opens the refrigerator, mother enters the kitchen to find child drinking from her bottle of liquid methadone. Mother had methadone at home only because the clinic is closed on weekends. Child dies. 8b) 3-year-old toddler **in care of grandparents while parents on anniversary cruise. Child playing on floor in living room while grandmother is cooking dinner. Child finds an open bottle of Tylenol [acetaminophen, paracetamol] and ingests all the pills. Ingestion is not discovered until the child becomes seriously ill and dies of liver failure**.	Adequacy of supervision (distracted caregiver) Poverty *Attribute removed*: Poverty
Drowning	9a) 3-year-old boy in a trailer park is playing with 4 other children during a party/picnic in the back yard with neighbours, including the child's parents and other adults. Boy wanders next door unnoticed and falls into neighbour's fish pond and drowns. Parents were drinking with neighbours, but are not noticeably intoxicated when police arrive. No blood alcohol test is conducted. 9b) 3-year-old boy is playing with 4 other children during **a family reunion at a lakeside resort**. Boy wanders down to lakeside unnoticed, falls off the dock and drowns. Parents were drinking with other family members but are not noticeably intoxicated when police arrive. No blood alcohol test is conducted.	Adequacy of supervision (distracted caregiver) Poverty *Attribute removed*: Poverty
Fire	10a) Fire engulfs rental duplex [apartment]. Two children and one parent die from smoke inhalation, one parent escapes. Fire occurred at 14:00, everyone was napping at the time. During the investigation it was learnt that the fire was due to faulty wiring in the attic. There was no smoke detector in the building. 10b) Fire engulfs rental duplex. **Two children and adult caregiver die** from smoke inhalation. Fire occurred at 14:00. During the investigation it was learnt that the **children's mother was working at the time of the fire. She left her two toddlers with her father (the children's grandfather), who is disabled and wheelchair bound due to multiple sclerosis. The children were napping when the fire started and the grandfather could not get the children out of the house. Origin of the fire undetermined**.	Social norms regarding use of safety devices (smoke detector) *Attribute added:* Adequacy of supervision (disabled caregiver)

a hot car, with the addition of poverty and intent in 6b. Vignette 7b assessed social norms regarding infant sleep environment and poverty with the additional attributes of chronicity and intent.

The change in distribution of responses across each vignette pair was statistically significant for eight of the 10 pairs, indicating that the change in attributes across the pair influenced the respondent's classification of the extent to which the caregiver was responsible and the death was neglect related. The two pairs without a statistically significant change in the distribution of responses were vignettes 5 and 9 (table 3).

Results from Fischer's exact test provide information on whether the distribution of responses for each pair differed significantly between vignette a and b. It does not, however, provide information on whether or how individual respondents changed responses across vignettes. Eight of the 10 vignette pairs (vignettes 1–7 and 10) were ordered so that one or two additional attributes were included in the second vignette (b). It was anticipated that if the attribute(s) added to the b vignette in these eight pairs influenced the respondent's categorisation of whether the death was neglect related, they would assign more caregiver responsibility in the b vignette. In vignettes 8 and 9, an attribute (poverty) included in vignette a was removed in b. The expectation here was that the assignment in caregiver responsibility would decrease in the b vignette if the removal of poverty influenced the respondent's categorisation. To assess the influence of the addition (or removal) of these attributes commonly considered when classifying child neglect, the proportion of respondents who changed their classification of caregiver responsibility across vignette pairs was evaluated (table 4). The direction of the change in assigned caregiver responsibility was as anticipated across all vignette pairs, except for vignette 9.

The three vignette pairs with the greatest proportion of respondents who changed classification across the pair were vignettes 2, 4, and 10, with 54.7%, 62.7%, and 54.8% changing classification across the vignette pair, respectively. Although 33%

Table 2 Respondent characteristics (n=287)*

Respondent characteristic	Frequency (%)
Age group	
<30 years	12 (4.2)
30–39	52 (18.1)
40–49	95 (33.1)
50–59	102 (35.5)
60+	26 (9.1)
Sex	
Female	187 (65.2)
Male	100 (34.8)
Race (missing =1)	
Caucasian	271 (94.4)
African-American	7 (2.5)
Asian	6 (2.1)
Other	2 (0.7)
Ethnicity	
Hispanic	10 (3.5)
Profession	
Law enforcement/judicial	93 (32.4)
Law enforcement (n=55)	
Prosecutor (n=15)	
Juvenile (n=18)	
Other judicial (n=5)	
Medical doctor (MD)	24 (8.4)
Medical examiner/pathologist (n=7)	
Paediatrician (n=10)	
Other MD (n=7)	
Coroner/other death investigator	9 (3.1)
Social worker	66 (23.0)
Nurse/emergency medical service (EMS)	65 (22.7)
Public health nurse (n=24)	
Other nurse (n=15)	
EMS/paramedic (n=9)	
Others	30 (10.5)
Other child advocate (n=15)	
Mental health (n=6)	
Other profession (n=6)	
Education/schools (n=3)	
Years on review team	
≤2 years	89 (31.1)
3–4 years	46 (16.1)
5–10 years	95 (33.2)
>10 years	56 (19.6)
State	
Missouri	130 (45.3)
Michigan	96 (33.5)
Texas	35 (12.2)
Washington	23 (8.0)
Maine	3 (1.0)
Team jurisdiction	
Local	261 (90.9)
State	16 (5.6)
Both	10 (3.5)
Team location (missing=16)	
Rural	143 (52.8)
Urban/suburban	128 (47.2)

*Seven respondents who did not respond to any vignettes were excluded.

of respondents indicated the caregiver was definitely responsible for the child's death in vignette 2a, the addition of the caregiver's elevated blood alcohol concentration resulted in 152 more respondents classifying the death as definitely neglect related, a 160% increase. The difference in child age across response pairs in vignette 4 was more influential in assigning caregiver responsibility for this ATV related death than the fact that the 15-year-old was not wearing a helmet in 4a and the 12-year-old was wearing a helmet in 4b. In vignette 10, 46.7% of respondents assigned more caregiver responsibility in vignette 10b then 10a, indicating the addition of detail that the children's mother knowingly left her children with an inappropriate (disabled) caregiver was influential in the primary shift in categorisation of this death from not neglect related to somewhat neglect related.

Vignettes 1, 5, and 9 had the lowest proportion of respondents who changed their classification across pairs: 12.5%, 15.0%, and 11.2%, respectively. For vignettes 1 and 5, this was largely because most respondents (>60%) classified both deaths in each pair as definitely neglect related, although in vignette 1b, 29 (10%) additional respondents classifying this death as definitely neglect related were likely influenced by the mother's prior CPS substantiation. In vignette 5, respondent comments indicated they felt strongly that children should not be left unsupervised during the night, regardless of the reason. The difference in socioeconomic status described in vignette 9 (lake/pond drowning) did not influence many respondents to change their classification across the pair. The higher proportion of respondents that classified 9b as definitely neglect related was unanticipated. Respondent comments explained this finding by noting that the pond in the trailer park might have been out of sight, whereas parents would definitely have known about the lake at the resort (table 4).

Each vignette received multiple comments from respondents, ranging from 22 comments on vignette 10a to 68 on vignette 5a. These comments provide important insights into the respondent's decision processes. For example, chronicity (eg, evidence of 'a pattern' of neglect) and intent were frequently mentioned in the comments, and respondents identified them as highly influential attributes when considering whether a death was neglect related. In addition, the comments document wide variation in judgement and opinion among CDR team members and frequently note that the circumstances described in the vignettes were 'tragic', 'unfortunate' or 'freak' accidents. A sample of the comments is included in table 5.

DISCUSSION

In this exploratory, descriptive study, current members of CDR teams classified the extent to which a child's unintentional injury death was neglect related based on information provided in 20 vignettes describing common circumstances of unintentional injury deaths of children. A majority of CDR team members assigned at least some caregiver responsibility for 18 of the vignettes. In eight of the vignettes, over 60% of respondents classified the caregiver as responsible and the death definitely neglect related. Three of these vignettes were the first vignette in the pair (the 'a' vignette) indicating that the attribute assessed in these three initial vignettes, inadequacy of supervision, was sufficient to classify the death as neglect related. The remaining five vignettes where the majority of respondents classified the death as definitely neglect related assessed the addition of: (1) chronicity to adequacy of supervision (1b) and social norms regarding infant sleep environment (7b); (2) adequacy of supervision to social norms regarding use of safety devices (2b); (3) poverty to adequacy of supervision (5b, 6b); and (4) intent to adequacy of supervision (6b) and social norms regarding infant sleep environment (7b).

The 20 vignettes represented 10 vignette pairs that described similar circumstances, where the second (b) vignette included a change in attributes that might influence classification of neglect.

Table 3 Classification of caregiver responsibility and outcomes for vignettes

Vignette	Attribute addressed/added	Caregiver responsibility			
		Caregiver not responsible/ not neglect related n (%)	Some responsibility/ somewhat neglect related n (%)	Caregiver responsible/ definitely neglect related n (%)	Fisher's exact test p value
Drowning					
1a)10-month-old in bathtub with 4-year-old sibling. Mother leaves to answer doorbell.	Adequacy of supervision (distracted caregiver)	4 (1.4)	107 (37.3)	176 (61.2)	
1b) …Mother had prior CPS substantiation on 4-year-old, 3 years ago.	Chronicity (prior CPS report)	1 (0.4)	81 (28.2)	205 (71.4)	0.018
Motor vehicle crash (missing = 2)					
2a) 1-year-old child buckled in car seat, but car seat not secured to car; child's father driving; not at fault for crash.	Social norms regarding use of safety devices (incorrect use of care seat)	18 (6.3)	172 (60.4)	95 (33.3)	
2b) …father's blood alcohol was 0.15 (0.08 is legal limit).	Adequacy of supervision (impaired caregiver)	4 (1.4)	34 (11.9)	247 (86.7)	<0.0001
Suffocation (missing = 5)					
3a) 4-month-old sleeping in bed with parents	Social norms regarding infant sleep environment	31 (11.0)	183 (64.9)	68 (24.1)	
3b)… Father had 'a couple' beers before bed.	Adequacy of supervision (impaired caregiver)	17 (6.0)	145 (51.4)	120 (42.3)	<0.0001
All terrain vehicle (ATV) crash (missing = 8)					
4a) 15-year-old riding ATV, not wearing a helmet	Social norms regarding use of safety devices (helmet)	198 (71.0)	78 (28.0)	3 (1.1)	
4b)… 12-year-old… was wearing a helmet… legal age for riding an ATV is 15 years old.	Age Legal mandate	74 (26.5)	139 (49.8)	66 (23.7)	<0.0001
Fire (missing = 8)					
5a) Child playing with lighter at 02:00; single mother left her children alone—she went to work.	Adequacy of supervision (absent caregiver)	6 (2.2)	59 (21.2)	214 (76.7)	
5b)…mother went to store to buy cigarettes.	Poverty	3 (1.1)	54 (19.4)	222 (79.6)	0.52
Hyperthermia (missing = 9)					
6a) 7-month-old infant left in car. Father, a surgeon, distracted, forgot infant in back seat.	Adequacy of supervision (absent caregiver)	9 (3.2)	93 (33.5)	176 (63.3)	
6b)…mother went to hair appointment. No babysitter so left baby in car.	Poverty Intent	1 (0.4)	4 (1.4)	273 (98.2)	<0.0001
Suffocation (missing = 10)					
7a) 4-month-old infant sleeping in double bed with mother and 2 toddlers; mother cannot afford crib.	Social norms regarding infant sleep environment Poverty	32 (11.6)	159 (57.4)	86 (31.1)	
7b)…Mother has crib but not using it; previous report to CPS for inadequate supervision of toddlers.	Chronicity Intent	7 (2.5)	81 (29.2)	189 (68.2)	<0.0001
Poisoning (missing = 11)					
8 a) 3-year-old wanders into the kitchen; Mother enters kitchen—child drinking her liquid methadone.	Adequacy of supervision (distracted caregiver) Poverty	20 (7.3)	132 (47.8)	124 (44.9)	

Continued

Table 3 Continued

Vignette	Attribute addressed/added	Caregiver responsibility			Fisher's exact test p value
		Caregiver not responsible/ not neglect related n (%)	Some responsibility/ somewhat neglect related n (%)	Caregiver responsible/ definitely neglect related n (%)	
8b) ...3-year-old in care of grandparents, finds bottle of Tylenol; ingests all pills.	Poverty (removed)	23 (8.3)	169 (61.2)	84 (30.4)	0.002
Drowning (missing = 11)					
9a) 3-year-old boy in trailer park, playing during a picnic. Boy wanders next door; drowns in pond.	Adequacy of supervision (distracted caregiver) Poverty	8 (2.9)	155 (56.2)	113 (40.9)	
9b)... a family reunion at a lakeside resort. Boy wanders down to lakeside and drowns.	Poverty (removed)	7 (2.5)	142 (51.5)	127 (46.0)	0.50
Fire (missing = 15)					
10a) Fire engulfs rental duplex. Two children and one parent die. Fire at 14:00, everyone napping at the time.	Social norms regarding use of safety devices (smoke detector)	162 (59.6)	103 (37.9)	7 (2.6)	
10b) ... Children's mother left them with her father, who is wheelchair bound.	Adequacy of supervision (disabled caregiver)	76 (27.9)	149 (54.8)	47 (17.3)	<0.0001

*Respondents could choose more than one outcome.
CPS, Child Protective Services.

A change in assessment of caregiver responsibility across vignettes reflects the potential for different attributes to influence the respondents' judgements. The change in assessment of caregiver responsibility was statistically significant for eight of the 10 vignette pairs. The two vignette pairs without a significant change in the assessment of caregiver responsibility both assessed the attributes of adequacy of supervision and poverty. Vignette 5b added poverty while vignette 9b removed the poverty attribute. Other vignette pairs where the poverty attribute was included or changed did have a significant shift in distribution across pairs (vignettes 6, 7, 8). It is not clear from these mixed results whether or how poverty might influence CDR team members when assessing caregiver responsibility and the role of neglect in a child's unintentional injury death.

The three vignettes with the highest proportion of respondents who changed their classification of caregiver responsibility from vignette a to vignette b assessed the addition of disabled or impaired caregiver (vignettes 2 and 10) or young age and legal mandate to social norms regarding the use of safety devices (vignette 4). The three vignettes with the lowest proportion of respondents who changed their classification (vignettes 1, 5, and 9) all initially assessed adequacy of supervision. These findings suggest that the presence of additional attributes may be an important influence when the CDR team is attempting to determine caregiver responsibility and the role of neglect in unintentional injury deaths that involve social norms related to use of safety devices. In contrast, when there is consensus that the death was neglect related in light of inadequate caregiver supervision, the presence of additional attributes may have little influence. Importantly, the addition of chronicity or intent always resulted in a statistically significant change in distribution of caregiver responsibility across vignette pairs and an increase in the proportion of respondents who classified the caregiver as responsible and the child's death as definitely neglect related. This was also supported by the respondent comments.

Survey respondents were given the option of including comments on each of the 20 vignettes. Because comments were not required of or provided by all respondents, we did not conduct a formal qualitative analysis. However, the numerous comments included for each vignette provide important insight into respondents' thoughts and decision processes, and demonstrate the wide range of opinions held by CDR team members. Moreover, the comments highlight the importance of chronicity and intent in assessing the role of neglect in unintentional injury deaths, clearly documenting that some team members are reticent to call a death neglect related without evidence of chronicity (eg, 'a pattern of neglect') or caregiver intent.

The distribution of the survey results, with the majority of responses indicating some but not full caregiver responsibility, and the wide disparity in opinion provided in the respondents' comments, document the challenge for CDR teams in reaching consensus when attempting to determine if a child's unintentional injury death was neglect related. This provides support for using a continuum to characterise better the role of child neglect in these deaths.

There are several potential limitations to this study. The survey respondents are a convenience sample of CDR team members, and the response rate is not known. However, it is important to note that the respondents represent the most common professions serving on CDR teams, a range of years of experience, rural and urban areas, and local and state teams. Furthermore, based on two of the authors' (PGS, TMC) over 20 years of combined experience serving on local and state CDR teams and providing technical assistance and consultation in

Table 4 Proportion of respondents who changed choice of caregiver responsibility from vignette a to vignette b

Vignette	Proportion of respondents		
	Who changed classification of responsibility	Who assigned less responsibility in vignette a than in vignette b	Who assigned more responsibility in vignette a than in vignette b
Drowning			
1a) 10-month-old in bathtub with 4-year-old sibling. Mother leaves to answer doorbell.	12.5	11.8	0.7
1b) …Mother had prior CPS substantiation on 4-year-old, 3 years ago.			
Motor vehicle crash (missing = 2)			
2a) 1-year-old child buckled in car seat, but car seat not secured to car; child's father driving; not at fault for crash.	54.7	54.4	0.3
2b) …father's blood alcohol was 0.15 (0.08 is legal limit).			
Suffocation (missing = 5)			
3a) 4-month-old sleeping in bed with parents	23.0	22.7	0.3
3b)… Father had 'a couple' beers before bed.			
All terrain vehicle (ATV) crash (missing = 8)			
4a) 15-year-old riding ATV, not wearing a helmet	62.7	59.1	3.6
4b)… 12-year-old… was wearing a helmet…legal age for riding an ATV is 15 years old.			
Fire (missing = 8)			
5a) Child playing with lighter at 02:00; single mother left her children alone—she went to work.	15.0	9.3	5.7
5b)…mother went to store to buy cigarettes.			
Hyperthermia (missing = 9)			
6a) 7-month-old infant left in car. Father, a surgeon, distracted, forgot infant in back seat.	34.9	34.9	0
6b)…mother went to hair appointment. No babysitter so left baby in car.			
Suffocation (missing = 10)			
7a) 4-month-old infant sleeping in double bed with mother and 2 toddlers; mother cannot afford crib.	43.3	43.0	0.3
7b)…Mother has crib but not using it; previous report to CPS for inadequate supervision of toddlers.			
Poisoning (missing = 11)			
8 a) 3-year-old toddler wanders into the kitchen. Mother enters kitchen—child drinking her liquid methadone.	32.2	8.3	23.9
8b) …3-year-old toddler in care of grandparents, finds bottle of Tylenol; ingests all pills.			
Drowning (missing = 11)			
9a) 3-year-old boy in trailer park, playing during a picnic. Boy wanders next door; drowns in pond.	11.2	8.3	2.9
9b)… a family reunion at a lakeside resort. Boy wanders down to lakeside and drowns.			
Fire (missing = 15)			
10a) Fire engulfs rental duplex. Two children and one parent die. Fire at 14:00, everyone napping at the time.	54.8	46.7	8.1
10b) … Children's mother left them with her father, who is wheelchair bound.			

CPS, Child Protection Services.

Table 5 Select comments by respondents that reflect diverse opinions of caregiver responsibility

Vignette	Comment (profession; years CDR experience)
1a (bathtub drowning)	"This is a relatively frequent type of scenario. Almost always, the time exceeds what the responsible adult thinks passed. 4 y/o cannot be expected to know what to do or supervise the younger child." (MD; 10 years) "Hard to believe that a 10-month-old could drown in that scenario." (Paediatrician; 9 years)
2b (motor vehicle accident)	"Unfortunate accident." (Public Health Nurse; 15 years) "Parent driving impaired. He is negligent!" (Juvenile Worker; 19 years)
3a (suffocation)	"This is a terrible accident, but it is doubtful that there is any carelessness or intent to harm the baby" (CPS Worker; <1 year) "Parents should have known risks." (Juvenile Worker; 12 years)
3b	"It's not illegal to drink in your home." (Law Enforcement; <1 year) "A parent who has consumed intoxicants while caring for an infant does begin to show a pattern of neglect." (Law Enforcement; 4 years)
4b (all terrain vehicle (ATV) crash)	"The reason for the age limit is to protect unskilled operators from injury, due to lack of skills, and it is the responsibility of the caregivers to enforce the safety warnings." (Law Enforcement; 5 years) "These ages are recommended. There is no legal age to ride an ATV on private property. Freak accidents happen. My son has been riding an ATV since he was 2½ years old." (Law Enforcement; <1 year)
5a (fire)	"Mom had extenuating circumstances and was unable to seek another caregiver for the children. This is a very harsh reality that many single parents face these days, and this does not appear to have been by choice." (Public Health; 2 years) "No job is worth losing your children. Children should never be left unsupervised overnight." (Other Child Advocate; 2 years)
6a (hyperthermia)	"I cannot comprehend how a father (or mother) could 'forget' their baby in a car. Even though it was out of their routine, the baby should have been important enough to remember. While there was no intent to harm the baby, I do believe the father was neglectful." (Law Enforcement; 16 years) "Tragic case of human error without malice or obvious disregard for child safety (neglect)." (Public Health; 10 years)
7b (suffocation)	'Post-partum depression is a serious illness and the mother needs psychiatric help, not jail time.' (Public Health; 2 years) 'No excuse.' (Law Enforcement; 2 years)
8b (poisoning)	"Inadequate adult supervision." (Public Health; 2 years) "Parents should have helped grandparents 'child proof' the home before they left. No intent on the part of the grandparents." (Law Enforcement; 3 years)
9a (drowning)	"A neighbourhood party or picnic is no excuse to neglect the supervision of a 3-year-old child. The amount of drinking or lack of drinking has nothing to do with ensuring parental supervision." (Juvenile Worker; 17 years) "Sounds like supervision was adequate. Would be nice to have the blood alcohol levels." (Nurse; 12 years)

CDR, the comments made by respondents represent the full range of opinions typically expressed during review and classification of caregiver responsibility and the role of neglect in unintentional child injury deaths, lending some degree of confidence in the results. The focus of the study on the role of neglect in unintentional injury deaths is another potential limitation, as the results do not provide information on classifying deaths related to other types of neglect (eg, medical, physical). Although examining other types of child neglect mortality is important, inadequate supervision is the most common type of neglect reported to CPS agencies[8] and a contributing factor to most injury deaths among young children.[4 9] To keep the survey completion time reasonable, only unintentional injury deaths were included.

In spite of these potential limitations, the results of this study document attributes that influence CDR team members and contribute to the challenge of reaching consensus when determining whether unintentional injury deaths are neglect related. Efforts to document child neglect might be viewed by some as piling on blame and punishment to a family who is already suffering with the loss of their child, and by others as an effort in futility. However, many risk factors for child neglect also increase child injury risk,[10] and understanding the circumstances and risk factors for child injuries are important antecedents to developing and implementing effective prevention strategies.[11] Therefore, the CDR process of discussing the circumstances of child injury deaths and identifying contributing factors has significant potential to facilitate development of prevention strategies that will effectively reduce all child injury deaths, regardless of whether neglect is ultimately identified as a contributing factor in the death.

Notably, most CDR programmes cite prevention of child deaths as a key programme function.[1–3] The findings of this study offer valuable insights into the challenge of incorporating injury prevention into CDR more effectively. Specifically, the persistent references to 'accident', 'tragic accident', and 'freak accident' in respondents' comments belies decades of effort on the part of public health professionals to facilitate injury prevention with the message that 'injuries are not accidents'. Clearly, there is still important work to do at a fundamental level in framing unintentional injuries as preventable. The findings also highlight the need for training CDR team members to enhance their ability to recommend and facilitate prevention efforts aimed at improving caregiver skills in protecting children

What is already known on this subject

- Identifying the potential contribution of abuse or neglect to a child's death is a component of child death review (CDR) in most US states. Determining if a death is neglect related is particularly challenging.
- A number of attributes are considered when determining child neglect, including poverty, intent, child age, and chronicity—whether similar risk to the child has been documented in the past.
- Different definitions of neglect, lack of standards for minimally adequate care and appropriate supervision, and changing social norms can lead to a lack of consensus among CDR team members.

What this study adds

- CDR team members assigned some but not full caregiver responsibility for half of the unintentional child injury death scenarios reviewed, indicating use of a continuum or scale might help characterise the role of neglect in child injury deaths.
- Team members often hesitate to call a death definitely neglect related without evidence of intent or 'a pattern of neglect'.
- Persistent references to 'tragic', 'freak', and 'horrible' accidents made by study respondents indicate there is still important work needed at a fundamental level to frame unintentional injuries as preventable.

from injury. Training should especially be focused in the areas of injury prevention related to improved supervision of young children, reducing substance use while caring for children, and the consistent and correct use of legally mandated safety devices. Moreover, guidance to teams on strategies for developing or adopting a continuum on which to classify whether a child's death was neglect related might reduce the challenge in reaching consensus. Use of such a continuum might also assist teams in determining appropriate agency responses, such as CPS and law enforcement. Given the depth of information on circumstances of child injury deaths, their systematic review of these deaths, their multidisciplinary nature, and their identification of prevention as a key programme function, CDR programmes are logical injury prevention partners. Working with CDR team members to ensure understanding of the tenets of injury prevention has the potential to further advance existing injury prevention efforts at the local, state and national levels and should be a public health priority.

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The burden of childhood injuries and evidence based strategies developed using the injury surveillance system in Pasto, Colombia

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ABSTRACT

Objective This article characterises the burden of childhood injuries and provides examples of evidence—based injury prevention strategies developed using a citywide injury surveillance system in Pasto, Colombia.

Methods Fatal (2003-2007) and non-fatal (2006-2007) childhood injury data were analysed by age, sex, cause, intent, place of occurrence, and disposition.

Results Boys accounted for 71.5% of fatal and 64.9% of non-fatal injuries. The overall fatality rate for all injuries was 170.8 per 100,000 and the non-fatal injury rate was 4,053 per 100,000. Unintentional injuries were the leading causes of fatal injuries for all age groups, except for those 15-19 years whose top four leading causes were violence-related. Among non-fatal injuries, falls was the leading mechanism in the group 0-14 years. Interpersonal violence with a sharp object was the most important cause for boys aged 15-19 years. Home was the most frequent place of occurrence for both fatal and non-fatal injuries for young children 0-4 years old. Home, school and public places became an important place for injuries for boys in the age group 5-15 years. The highest case-fatality rate was for self-inflicted injuries (8.9%).

Conclusions Although some interventions have been implemented in Pasto to reduce injuries, it is necessary to further explore risk factors to better focus prevention strategies and their evaluation. We discuss three evidence-based strategies developed to prevent firework-related injuries during festival, self-inflicted injuries, and road traffic-related injuries, designed and implemented based on the injury surveillance data.

INTRODUCTION

Road traffic related injuries, drowning, burns, falls and poisoning are the most common mechanisms of childhood injuries in the world.[1] According to the World Health Organization, nearly 9 million children under 18 years of age die each year due to an injury. Unfortunately, 95% of this burden exists in low and middle income countries.[2] One common problem in these countries is the lack of injury surveillance data to inform appropriate injury prevention interventions. In addition, there is little information about the causes and risk factors for childhood injuries, particularly in countries such as Colombia.

In Pasto, the capital of Nariño State in Colombia, a city with 383 846 inhabitants, in 2003 the local government established an injury surveillance system to supply data to inform prevention strategies. The results have provided local authorities information that has been used to devise injury control strategies in the city.

Political process and motivations that led to creation of the system—In 2002, the local government was interested in establishing an injury surveillance system and sent a delegation to visit other cities in Colombia where surveillance systems were in place to learn more about the methods used and system requirements. Following these visits, they began collaboration with experts from the CISALVA Institute[3] and the Georgetown University Colombia Program. These two institutions were involved in the development of Observatories in other municipalities in Colombia. Together they came up with the idea to establish an Observatory of Crime in Pasto, which could be used as a tool to strengthen the local government. In 2003, the Observatory was created officially through a decree of the municipal council. Subsequently, the institutions that could potentially provide data (forensic medicine, police, transportation office, district attorney) and the resources needed for the project were identified. The local government demonstrated its commitment to the programme by financing personnel costs. The Georgetown University Program contributed the first equipment and training costs. Since then, fatal injury data are collected through monthly meetings with staff from the different data source institutions, and the city has a standardised fatal injury dataset to inform and monitor prevention activities.

In 2005, with the contribution of CISALVA Institute, the Observatory expanded to include non-fatal injuries, child maltreatment, and domestic violence. Information from all 16 public and private emergency departments (ED) existing in Pasto city is combined into a single dataset.

The funding of the system—The Observatory is now financially supported by the mayor's office through the secretaries of health, government, and transportation. The funds cover personnel, equipment, office space, and materials. The total annual budget is approximately 80 million Colombian pesos (US$40000).

Reporting requirements of the system—The Observatory office collects and analyses the data on a regular basis and publishes a quarterly bulletin including mortality and morbidity data. Printed and electronic copies of these bulletins are sent to the mayor's office, other local authorities, stakeholders, participating institutions, and hospital personnel involved in the surveillance system.

These reports are analysed in the Epidemiological Surveillance Committee in the Health Secretary, and in the Security Council in the mayor's office.

The quality and stability of both the fatal and non-fatal datasets is maintained through several factors:

- There is a general coordinator of the observatory since it was established, who is an epidemiologist from the Municipality Health Office. This person is in charge of interpreting the results for decision making and maintaining the topic of injury prevention on the local government agenda.
- A nurse periodically visits the health institutions to provide training to new personnel and assure quality control of data. Information collected in the ED is sent to the Observatory where data are aggregated into one single dataset. After that, data are cleaned and prepared for analysis and production of periodical reports.

A psychologist leads a monthly meeting with participants from all data sources for the fatal surveillance system, which guarantees the quality of data and maintains the motivation of participants. Cases are compared and discussed in this meeting based on the information from each participating institution.

- A system engineer is in charge of dataset management and receives the data sent from health institutions, reviews the quality of data, and prepares the reports.

Although information about fatal and non-fatal injuries by age group is periodically reported by this system,[4] a detailed analysis of the characteristics, risk groups, and causes of childhood injuries has not been published. The first objective of this paper is to characterise the burden of fatal and non-fatal injuries for both violence related and unintentional injuries among children aged 0–19 years. The second objective is to provide examples of evidence based strategies designed and implemented by the mayor's office and other stakeholders to reduce the burden of injuries in Pasto.

METHODS

We included all recorded fatal injuries from 2003 to 2007, and non-fatal injuries from 2006 to 2007 among children aged 0–19 years residing in Pasto city. Variables included in the analysis were age, sex, cause of injury, intent, place of occurrence, and disposition of the injured person (ie, treated and discharged, hospitalised). Injuries were categorised by intent into violence related and unintentional injuries. We further classified the violence related fatal injuries into either homicides or suicides, and the violence related non-fatal injuries into interpersonal or self inflicted injury cases. Similarly, unintentional injuries were categorised into road traffic related and other unintentional injuries (ie, falls, burns, drowning, and poisoning). We used SAS (version 9.1)[5] to analyse the data.

The 2005 midyear population was used to compute the fatal injury rates; combined census population[6] (2006 and 2007) was used to calculate non-fatal injury rates. Rates were not calculated if the number of observations was below 20.[7] We included 2 years (2006 and 2007) of fatal and non-fatal injury data to calculate case fatality rates by dividing the number of fatal injuries by the number of fatal plus non-fatal injuries and multiplying by 100.

RESULTS

Burden of childhood injuries

Fatal and non-fatal Injuries by intent, sex and age group

During 2003 to 2007, there were 246 fatal injuries among children aged 0–19 years (table 1). Overall, 51.6% (127/246) were violence related deaths: 28.9% (71/246) homicides, and 22.7% (56/246) suicides. A total of 48.4% (119/246) were due to unintentional injury related deaths: 17.5% (43/246) road traffic related, and 30.9% (76/246) other unintentional injuries. Boys accounted for 71.5% (176/246) of all fatal injuries. Children aged 15–19 years contributed the highest proportion of violence related and unintentional injury deaths, 56.3% (99/176) among boys and 47.1% (33/70) among girls. The proportion of violence

Table 1 Numbers, percentages, and rates of fatal injuries among children aged 0–19 years by intent, sex, and age group in Pasto (2003–2007)

	Violence related deaths				Unintentional deaths					
	Homicide		Suicide		Road traffic-related		Other unintentional*		Total	
Total No.	71	(28.9%)	56	(22.7%)	43	(17.5%)	76	(30.9%)	246	(100%)
Sex and age group										
Male	No.	%	No.	%	No.	%	No.	%	No.	%
0–4	7	11.5	0	0.0	5	13.9	28	54.9	40	22.7
5–9	0	0.0	0	0.0	9	25.0	4	7.8	13	7.4
10–14	0	0.0	5	17.9	10	27.8	9	17.6	24	13.6
15–19	54	88.5	23	82.1	12	33.3	10	19.6	99	56.3
Male total	61	100.0	28	100.0	36	100.0	51	100.0	176	100.0
Female	No.	%	No.	%	No.	%	No.	%	No.	%
0–4	1	10.0	0	0.0	2	28.6	19	76.0	22	31.4
5–9	2	20.0	0	0.0	2	28.6	3	12.0	7	10.0
10–14	2	20.0	2	7.1	1	14.2	3	12.0	8	11.4
15–19	5	50.0	26	92.9	2	28.6	0	0.0	33	47.1
Female total	10	100.0	28	100.0	7	100.0	25	100.0	70	100.0

	Homicide	Suicide	Road traffic related	Other unintentional	Total
Overall rate†	49.3	39.9	29.9	52.8	170.8
Male rate	84.3	38.9	49.8	70.5	243.4
Female rate	–‡	39.0	–‡	34.9	97.6
Rate ratio§	6.0	1.0	5.1	2.0	2.5

*Other unintentional injuries include falls, burns, drowning, and poisoning, and exclude road traffic related injuries.
†Crude rate per 100 000 inhabitants.
‡The rate is not shown due to less than 20 observations.
§Male:female ratio = male rate/female rate.

related deaths was highest among boys and girls aged 15–19 years, 85% (108/127). Children aged 0–4 years accounted for the highest percentage, 45.3% (54/119), of unintentional injury deaths, with the majority of these, 87% (47/76), falling into the other unintentional injury category.

Death rates differed by sex, cause, and intent. Overall, the death rate for all injuries was 170.8 per 100 000, 243.4 for boys and 97.6 for girls. The highest death rate (52.8 per 100 000) was found for other unintentional injuries (eg, burns, drowning, poisoning, and falls), followed by homicide (49.3 per 100 000). Among boys, the highest rate was found for homicide (84.3 per 100 000 children), followed by other unintentional injuries (70.5 per 100 000). However, among girls, the highest rate was found for suicide (39.0 per 100 000), followed by other unintentional injuries (34.9 per 100 000). Overall, the male to female rate ratio for all injuries was 2.5. The male to female rate ratios were highest for homicides (6.0) and road traffic related injuries (5.1), and equal for suicide (1.0).

During 2006 and 2007, there were 12 015 non-fatal injuries among children aged 0–19 years (11 894 cases with information on sex, age group, and intent) (table 2). Overall, 75.8% (9012/11 894) of all non-fatal injuries were due to unintentional causes, 11.8% (1405/9012) were road traffic related, and 64% (7607/9012) were other unintentional injuries. Boys accounted for 64.9% (7728/11 894) of all non-fatal injuries. The pattern by age group was evenly distributed with about one quarter of the non-fatal injuries occurring among each of the four age groups. Boys aged 15–19 years represented 56.8% (1039/1828) of interpersonal violence (IPV) cases, and 87.8% (65/83) of self inflicted non-fatal injuries. A similar situation was observed for girls aged 15–19 years, with 34.8% (290/833) of interpersonal violence injuries, and 77.9% (102/138) of self inflicted injuries. Those aged 0–4 years had the highest proportion of unintentional injuries, 29.7% (2677/9012), with the highest percentage of these falling into the other unintentional category, 41.7% (1489/4893) for boys, and 35.2% (956/2714) for girls.

Non-fatal injury rates also differed by sex, cause, and intent. Overall, the non-fatal injury rate was 4053 per 100 000 (5244 for boys and 2853 for girls) (table 2). Among the four causes of injury, the highest rate was found for other (non-traffic-related) unintentional injuries (2583 per 100 000), followed by the rate for interpersonal violence (903.5 per 100 000). Among both boys and girls, the highest non-fatal injury rates were found for the other unintentional injury category (boys 3309 per 100 000; girls 1851 per 100 000), followed by interpersonal violence (boys 1236 per 100 000; girls 568 per 100 000). The highest non-fatal injury rates were found in the other unintentional injury category among boys (6068 per 100 000) and girls (2952 per 100 000) aged 0–4 years old. Boys 15–19 years had the second highest rate (2790 per 100 000), due to interpersonal violence related injuries.

Leading causes of fatal and non-fatal injuries by age group

The leading causes of fatal injury differed by age group (table 3). For children aged 0–4 years the leading cause was unintentional suffocation. For children aged 5–9 years and those aged 10–14 years the primary cause was road traffic, and homicide was the principal cause for those aged 15–19 years. The leading cause of non-fatal injury was falls for those younger than 15 years, and interpersonal violence for those aged 15–19 years. Drowning was in third place for children aged 0–4 (10%).

Case fatality rate by intent and sex

We used the case fatality rate as an indication of the lethality of the mechanism (or cause) of the injury. Overall, the case fatality rate (CFR) for children 0–19 years was 0.7 and was highest for self inflicted injuries (8.9) (table 4). The overall CFR was higher for boys (0.9) than girls (0.5). The CFR for self inflicted injuries was higher for boys compared to girls (CFR 12.6 vs 6.3).

Fatal and non-fatal childhood injuries by age group and place of occurrence

Figure 1 shows the distribution of fatal and non-fatal injuries by age group and place of occurrence. Among children aged 0–4 years, 78% of fatal injuries and 70% of non-fatal injuries took place at home. Among children aged 5–9 years and 10–14 years, fatal injuries happened most frequently in several locations (home, on the street, and field or playground); most of the non-fatal injuries occurred at home, public places, and at school. In contrast, for those aged 15–19 years, 40% of fatal injuries and 58% of non-fatal injuries occurred on the street or in a public place.

Disposition by intent

Hospital admission is an indirect measure of severity used here in the absence of information such as the injury

Table 2 Non-fatal injuries among children aged 0–19 years by intent, sex, age group, and disposition in Pasto (2006–2007)

	Violence related injuries						Unintentional injuries						Total[1]		
	Interpersonal violence			Self-Inflicted injuries			Road traffic related			Other unintentional*					
	No.	%	Rate†	No.	%	Rate†	No.	%	Rate†	No.	%	Rate†	No.	%	Rate†
Total	2661	22.3	903.5	221	2.0	75	1405	11.8	477	7607	63.9	2583	11894	100.0	4053
Age group[2] (in years) and sex[3]															
Male															
Total	1828	100	1236	83	100	56.1	924	100	625	4893	100	3309	7728	100.0	5244
0–4	395	21.1	1144	0	0.0	0.0	152	16.5	452	1489	41.7	6068	2036	26.4	6062
5–9	179	9.8	471	0	0.0	0.0	209	22.6	549	1363	27.9	3583	1751	22.7	4608
10–14	215	11.8	552	9	12.2	NR	208	22.5	534	1086	22.2	2787	1518	19.7	3896
15–19	1039	56.8	2790	65	87.8	175	355	38.4	953	955	19.5	2565	2414	31.3	6483
Female															
Total	833	100	568	138	100	94.1	481	100	328	2714	100	1851	4166	100.0	2853
0–4	239	28.7	738	0	0.0	0.0	80	16.6	247	956	35.2	2952	1275	30.6	3952
5–9	154	18.5	416	0	0.0	0.0	134	27.9	362	781	28.8	2107	1069	25.7	2890
10–14	150	18.0	394	29	22.1	76.2	116	31.4	397	515	19.0	1354	810	19.4	2129
15–19	290	34.8	741	102	77.9	260.5	151	31.4	386	462	17.0	1180	1005	24.1	2566

1=121 missing cases, 2=137 missing cases, 3=121 missing cases.
*Other unintentional injuries include falls, burns, drowning, and poisoning, and exclude road traffic-related injuries.
†Crude rate per 100.000.

Table 3 Five leading causes and mechanisms of fatal (2003–2007), and non-fatal injuries (2006–2007) among children aged 0–19 years by age group in Pasto

	Age Group in Years							
	0 to 4		5 to 9		10 to 14		15 to 19	
Rank	Fatal	Nonfatal	Fatal	Nonfatal	Fatal	Nonfatal	Fatal	Nonfatal
	n = 62	n = 3,194	n = 20	n = 2,749	n = 32	n = 2,249	n = 132	n = 3,322
1	UI Suffocation 48%	UI Falls 47%	UI RT Injuries 55%	UI Falls 46%	UI RT Injuries 34%	UI Falls 35%	Hom Sharp object 23%	IPV Sharp object 18%
2	UI RT Injuries 11%	UI Blunt object 15%	UI Falls 15%	UI Blunt object 19%	19%	UI Blunt object 21%	Sui Poisoning 22%	UI Falls 16%
3	UI Drowning 10%	IPV Unknown mec. 12%	Other UI 15%	UI RT Injuries 12%	Other UI 16%	UI RT Injuries 14%	Hom Firearm 20%	UI RT Injuries 15%
4	Other UI 10%	UI RT Injuries 7%	Hom Other Mec. 10%	IPV Unknown Mec. 7%	UI Falls 13%	UI Sharp object 6%	Sui Hanging 11%	UI Blunt object 14%
5	Hom Other Mec. 6%	UI Burns 4%	UI Suffocation 5%	UI Sharp object 5%	UI Suffocation 6%	IPV Unknown Mec. 5%	UI RT Injuries 11%	IPV Blunt ob.ec 11%

Missing data for non-fatal injuries = 531

Fatal injuries
UI: Unintentional Injuries
RT: Road Traffic Injuries
Other UI: Other Unintentional Injuries
Hom: Homicide
Sui: Suicide

Non-fatal injuries
UI: Unintentional Injuries
RT: Road Traffic Injuries
Other UI: Other Unintentional Injuries
IPV: Interpersonal Violence
SIV: Self-inflicted Violence

severity score (ISS). Analysis of disposition data showed that of all non-fatal injuries, 76.4% cases were treated and released and 11.5% were admitted to a hospital. The proportion of non-fatal injuries requiring hospital admission differed by type of injury. Of all self inflicted injuries, 45% required hospital admission, followed by 22.1% of road traffic related injuries.

Interventions to address the leading causes of injury

In Pasto, the mayor's office and other stakeholders have used the surveillance data to design and implement injury prevention interventions. We discuss three evidence based strategies developed to address: (1) firework related injuries during the festival season; (2) self inflicted injuries, and (3) road traffic related injuries.

Interventions to address firework related non-fatal injuries

In Pasto city, there is a traditional festival in the first days of the year, which includes firework activities. In December 2004/5, a pilot test of the injury surveillance system collected data for firework injuries attended in EDs during the festival season. This information was used as a baseline for this strategy. The mayor's office, in collaboration with fire departments, hospitals, and other stakeholders, designed strategies to reduce burn related injuries during the festival season in December 2005 and January 2006, and in the following year. The strategies included media campaigns, fireworks ban, neighbourhood fireworks, community sentencing for parents, and promotion of alternative products. A public awareness campaign was planned to communicate the dangers of fireworks, especially related to burn

Table 4 Case fatality rate by intent and sex in Pasto (fatal and non-fatal injury data for 2006 and 2007)

	Male			Female			Total		
	Fatal	Non- fatal + fatal	CFR	Fatal	Non- fatal + fatal	CFR	Fatal	Non- fatal + fatal	CFR
Road traffic related	10	944	1.1	2	485	0.4	12	1429	0.8
Other unintentional	22	4937	0.4	6	2726	0.2	28	7663	0.4
Self inflicted	14	111	12.6	10	158	6.3	24	269	8.9
Interpersonal violence	22	1872	1.2	5	843	0.6	27	2715	1.0
Total No.	68*	7864	0.9	23*	4212	0.5	91*	12076	0.8

Missing data for non-fatal injuries=30.
*Fatal cases from only 2 years (2006 and 2007).
CFR= (case fatality rate = number of fatal injuries/number of non-fatal + fatal injuries) ×100.

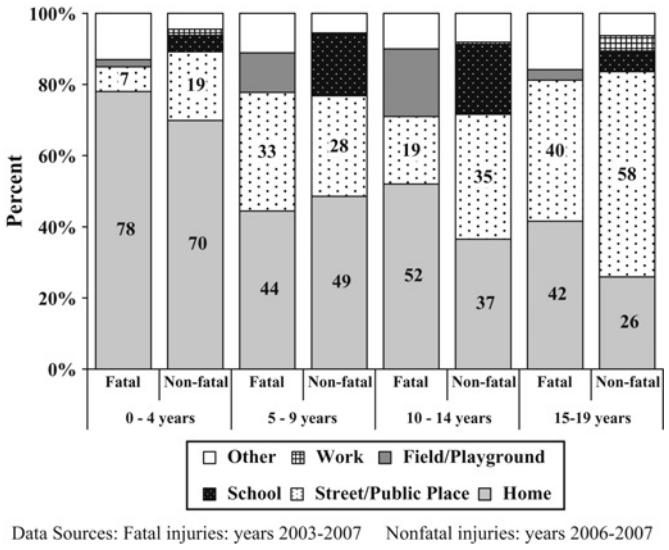

Figure 1 Fatal and non-fatal injuries among children 0–19 years by age group and place of occurrence.

injuries among children. Another part of the plan was to ban the manufacturing and sale of fireworks. The municipality created authorised areas for community fireworks in neighbourhoods with assigned emergency staff (police, medical staff, and fire department) to attend burn cases immediately. A mandatory community service sentencing law was established for parents whose child sustained a firework related burn injury. The intention of this law was to improve child supervision during the festival season. At the same time, public authorities promoted activities to substitute the local production of fireworks to other products like handicrafts and items to be used at the carnival. Figure 2 shows firework related injuries for the months of December and January, for the period 2004 to 2006. Although a formal evaluation has not been done, data have shown a reduction of 80% of burn cases with the largest decrease among children aged 5–14 years.[8]

Interventions to address non-fatal self inflicted injuries

The surveillance data indicated self inflicted injuries were a public health problem in the city, especially for youth aged 10–19 years (table 2). Data from 2005 were used to identify and target higher risk communities. In 2006, the local government formed an expert group to study and design prevention programmes for self inflicted injuries. The analysis of data from the surveillance system was used to identify high risk neighbourhoods and to develop, target and monitor cultural, sports and educational programmes. Two communities were identified as high risk. Health personnel were trained to follow a special protocol for patients who attempted suicide and to provide psychological support to their families. Preliminary results from 2006 to 2007 showed a 41% reduction in the number of suicide attempts among youth aged 10–19 years[9]

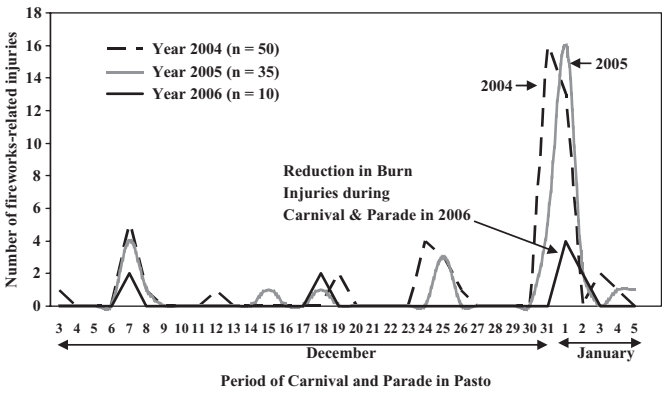

Figure 2 Number of firework related burn injuries during the period of carnival and parades in Pasto, 2004–2006.

Interventions to address road traffic injuries

In 2006, the Transportation Office in Pasto used road traffic injury data to design intervention strategies to reduce road crashes. Two main strategies were: (1) checkpoints for drunk drivers in risky areas of the city, based on the findings of alcohol consumption in a high percentage of injured patients—an analysis of alcohol and injury visits showed that 20% of them had consumed alcohol[10]; and (2) road safety education for pre-school, elementary and high school students, based on the fact that road traffic injuries are among the five leading causes of injuries and deaths among children in Pasto. Analysis of initial data shows traffic related fatal injuries has been reduced by 37% from 18.4 per 100 000 population in 2004 to 11.6 per 100 000 population in 2007.[9]

DISCUSSION

This study was possible because the mayor's office in Pasto supported and implemented the injury surveillance system in the city. The successful creation of one standardised injury data system gathering information from multiple sources (eg, police, hospital) is uncommon in many parts of the world. In many low and middle income countries, this type of system and the research it facilitates are still not possible due to a lack of infrastructure and the necessary resources for injury surveillance activities.

The findings of this study revealed two important target groups for injury prevention efforts among children in Pasto: children aged 0–4 years were most affected by unintentional injuries (suffocation and falls); and children aged 15–19 years were most affected by interpersonal violence and self directed violence, including homicides and suicide. These two groups have been found to be at high risk for injury in many countries.[1 11]

Among children aged 0–4 years most of the fatal suffocation injuries happened at home. A detailed risk analysis of suffocation related child deaths is needed to understand common risk factors and to design interventions to reduce these preventable deaths. Parenting programmes aimed at improving parenting skills and strengthening child supervision have the potential to prevent such injuries.[12] Among those aged 0–4 years, falls are a common cause of non-fatal injury, occurring primarily at home. School and public places pose a great threat for non-fatal injuries in children aged 5–9 and 10–14 years old. Efforts aimed at removing hazards in the home and making schools and parks safer (eg, with respect to equipment and surfaces) could also prevent many of these early childhood injuries.[12] Drowning is the most common cause of deaths among children under the age of 18 years in South and East Asia[13]; however, this has not been shown in Latin American countries. We found 10% of deaths among children aged 0–4 years due to drowning. In addition, there was 10% and 15%, respectively, of other unintentional fatal injuries in these groups (0–4 and 5–9), that need further study to define what type of mechanisms are included in this category.

The second target group for prevention is those aged 15–19 years old, particularly boys affected by interpersonal violence. Fatal and non-fatal assaults involving youth contribute

greatly to the global burden of premature death, injury, and disability.[14] The proportion of homicide among those aged 0–19 years (83%) in Pasto is high relative to other countries[15–17] However, two other cities in Colombia have even higher proportions of homicide deaths among this same age group (Cali 92%, Cartagena 96%).[18 19] Understanding the risk factors for becoming victims or perpetrators of violence in Pasto is essential for developing effective policies and programmes to prevent violence.

The CFR indicated that for every 100 non-fatal self inflicted injuries, there are nine deaths, which is more than 10 times higher than the average CFR for all injury causes (0.7). Poisoning was a common method for non-fatal attempts for a self inflicted injury, which has been reported in other places,[20 21] while hanging was a common method among those who died from a self inflicted injury. Adolescence is a difficult transition period in the lives of many young people, and there are many factors that can trigger a suicide attempt (eg, ending of a relationship, difficulties experienced in school or with peers or finding employment, experiencing a traumatic event).[22] Although some interventions have been implemented in Pasto to prevent these types of injuries, it is necessary to further explore risk factors to better focus prevention strategies and their evaluation. In addition, it is important to know the type of poisoning substance used in the attempt to assess whether it is possible to limit its distribution or access to minors.

Road traffic injuries were one of the leading causes of fatal injuries across all age groups, especially for children aged 5–14 years. The strategies, such as checkpoints and education, currently applied to prevent this type of injury in Pasto have been found effective; this indicates these interventions must be maintained. However, road traffic injuries remain high in Pasto. In order to get an injury reduction, the local government needs to adopt, promote, and increase the use of other preventive measures such as child safety seats and seat belts.[23] Attention should also be given to reducing drinking and driving, as well as other risk taking behaviours among teenagers such as non-use of seat belts, or helmets for motorcyclists and cyclists.

This study has some limitations to consider when interpreting the results. The years analysed for fatal and non-fatal injuries were different, making a direct comparison of fatal to non-fatal injuries difficult. The information on International Classification of Diseases (ICD) codes was also incomplete for non-fatal injuries which limited the data available on cause of injury, and 12% of non-fatal IPV cases among youth 0–4 years, and 7% of non-fatal IPV cases among 5–9 years, had unknown mechanisms. The number of cases caused by an unknown mechanism are an indication of the necessity to improve the process in the ED at the hospitals. Also indicated is a need for periodic training of the personnel in charge of data collection, especially new personnel.

Although information from the injury surveillance system did not collect detailed information about the circumstances surrounding the injury incident, the data have provided valuable information to design several successful prevention strategies in Pasto.

However, a formal evaluation should be carried out to confirm these results. The participation of the research centres of the local universities could contribute to the design and implementation of a formal evaluation of the interventions implemented in Pasto.

This city-wide injury surveillance system is an example of what can be accomplished when strong political will and cooperation from all sectors of the community combine to produce reliable and useful data that can then guide the development of evidence based strategies specific to local needs. Such efforts would be useful in other low and middle income countries to help reduce the heavy burden injury imposes on their communities. This method has demonstrated that if the will of the local authorities is present, even small infrastructure with limited personnel can effectively prevent injuries using data collected in an injury surveillance system. One of the first steps in establishing a similar system should be the involvement of the decision makers and local authorities, who must be willing to use the data to orient their decisions.

What is already known on this subject

- Road traffic related injuries, drowning, burns, falls, and poisoning are the most common mechanisms of childhood injuries in the world.
- Ninety-five per cent of the burden generated by injuries occur in low and middle income countries.
- One common problem in these countries is the lack of injury surveillance data to inform appropriate injury prevention interventions.

What this study adds

- We describe the citywide injury surveillance system developed as a result of strong political will and cooperation from all sectors of the community. This surveillance system produced reliable and useful data that were used to guide the development of evidence based strategies specific to local needs. Such efforts would be useful in other low and middle income countries to help reduce the heavy burden injury imposes on their communities.
- Findings indicate two important target groups for injury prevention efforts among children in Pasto: children aged 0–4 years were most affected by unintentional injuries (suffocation and falls); and children aged 15–19 years were most affected by interpersonal violence and self directed violence, including homicide and suicide.
- We confirm that poisoning was a common method for non-fatal attempts for a self inflicted injury, while hanging was a common method among those who died from a self inflicted injury.

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Developing effective child death review: a study of 'early starter' child death overview panels in England

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Developing effective child death review: a study of 'early starter' child death overview panels in England

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ABSTRACT

Aim This qualitative study of a small number of child death overview panels aimed to observe and describe their experience in implementing new child death review processes, and making prevention recommendations.

Methods Nine sites reflecting a geographic and demographic spread were selected from Local Safeguarding Children Boards across England. Data were collected through a combination of questionnaires, interviews, structured observations, and evaluation of documents. Data were subjected to qualitative analysis.

Results Data analysis revealed a number of themes within two overarching domains: the systems and structures in place to support the process; and the process and function of the panels. The data emphasised the importance of child death review being a multidisciplinary process involving senior professionals; that the process was resource and time intensive; that effective review requires both quantitative and qualitative information, and is best achieved through a structured analytic framework; and that the focus should be on learning lessons, not on trying to apportion blame. In 17 of the 24 cases discussed by the panels, issues were raised that may have indicated preventable factors. A number of examples of recommendations relating to injury prevention were observed including public awareness campaigns, community safety initiatives, training of professionals, development of protocols, and lobbying of politicians.

Conclusions The results of this study have helped to inform the subsequent establishment of child death overview panels across England. To operate effectively, panels need a clear remit and purpose, robust structures and processes, and committed personnel. A multi-agency approach contributes to a broader understanding of and response to children's deaths.

BACKGROUND

In April 2008 new procedures for reviewing child deaths were instituted across England. Under the Children Act (2004) and subsequent national guidance, each local authority was required to establish a child death overview panel (CDOP) to review all deaths of children from birth to 18 years normally resident in their area.[1 2] These panels were intended to improve the identification of deaths related to child maltreatment, to identify wider matters of concern affecting the safety and welfare of children in their area, and to identify any wider public health or safety concerns arising from a particular death or a pattern of deaths in that area.[1] As such, they had a clear public health remit related to preventing future child deaths, including deaths from injury. Although there was some evidence that child death reviews can be effective in providing contemporary information on patterns of child death and promote action to prevent child deaths,[3–7] before this there was limited experience in the UK of carrying out such reviews. In order to support the development of child death review systems in England, we carried out a qualitative study of a small number of 'early starter' CDOPs.[8]

METHODS

The overall aim of the study was to observe and describe the experience of authorities in implementing child death review processes, in order to inform the wider introduction of these processes. Within this overall aim, the study team sought to evaluate four basic components of the child death review processes:

A. Establishing systems—experience in establishing the mandate, protocols, membership and leadership, and operational practices of the CDOP
B. Data collection—an evaluation of systems for notification and data collection
C. Data analysis—comparison of different tools used for analysing the data collected, and approaches to identifying trends, patterns and issues
D. Outputs of the child death review processes—how authorities planned to use the information to inform children's services planning and interagency working to safeguard and promote the welfare of children.

The research team consisted of experienced academics and practitioners representing health, social care and policing, and was supported by a wider project advisory group from a range of backgrounds in policy, practice, and academia. The core research team was involved in all aspects of the study, including visiting and observing the panels and analysing the data.

Nine study sites were selected from all Local Safeguarding Children Boards (LSCBs) in England who responded to an initial questionnaire, in order to reflect a diversity of geography, population, ethnic composition, and levels of deprivation. The study sites were then visited by a member of the research team to explain the project needs and requirements and to hold initial discussions around the progress made so far. Data for the study were collected through a combination of audit questionnaires, interviews with key informants, and structured observations of meetings, along with an evaluation of submitted protocols and documents.

An audit tool was developed to capture preliminary information about the existing status of the CDOPs in the study and included information on: population; geography; age range and types of

deaths; current processes in place for mortality review and responding to unexpected child deaths; the individuals and agencies involved in developing the CDOP; and any factors that had proved instrumental, along with possible barriers and constraints, to development of the CDOP. Each CDOP was visited by two members of the research team who carried out non-participant observation of the panel meeting using a structured proforma. The focus of the observation was on the structure and process of the meeting, rather than on details of the cases discussed. This technique was supplemented by in-depth qualitative interviews with the chair of each CDOP. The interview schedule was designed to clarify the processes and structures involved in developing and running the CDOP, along with the background knowledge and skills necessary for chairing the panel.

A combination of different tools was used to analyse the data. The audit tool, interview transcripts and observation notes were subjected to predominantly qualitative analysis using N-Vivo. The analysis divided into two broad domains: team development, systems and structures; and the process and function of the child death review. Initial scrutiny of the interview transcripts and field notes enabled the research team to develop a coding framework reflecting the key themes identified within each of the two domains. Following coding of the data, different team members analysed the interview data, identifying consistent themes, outriders, and examples of good practice. The outcomes of this further analysis were then discussed by the research team and the wider project steering group allowing the perspectives of different professionals, policy members, and other stakeholders to inform the interpretation of the results. Field notes from the structured observations, along with any protocols, minutes, agendas, and reports supplied by the sites, were reviewed by the research team and compared with the interview data in a process of triangulation. The collated results were distributed to the sites, enabling them to contribute to the interpretation of the results and to question or clarify any issues arising from the analysis.

The project was discussed with the local medical research ethics committee (comparable to an institutional review board), and it was agreed that as an evaluation of those LSCBs which were at the beginning stages of implementing the child death review processes, it fell within the bounds of audit rather than research. Nevertheless, the research team recognised that there were significant issues around confidentiality, with the overview panels themselves and the research team being privy to confidential and identifiable sensitive information. The research team followed strict ethical guidelines agreed in advance with the project steering group and with each site. No identifiable details (names, addresses or specific dates) were recorded in relation to any of the cases discussed. Agreement to the presence of observers at the meetings attended was sought from all members of the panel and all were given the opportunity to ask the observers to leave if particularly sensitive material was being discussed. Participation in the interviews was carried out with fully informed consent of the interviewees. The interview schedules did not require any identifiable client or professional information to be collected. After the field notes and interviews had been transcribed, all transcripts were reviewed by the researcher and project manager to ensure no identifiable data were included.

RESULTS

The initial questionnaire was distributed to the chairs of all 144 LSCBs operating in England. Sixty responded (42%), of which 24 indicated a willingness to participate. From these 24 LSCBs, nine sites were selected for the study. Two of these did not manage to establish a CDOP within the timescale of the project. These two sites were nevertheless included in the study to facilitate an understanding of the processes involved in establishing such panels. All nine sites completed the preliminary audit tool (table 1).

The audit returns described the demography of the sites, with populations ranging from less than 120 000 to nearly 1 000 000; a spread of ethnic groups, with between 1% and 30% of the total population belonging to black and minority ethnic groups; and a mix of metropolitan, urban, and rural areas. Where data were provided based on estimates or known childhood deaths, they did not completely match the Office for National Statistics (ONS) data. Discrepancies arose particularly in relation to deaths in the <28 days and 15–19 years age groups.

Interviews were held with the chairs of all nine research sites. A total of nine panel meetings at eight sites were attended by members of the research team. The results from the three main methods of data collection (interviews with chairs, structured observations of panel meetings, and analysis of provided documents) have been combined in a process of triangulation and fall within a number of themes within two overarching domains:

Table 1 Study sites—data from audit and national statistics

Study site	Population (2001 census)	Ethnicity (% black and minority ethnic)	Deprivation indices rank (2001 census)*	Urban/rural mix†	Child deaths known to team in previous year	ONS mortality data from previous year‡
1	977087	29.65%	15/354	Metropolitan	92	370
2	380615	8.17%	67/354	Metropolitan	50	83
3	492324	2.30%	243/354	2/3 urban; 1/3 rural	27	85
4	118208	1.11%	21/354	Urban	5	34
5	206814	41.23%	232/354	Metropolitan	27	Not known
6	617168	10.1%	332/354	Urban/rural	68	111
7	216103	7.29%	12/354	Metropolitan	23	48
8	253800	36.98%	17/354	Metropolitan	Not known	76
9	315172	2.26%	54/354	Metropolitan/urban	34	77

*The deprivation index used in the 2001 census is a composite index using weighted factors in a number of domains including income, employment, education and health. 354 local authority areas were ranked from 1= most deprived to 354 = least deprived. Further information is available at: http://www.neighbourhood.statistics.gov.uk/dissemination/Info.do?page=aboutneighbourhood/indicesofdeprivation/indices-of-deprivation.htm

†For the purposes of the 2001 census, urban areas were defined as those with populations of 20 000 people or greater, while metropolitan districts referred to six heavily populated centres including London.

‡The Office for National Statistics (ONS) data are collated data of returns on death certification from the registrars of births, deaths and marriage.

the systems and structures in place to support the child death overview process; and the actual process and function of the panels.

Nine core themes emerged from the data in relation to systems and structures (appendix 1):

- Developing the CDOP—there was a widespread enthusiasm for the process, recognising that this work was challenging but worthwhile; successful implementation depended on the engagement of motivated individuals and good working relationships; lack of understanding or commitment could hinder implementation.
- Purpose—panels recognised the importance of clear purposes and were working to those set out in government guidance; the key purpose was to learn lessons.
- Structure—there were variations in relation to local geography; a degree of flexibility is important.
- Membership—All teams had developed models of core membership with additional co-opted or ad hoc members; optimal team size was between four and 11 members, with public health, coroner's officers, children's social care, police and paediatricians most commonly represented; representatives needed sufficient seniority and experience.
- Team functioning—an atmosphere of trust was considered particularly important given the sensitive nature of this work; multi-agency working can, however, be challenging; chairs could come from a range of backgrounds and needed generic chairing skills but also needed support from members with specific expertise.
- Protocols and procedures—protocols were considered important but had not been fully developed.
- Relationship with other processes—the overlap with other processes, including more in-depth Serious Case Reviews, was an important area, but had not been fully clarified by any of the teams.
- Resources—panels require sufficient resource to function effectively; this includes funding of key administrative staff and processes, professionals' time, and training costs.
- Audit and governance—systems of audit and governance were important but had not been developed.

Six themes emerged in relation to process and function (appendix 2):

- Criteria for review—panels recognised their responsibility to review all deaths, but most felt that not all deaths could be reviewed to the same depth.
- Data processing—panels relied on multiple sources of notification; the most helpful approaches to data collection combined a limited data set of categorical information supplemented by narrative information; data collection and review is time consuming.
- Liaison and information sharing—different approaches to information sharing, confidentiality, and data protection were observed; some panels anonymised information before the review; no panels had yet involved parents in the review process.
- Team meetings—frequency of meetings varied from monthly to every 3 months; 3–5 cases appeared an optimum number to discuss in a 2–3 h meeting; panel meetings worked best when members were provided with collated information before the meeting, rather than relying on original case records.
- Analysis—at this stage few panels had developed any formal frameworks or systems for analysis.
- Outcomes—the main emphasis was on learning broad lessons from all deaths rather than individual case issues; panels anticipated producing an annual report.

Our observations and the interview data emphasised the importance of child death review being a multidisciplinary process involving professionals of sufficient seniority to be able to analyse and make sense of the information being presented; that the process was resource intensive with time needed not only for the panel meetings, but also for preparation by all panel members; that effective analysis requires both quantitative and qualitative (narrative) information, and is best achieved through a structured analytic framework; and that the focus should be on learning lessons from the deaths, not on trying to apportion blame.

At the nine panel meetings attended by members of the research team, a total of 24 cases were discussed in detail, with between two and seven cases discussed in each. The ages of the children discussed ranged from 2 days to 19 years, with 10 aged <1 year, five between 1–6 years, and nine teenagers (15–19 years). Five of the cases were deaths related to prematurity or congenital abnormalities; seven others involved children dying of other natural causes (two of whom were severely disabled children), five deaths were from external causes (including one road traffic death, two drownings, and two deaths from choking), three were unexplained infant deaths, and a further four cases were near misses from deliberate self harm or assault (table 2).

In 17 of the 24 cases issues were raised that may have indicated preventable factors in the child or young person themselves; the parents or carers; the environment; or service provision. Even though the panels were at an early stage of development, a number of examples of recommendations and action relating to injury prevention were observed (table 3).

DISCUSSION

At the time this study was undertaken, child death review was in its infancy in the UK. Although there were well established hospital mortality review processes, and in-depth enquiries into maltreatment related deaths (Serious Case Reviews), the concept of a broader multi-agency approach to reviewing all childhood deaths had not been established. Drawing on lessons from child death review in the USA and elsewhere, the Department for Children, Schools and Families mandated the establishment of multi-agency CDOPs in each local authority area in England. This was backed up with new government funding of £52 million (€62 million, US$80 million) over 3 years through both health and local authorities, and with the development of national guidance[1] and training materials[9] to support their introduction. Through this study we were able to observe the experience of a small number of 'early starter' CDOPs and to use their experience to help guide and support the further development of these processes across England. The introduction of these processes across England was further supported through a series of regional seminars at which the results of this study were presented, allowing other panels to learn from the experience of the early starters.

Our study highlighted a number of issues involved in establishing these panels. In all of the panels observed, a lot of effort had gone into developing the structures and processes even before any deaths could be reviewed, sometimes taking many months of negotiation and planning. In some instances the panels were still focused on development issues and this introduced delays into the review of deaths. It was clear that reviews could not be effectively carried out without clear structures and processes for gathering and using data and for the subsequent steps of making effective recommendations. With that in mind, we feel it is worth investing time and resources into the initial

Table 2 Cases reviewed in the observed panel meetings

	Child's age	Cause of death/incident as determined by the panel	Issues identified
Deaths			
1	2 days	Extreme prematurity, twin	No issues identified
2	2 days	Extreme prematurity, twin	No issues identified
3	2 weeks	Congenital heart defect	No issues identified
4	25 days	Multiple congenital abnormalities; twin	Issues around support / monitoring of twin
5	1 month	Tracheo-oesophageal fistula	No issues identified
6	2 months	Sudden unexpected death in infancy (SUDI)	Initial concerns re welfare of siblings
7	2 months	Meningitis	Issues around speed of medical response; discussed with hospital staff
8	6 months	Choking	Possibility of neglect raised but discounted.
9	8 months	Unclear; premature	Issues around domestic violence
10	9 months	SUDI	Paternal alcohol use and co-sleeping
11	15 months	Choking	No issues identified
12	2 years	Cancer: expected death	No issues identified
13	2 years	Multi-organ failure secondary to epilepsy	Missed appointments
14	3 years	Drowning abroad	Issues around safety of children in swimming pools abroad
15	6 years	Drowning abroad	Issues around safety of children in swimming pools abroad
16	15 years	Sudden collapse: presumed cardiac arrhythmia	Coroner not holding an inquest; issues around school safety and response of services
17	16 years	Pneumonia and multiple organ failure; severe disabilities; expected death	No issues identified
18	17 years	Road traffic accident	Alcohol and drug use
19	17 years	Gastroenteritis	Possible issues around primary care provision
20	19 years	Died during cardiac catheterisation; severely disabled young person	Outside standard age range, but considerable involvement of children's health and social care services
Near miss incidents			
21	13 years	Near miss: deliberate self harm	Connection with case 22
22	15 years	Near miss: deliberate self harm (DSH)	Child behaviour issues; provision of secure places; management of severe DSH; awareness raising
23	15 years	Near miss: deliberate self harm	Connection with case 22
24	17 years	Near miss: serious assault	Criminal investigation ongoing

development of the panel, and that this should be separated out from the panel working itself. The individuals involved in the study emphasised the importance of having local champions to drive the process forward, so that it is seen as something worthwhile for improving children's safety and well-being, rather than a bureaucratic exercise; of engaging a wide range of stakeholders in scoping and setting up the panels; and for good induction and training of the panel members. Overwhelmingly panel members conveyed a sense that they considered this process to be worthwhile and to carry enormous potential for improving children's lives.

The panels studied were at an early stage of development of their processes and recognised that they were unlikely to have full notification of deaths in their area. This was highlighted by the discrepancies between the ONS death registration data and the panel notification data (table 1). In particular, many panels were not being notified of perinatal deaths or of later adolescent deaths. The introduction of statutory guidelines with a duty to report should improve this coverage. At the time of the study, the major focus was on establishing membership and remits of the panels, and systems for gathering and storing the data. Although the focus was on learning lessons and taking action to prevent future child deaths, there was very little awareness of different methods for analysis of data and formulation of recommendations. Some preliminary ideas emerged from some of the panels, but this is an area that requires further research, development, and training. As this was an observational study focused on understanding the experience and process of child death review, we were unable to follow-up on any recommendations coming from the panels. As child death review processes become more established there is an urgent need for robust evaluations of the outcomes and effectiveness of these processes, with clearly defined outcome measures and standards.

Table 3 Outcomes from case reviews related to injury prevention

Case	Recommendations and action
Two drowning deaths abroad	Production of a safety leaflet for families travelling with children
3 'near miss' cases of deliberate self harm	A collaborative project between mental health and education services to raise awareness in schools, train and support teachers in prevention, and develop a joint agency protocol for responding to deliberate self harm
Death of a child from carbon monoxide poisoning	Review of local policies on servicing of gas appliances in social housing
Death of a disabled child in a special school following a choking episode	Training of teachers in safe feeding practices

In spite of these limitations, we were able to observe a number of significant actions coming from the cases reviewed, including public awareness campaigns, community safety initiatives, training of professionals, development of protocols, and lobbying of politicians. The examples seen emphasised the potential for these panels to be significant drivers for safeguarding children's welfare. The engagement of public health and professionals from other agencies involved in injury prevention was seen as crucial to the success of these panels, although the degree of engagement varied between the sites studied. At the time of the study, most arrangements seemed to be ad hoc, although there appeared to be a commitment to collaborative working to identify and respond to risks to children's safety and welfare. The involvement of parents in review processes was considered important by many participants, but

Box 1 Recommendations for developing child death overview panels (CDOPs)

1. New child death overview panels should be established in accordance with any national guidance, taking account of the local situation and in consultation with neighbouring areas.
2. Each panel should define their terms of reference, to include the purposes and functions of the panel, membership, chairing and administration, relationships with other processes, information sharing, outputs and lines of accountability.
3. The CDOP should have a core membership, with representatives of the local key agencies, including public health, paediatrics, social care, and police as a minimum. The core membership may be supplemented by co-opted members from other disciplines.
4. Panels should consider how they can appropriately include lay representatives.
5. Panels should establish mechanisms for appropriately informing and involving parents and other family members in the child death review process.
6. Each panel should appoint an administrative team to support its working.
7. CDOPs should meet on a regular basis to review all deaths of children normally resident in their area.
8. Each panel should establish operational procedures for the smooth running of the child death review processes and should monitor their implementation and output. This will include procedures for notification, information gathering, collation and analysis of the information gained, overviews of all deaths, and outcomes.
9. Each panel should establish systems for safe storage and use of data gathered for the child death overview processes.
10. Each panel should ensure that training is provided for all members, including co-opted members.
11. Each panel should monitor the function and outcomes of its CDOP and any related processes and should have clear accountability to an overseeing organisation or agency.

none had developed effective systems for doing so. Most participants did not anticipate inviting bereaved parents to panel meetings, but felt that there should be a system allowing them to contribute information or questions and to receive feedback from the panel.

There was recognition among the study sites of the need for different levels of review. England already has well established systems for Serious Case Reviews into deaths from abuse or neglect. Such deaths require a more in-depth review of inter-agency working and child protection procedures which can sit alongside a broader review of the wider circumstances and patterns of all child deaths.

This study was a small, predominantly qualitative study of early starter sites in England. Only 24 of the 144 LSCBs in England responded indicating a willingness to participate. The early starter sites selected may represent those that were particularly motivated to introduce child death review, and this may not be replicated where the processes are imposed on a local team. The processes being developed have to be interpreted in the social and political context, and the advances seen since then could not have been achieved without the investment of time, resources, and training. While many of the specific approaches may not translate to other situations, the general principles to emerge from the qualitative analysis could apply to any emergent systems for child death review. Within the scope of this study, we were not able to observe or comment on any outcomes from child death review. Ultimately the effectiveness of child death review processes must be judged by their impact on outcomes for children, but this will require more detailed and long term studies.

The findings of our observational study enabled us to make a number of recommendations to assist LSCBs in establishing new CDOPs (box 1).

What is already known on this subject

- Child death review has been operating in parts of the USA since the 1970s and 1980s.
- There is some evidence that child death reviews can be effective in providing contemporary information on patterns of child death and promote action to prevent child deaths.
- To date there has been only limited experience of child death review in the UK.

What this study adds

- Observations of 'early starter' panels have helped inform the introduction of child death review processes across England.
- To operate effectively, these panels need a clear remit and purpose, robust structures and processes, and committed personnel.
- The multi-agency nature of the panels supports a broader approach to understanding and responding to children's deaths than one located within health alone.

CONCLUSIONS

Through the Children Act (2004) and subsequent statutory guidance, England has become the first country in the world to establish a mandated national approach to reviewing all child deaths. The results of this study of 'early starter' CDOPs has helped to inform the subsequent establishment of panels across England. To operate effectively, these panels need a clear remit and purpose, robust structures and processes, and committed personnel. It is our view that the multi-agency nature of the panels supports a broader approach to understanding and responding to children's deaths than one located within health alone. There is some evidence that these reviews can lead to appropriate recommendations to promote children's safety and welfare. Further work is required, however, to establish whether these recommendations do in fact lead to effective action and positive outcomes for children.

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Contributor All authors were fully involved in all aspects of the study, including visiting and observing the panels and analysing the data. Dr Sidebotham produced the first draft of the paper, and all other authors reviewed and commented on drafts in preparation.

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APPENDIX 1 CORE THEMES AND ISSUES IN RELATION TO SYSTEMS AND STRUCTURES

Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Developing the child death overview panel (CDOP)	Enthusiasm within the teams to develop something that they saw as being worthwhile, combined with a recognition that this work was challenging.	*It is a new task for us and a new area of work and that's making links in areas that we haven't before, so some of it feels like uncharted territory, but I think we have had a lot of support from all agencies locally and we haven't come up against any brick walls, we've generally had enthusiasm and support.*
	Key elements contributing to the successful establishment of new teams were the engagement of and good working relationships between motivated individuals from a range of agencies.	
	One of the major barriers to implementation was a lack of understanding or commitment from individuals or professional groups.	*It's breaking new ground you see and we're just learning, forging our way in the dark really … and we know there's other people doing it now which really helps, so we're just learning as we go.*
Purpose	Although all panels thought it important to have a clear purpose or remit, few had set those out.	*I think people … will need to understand what's the purpose of CDOP… so it's not just seen as a chore that is a government imposed initiative, but that it actually has a benefit in what we're trying to achieve.*
	The purposes as set out in government guidance were felt to be appropriate.	
	Most saw the purpose of the CDOP in terms of learning lessons and were keen that it should not become an exercise in apportioning blame.	*… to gain an understanding of the circumstances of the child's life, including the possibility of abuse or neglect (and thus providing a safety net to identify possible Serious Case Reviews). One output will be the learning of common lessons which will be useful in the formulation of public health strategies.*
Structure	The size of population covered by the sites varied enormously and there were a number of issues raised in relation to geographical boundaries. Some sites were exploring collaborative arrangements with neighbouring authorities to maintain an optimum balance in having enough cases to allow meaningful analysis, while not too many to be unmanageable.	*If (the Safeguarding Board) is co-terminous with a Primary Care Trust, you've got the links there with general practitioners … You're looking at ideally co-terminosity with your local health service provider which is a bit more difficult but you're about making the process work by having sensible boundaries and sensible geography.*
Membership	All the teams had developed models of core membership with additional co-opted or ad-hoc members.	*What we'll have is a core membership and then an invited membership according to the nature of the cases to be discussed… We don't envisage that you have all those people there all the time, but we have a core group, and… a middle group who will be called upon regularly and then there will be a team of liaison people around each agency who will then feed the information and may come in for a particular single case rather than for a whole panel meeting.*
	Of the nine panel meetings observed, there were between 4 and 11 members present, with one outlier of 22 members.	
	Professionals most commonly included as core members were public health, coroner's officers, children's social care, police and paediatricians; with education, drug and alcohol teams, child and adolescent mental health and adult mental health typically participating as co-opted members.	
	Most sites considered it important to have experienced and credible representatives on the panel.	*I think there has got to be a credibility, that the people who are going to sit on the panel will be people who are experienced enough in understanding the issues… it's not someone coming for a learning experience, it's someone who's got a richness of experience to both analyse and contribute and provide some leadership.*
	Independence was felt to be important but difficult to achieve; some panels were looking at models for incorporating lay or parent membership.	

Continued

Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Team functioning	Good working relationships between team members; an atmosphere of trust—this was felt to be particularly important given the sensitive nature of the work.	*There may need to be some understanding about different analytic approaches and that different people approach things in different ways… there may be forensic approaches, there may be diagnostic approaches… there's going to have to be some training that will help people understand that other members of the panel will bring a different perspective.*
	Multi-agency working brings its own challenges, given the different backgrounds and working cultures of team members.	
	Key competencies of an effective chair include: a broad knowledge base in relation to children's issues; ensuring that everybody on the panel participates in the process; dealing with conflict; giving direction but not controlling; an ability to make sense of complex issues; a clear sense of the purpose of the child death review processes; and independence in the sense of not having any direct decision making or line management role in any of the cases	*I don't think there's anything about the chair that requires it to be medical, nursing or any other speciality, I think it's the ability to think above the detail… and its simply for me about extrapolating the detail of the individual case and translating it into a strategic, maybe a population preventive set of actions… I think you've got to be a… children's champion*
	Importance of having medical expertise available to the panel, but also other specific expertise (eg, legal, road traffic safety).	
Protocols and procedures	Protocols are seen as important in setting out accountability.	*Two protocols were provided to the team: one was an operational document covering systems for notification, data collection (with a data collection tool that had been developed locally), the membership and process of panel meetings; the other was more of a policy document, providing working definitions, and covering the remit and responsibilities of the panel and partner agencies*
	Most sites in our study had not yet developed protocols for their CDOP.	
	Three components to the protocol were identified: core principles; process; and structures and funding.	

Continued

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Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Relationship with other processes	The overlap with Serious Case Reviews (into deaths from abuse or neglect) was seen as important, but it was not clear how the two functioned together; Serious Case Reviews were seen as more intensive and time consuming.	*The internal reviews that are already happening in many hospitals… and have been running for sometime, but they have two very different, requirements. One is to have a bird's eye view of all deaths within the district and the other is part of the internal hospital governance arrangements and therefore different information needs to be provided for each setting, you can't necessarily use the same information for both. So getting people's heads clear around that, particularly when they've been in the habit of running mortality meetings whether that's intensivists or neonatologist or whole hospital arrangements, and shifting sideways and taking the emphasis off the medical bits and did the SHO get out of bed or did somebody write down the pulse rate, towards collecting wider information about, when did this mother book for antenatal care, or what do we know about father's drug use.*
	The rapid response process for unexpected child deaths, including a final local case discussion, is an operational response to individual cases; it should feed into the child death overview panel, which has a broader remit.	
	The CDOP differs from individual agency management reviews, or hospital based mortality reviews.	
	Surprisingly, none of the interviewees mentioned the relationship between the CDOP and the Coroner's inquest. This was felt by the study team to be an important area.	
Resources	Financial: funding of key administrative staff and processes; time costs of professionals on the panels; training costs.	*It takes a lot of time, I would say every meeting, the meetings usually last two hours… but they are usually preceded by, I would say, at least twelve hours of my time just collecting data.*
	Personnel: three crucial roles were identified—panel chair, co-ordinator or manager, and administrator.	
	Professional time was considerable and had to be fitted in among all the other time pressures; professionals needed time to attend the panels but also to prepare for the panel meetings and to take actions afterwards.	*I suppose the only resource issue I could put on the table in relation to this, is that this group sits alongside a million others, so your day job is stretched now that's the issue really. This is central to the working of the Safeguarding Board, but it's a new piece of work.*
Audit and governance	Systems of audit and governance were not well developed but were considered important.	*I guess each meeting will have to have a way of evaluating its work rather than waiting and looking back retrospectively over 6 months work. I think I would want a system whereby at the end of each meeting the panel actually reviewed what, how well do we think we've achieved what we set out to achieve today and then it would aggregate those up, into a quarterly kind of process.*
	Included lines of accountability and reporting to Local Safeguarding Children Boards and individual constituent agencies	
	Issues of confidentiality and data security were raised, but many panels had not yet found ways to address these	

APPENDIX 2 CORE THEMES AND ISSUES IN RELATION TO PROCESS AND FUNCTION

Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Criteria for review	The panels have responsibility for reviewing all deaths from all causes of infants and children aged 0—18 years.	*We look at all the new cases we've had in that month and we sort of allocate them… put in one pile… those that we think maybe need a Serious Case Review… put in another pile those that are clearly deaths from natural causes. then we've got a third pile where we feel that on the face of it they warrant a review because of something funny about them.*
	Not all deaths could be reviewed to the same depth: some case selection for more detailed review was necessary; many panels focused on more detailed reviews of deaths from external causes and other unexpected deaths.	
	Some panels grouped deaths for review into different categories (eg, road traffic deaths, cancers, sudden unexpected death in infancy (SUDI)) to allow specific expertise to be brought in.	*We're probably going to be looking at a neonatal and maternity category. We're probably going to be looking at an infectious diseases category… and we're probably going to look at an accidental death category and a non-accidental child abuse category….most of us understand the point of categories because you can then bring in… a neonatologist and midwives for the neonatal one or the Road Traffic Investigative Team for the other one.*
Data processing	Panels relied on multiple sources of notification; particular issues were raised in relation to children dying in tertiary centres or outside the area of residence.	*It's about getting the balance between the information that you need but not over loading people as we've seen today… it is a lot of work for agencies to pull together, so we tried to keep the form as straightforward as possible, whilst at the same time having the relevant information.*
	Various forms for data collection were being used; the most helpful seemed to combine a limited dataset of categorical information supplemented by narrative information within different domains.	
	Data collection is time consuming, typically taking up to 4 h to collate information on each death. Sufficient time needs to be allocated for this to be done well in advance of the panel meeting; reviews needed to be scheduled once all data were collated, which could be several months after the death.	
Liaison and information sharing	Very few panels had formalised systems for confidentiality, information sharing and data protection.	*Although we would want… to ensure that all the copies that the panel members have had to read in advance of a meeting [are] all destroyed. I certainly see that we would be keeping one working copy in case we ever had to go back to it, because if we produce an overview report on which we are later challenged we may have to go back to the evidence on which we based our findings… Now whether you keep that as a paper copy or whether you scan it and keep an electronic copy is academic, I mean obviously there are data protection issues as well as freedom of information issues in relation to the parents and the family members and potentially the staff involved.*
	Some panels anonymised the information before the panel meetings, others asked panel members to sign a confidentiality agreement, and shredded reports after the meeting, with all outputs from the panel being anonymised.	
	None of the sites had involved parents in the review process but all considered it important to develop systems to inform parents of the process, allow them opportunities to raise issues and to feedback outcomes of the process to parents.	*I think we're sharing information to improve children's welfare so it isn't a big issue for me, but I know different people have different stands and I know from a child protection arena that if you haven't got this clarified there are always people who are standing on the side saying, you know, what is the confidentiality issue here and can I share this.*

Continued

Continued

Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Team Meetings	The frequency of panel meetings varied from monthly to every 3 months; 3—5 cases appeared an optimum number to discuss in a 2—3 h meeting, with 20—30 min spent discussing each case.	*We are settling into a pattern about once every 3 months and you can see that there's usually five or six cases plus the following up of matters arising from previous minutes.*
	Time needs to be set aside for preparation before the meeting; panel members need to be provided with succinct, collated information on each case sufficiently in advance of the meeting to allow them to read the reports and come prepared.	*A lot of thought has to go into, into agenda setting. A huge amount of thinking and like we spend an hour and a half preparing for today's meeting… it's that thinking, getting [the paediatrician] out of his clinical area and getting his brain and thinking it through really carefully and then, that's really important.*
	Relying on original case records at the meeting can be counterproductive as it takes time and distracts from learning lessons and focusing on key issues.	*In one observed meeting, a member of the Primary Care Team had been invited but was unable to attend the meeting. However, the child's medical notes were lent to the children's social care delegate for use by the CDOP. Not unusually, these notes were very thick, unwieldy and full of complicated medical jargon. No-one had the relevant expertise to properly interpret the notes and a great deal of time was wasted while different delegates tried to decipher the text.*
	There were apparent dangers in spending too long discussing each case, in effect carrying out an investigation into the child's death rather than focusing on lessons to be learnt.	
Analysis	At this stage, few of the panels had developed any formal frameworks or systems for analysis.	*[Our panel uses a] multi-axial approach to individual deaths so, sort of medical factors, social factors, environmental factors and whether they were a major fact, a minor fact or no relevance at all.*
	There is a balance between ensuring enough information is available in a timely manner to make sense of the circumstances of the death, but not too much so as to overwhelm the process and delay learning lessons.	
	A number of participants highlighted the importance of regional or national collation of data and learning lessons at a wider level	

Continued

Continued

Core theme	Issues raised in interviews, structured observation and reviewed protocols	Examples
Outcomes	Most of the panels anticipated producing an annual report to go to the Local Safeguarding Children Board, with or without separate reports on each case or panel meeting.	*I think we would have a small summary report for each of the unexpected deaths… like a kind of closure on that piece of analysis… it would be what are the learning points from talking about child A or child B, and then they would be, something that we could aggregate up into our annual report which would be about the overall learning.*
	The main emphasis was on learning broad lessons from all deaths, rather than individual case issues which should be dealt with in other ways.	
	A number of specific outcomes came out of the cases observed, even at this very early stage.	*First of all looking at the individual child and whether in terms of the individual child we've actually covered all bases in terms of ongoing services for them where appropriate. And that means asking about child protection issues, are they dealt with, are they still live, are they ongoing, and are those support services going in… The second thing is the more global issue to do with broader [issues], so this is the system, the kind of systematic thinking that you might be looking for… to look at the… more global issues that affect the broader population, not just the individual child… and then the third thought… was about awareness raising and training.*
	It was perceived that the CDOP provided a forum for taking forward issues raised in respect to child safety.	*At the time no-one would take responsibility for it [the dangers of children falling out of open windows]. The Safeguarding Board wasn't in this mode, the Community Safety Partnership was not interested because it wasn't a crime. ROSPA… wasn't interested because it wasn't a road traffic accident… so we had got nowhere to go with it. Whereas now we would say, we're a Safeguarding Board, actually this is our problem, we now have that responsibility so we need to do something about it…*

Assessing and improving child death review team recommendations

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Assessing and improving child death review team recommendations

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ABSTRACT

Background Child death review teams (CDRTs) are multi-agency, multidisciplinary teams that review the circumstances surrounding child deaths. Although the potential of CDRTs to promote systems improvement and prevention is well recognised, teams often struggle to translate their findings into effective preventive actions.

Objective To present results from a study assessing the quality of written recommendations in published CDRT reports; and provide guidelines for improving the quality and effectiveness of these written recommendations.

Methods A descriptive, non-experimental design was used to analyse a set of 1093 recommendations from 21 randomly selected, publicly available state and local CDRT reports. An assessment instrument, modelled on the public health approach, was developed to score the quality of recommendations. It consists of three components divided into 10 dimensions: problem assessment; written recommendations; and action on recommendations.

Results CDRT reports scored highest in the problem assessment component (mean score: 2.7/dimension), followed by written recommendations (2.2/dimension), and action on recommendations (1.9/dimension). Even among the highest ranked dimensions, the average scores were only in the mid range of quality on our assessment scale.

Conclusions The results suggest that CDRTs are doing a better job of 'assessing the problem' than in 'proposing solutions' as indicated by their written recommendations. CDRT reports often do not address follow-up of their written recommendations. Guidelines are offered for use as a practical tool to help CDRTs enhance the likelihood of producing effective recommendations that prevent future child injuries and deaths.

INTRODUCTION

Child death review teams (CDRTs) are multi-agency, multidisciplinary teams that review the circumstances surrounding selected child deaths, including child maltreatment and other sudden, unexpected or traumatic deaths. This review process is intended to ensure proper investigation, protect siblings and other children, improve case management and systems of care, and ultimately prevent future child deaths.

Although the potential of CDRTs to promote systems improvement and prevention has been well recognised,[1–3] there are few published studies on the quality and usefulness of the recommendations generated by CDRTs.[4–6] However, there are many anecdotal examples of successful CDRT efforts to 'take their findings to action'. In the USA, the national joint Children's Safety Network and National Center on Child Death Review report on drowning prevention[7] used data from 17 state CDRTs to highlight the finding that most parents whose toddlers drown stated they were 'supervising' their child at the time. However, many were also on the phone, taking a nap, talking to friends, or otherwise distracted. The report proposed that prevention messages about supervision be more specific (eg, keep within arms length of toddlers when around water; learn to use the Water Watcher[8] method of sharing supervision at group events).

In November 1998, the CDRT in Allegheny County, Pennsylvania reviewed six infant deaths involving unsafe sleep environments. Members of the team formed a steering committee of public health, political and business leaders to address the problem. Cribs for Kids PA was the result, an organisation whose purpose is to distribute free cribs to needy families. The first 6500 infants who received cribs in Allegheny County lived to celebrate their first birthdays and the Cribs for Kids programme has been expanded nationally.[9] CDRTs throughout the USA continue to address unsafe sleeping environments and have had an impact on the current national discussion on preventing sudden unexpected deaths of infants (SUDIs).[10]

In another example, the Mobile Alabama CDRT identified several newborn infants along the Gulf Coast who had been abandoned or left to die. Frustrated with the horror of 'dumpster babies', the CDRT chairperson partnered with local media and built a programme called 'Safe Place'. The programme allowed mothers to leave newborns <72 h old at hospital emergency departments with no questions asked. This programme was passed into Alabama law in May 2000 and became a model for 'Safe Haven' laws.[11]

In California, a single CDRT in Placer County reviewed several toddler drowning deaths. As a result they made a policy recommendation to the federal Consumer Product Safety Commission (CPSC) to require 'warning' labels on 5 gallon buckets. The recommendation contributed to the CPSC initiating a rulemaking process and the industry voluntarily adding labels to 5 gallon buckets.[12] A similar process occurred involving several California CDRTs, the Consumer Federation of America, and other groups regarding baby bath seats.[13] More recently the Placer County CDRT again reported a safety problem related to a child's 'boat bed' which led to the product being removed voluntarily from the market.[14]

One of the biggest ongoing successes of the Sacramento, California CDRT was its promotion of home visitation services. Instead of a generic

recommendation in support of such programmes, the team worked with local leaders to assess the current resources and political context and recommended the formation of a high level task force to create and sustain evidence based home visitation services. The result was the multi-million dollar Birth and Beyond programme targeting eight high risk neighbourhoods. Following the programme's implementation, the team documented a significant decline in child maltreatment homicides.[15]

These are only a few examples, but many CDRTs have had successful efforts to 'take their findings to action'. However, over the last two decades working with CDRTs, we have noted that teams often struggle to see their findings translated into preventive actions with measurable outcomes. There are many possible reasons for these difficulties, but we believe that a CDRT's ability to develop, write, disseminate, and follow through with recommendations based on their review findings is critical. Unfortunately this process is often 'taken for granted' and not valued as a central function of the team process. Thus, it may be omitted or not given sufficient thought, resulting in recommendations that are generic, vague or not grounded in best practices and local conditions.

There is a growing body of literature that stresses the importance of making this 'knowledge to action' process explicit. Available evidence suggests approaches that use a 'planned action' model to 'deliberately engineer' change are more effective than more haphazard efforts.[16] There are many such models and frameworks available, but the public health approach to problem solving involves a four step 'action cycle': define the problem; identify risk and protective factors; develop and test interventions; and assure widespread adoption.[17 18] The development and dissemination of effective recommendations is an important component in assuring adoption of best prevention practices.

Our purpose is twofold: (1) to present results from a study assessing the quality of written recommendations in published CDRT reports; and (2) to provide guidelines for improving the quality and effectiveness of written recommendations. By making it explicit, we hope to focus attention on the importance of developing effective recommendations and promote its full integration into the CDRT process.

Study of CDT recommendations

The goal of our study conducted in 2003–4 was to describe and assess the quality of child death review recommendations published in written CDRT reports.[19]

METHODS

A descriptive, non-experimental design was used to analyse recommendations in publicly available written aggregate reports from state and local CDRTs. We solicited reports from states and counties around the USA with active CDR processes. To be eligible for analysis, we required that reports be published after 1999, be the latest available from a jurisdiction, and include some type of prevention focused recommendations. A random sample of these reports was selected for study. A Human Subject Review panel exempted the study because the written reports were public documents and did not contain identifying information on specific child deaths.[20]

Each report contained multiple, usually dozens, of recommendations. We defined a recommendation operationally as:

1. A statement or set of statements that was clearly identified as a recommendation either by the use of a heading or specific words stating it was a recommendation; or
2. A statement or set of statements with implied language or formatting indicating the report authors were suggesting actions that should be taken as a recommendation, and the statement(s) went beyond a simple description of 'best practices' or potential solutions to suggest some type of action (local, state or national) in the context of a specific problem.

Recommendations were further classified as being either:

1. An individual (stand alone) recommendation only; or
2. Part of a group of related recommendations clearly identified as a set either by subject heading or specific words indicating their more comprehensive nature.

In analysis, each recommendation within a group was reviewed both as a single recommendation and as part of the overall group recommendation.

We developed an assessment instrument, modelled after the public health approach, for evaluating the recommendations. It consisted of three components divided into 10 dimensions: problem assessment; written recommendations; and action on recommendations, as displayed in table 1.

Explicit scoring criteria were developed for each dimension and recommendations were scored on each dimension using a five point scale on how well it satisfied the standard (1=low quality, 5=high quality). As an example, table 2 displays the scoring matrix for both the problem statement and intervention focus dimensions. Inter-rater reliability was established for all dimensions.

Problem assessment

According to the criteria, the *problem statement* dimension should include at least a problem description with reference to local, state, and national data and identify relevant risk and protective factors in order to be considered 'high quality'. *Best practices* should demonstrate knowledge of evidence based 'best' or 'promising' practices for addressing the problem. Knowledge of existing local efforts, resources, capacities, 'political will', and consideration of any opportunities to take advantage of serendipitous circumstances are minimum requirements for the *capacity* dimension.

Written recommendations

Similar to SMART objectives (ie, specific, measurable, achievable, relevant, and time based),[21] a written recommendation should identify which persons or organisations will take action (ie, the intervention actor or 'doers' making a recommendation happen). Additionally, a written recommendation should clearly specify the intervention focus, the recipient of the intended action. This is often not the final recipient of the benefits of the intervention but a crucial 'next step' in the pathway to protecting the ultimate beneficiaries. The specificity dimension should include a description of the proposed action(s) with sufficient information to provide the actor(s) with guidance as to 'how' to proceed, including the places or institutions identified wherein changes will occur, and an initial timeframe for action. The criteria for a high quality recommendation also address the accountability dimension by requiring that someone was assigned to follow-up and track progress.

The Spectrum of Prevention was used as one of the 10 assessment dimensions, because it provides a broad framework for developing multifaceted approaches to injury prevention.[22] This framework currently includes seven strategies that offer a comprehensive approach for developing public health interventions and activities among multiple programs or agencies.[23] By considering all the levels, the Spectrum of Prevention promotes multiple intervention strategies that can act synergistically to create more effective and comprehensive solutions. The Spectrum of Prevention strategies include:

Table 1 Guidelines for writing effective recommendations

Problem Assessment		*Report and/or recommendation…*
Problem Statement	•	includes problem definition; local, state, and national data; and risk and protective factors.
Best Practices	•	demonstrates knowledge of "best" or "promising" practices for addressing problem.
Capacity	•	demonstrates knowledge of existing local efforts, resources, capacities, "political will", and/or takes advantage of serendipitous circumstances.
Written Recommendation		*Recommendation…* *Framed in a manner consistent with issues identified in the problem assessment*
Intervention Actor	•	identifies the persons and organizations ["doer(s)"] to take action
Intervention Focus	•	identifies the recipient (e.g., person, agency, policy, and/or law) of the intended action
Specificity	•	plan of action described in sufficient detail to allow follow-up consistent with:
	•	issues identified in problem assessment
	•	actions appropriate for actor
	•	places/institutions identified where changes will occur
	•	timeframe for action identified
Accountability	•	assigns and obtains buy-in of someone (i.e., team member or other individual) to be accountable for follow-up and tracking of progress on actions taken with timeframe identified for follow-up.
Spectrum of Prevention	•	demonstrates awareness of levels of intervention and identifies appropriate level(s) given issues identified in problem assessment:
		○ Strengthening individual knowledge and skills;
		○ Promoting community education;
		○ Educating providers/others;
		○ Changing organizational practices;
		○ Fostering coalitions and networks;
		○ Mobilizing neighborhoods and communities; and
		○ Influencing policy and legislation.
Action on Recommendation		*Report and/or recommendation…*
Dissemination	•	specifically states who will receive the recommendation, and includes not only the potential actors and recipients but also appropriate decision makers, funders, and potential supporters.
Outcomes/ Impacts	•	identifies a mechanism/procedure to document the impacts and outcomes that result from action on team recommendations.

1. Strengthening individual knowledge and skills
2. Promoting community education
3. Educating providers
4. Changing organisational practices
5. Fostering coalitions and networks
6. Mobilising neighbourhoods and communities
7. Influencing policy and legislation.

Action on recommendations

The criteria for the dissemination dimension specifically identify how and who will receive the recommendations. Not only should it include the potential actors and recipients, but also appropriate decision makers, funders, and potential supporters. The final dimension, outcomes/impacts, identifies the need for a procedure to track and document actions taken on team recommendations, and any impacts and outcomes that result from these actions. Table 3 provides an example of the guidelines applied to improve a written recommendation.

In this report we present results on the quality of recommendations analysed at the CDRT report level only.[19] For each report, an average score was generated for each of the 10 dimensions based on the scores on that dimension for all

Table 2 Assessment tool and sample criteria for two dimensions

Dimension	Quality standard	Scoring criteria
Problem statement (PS)	Report and/or recommendation includes problem definition, local, state, and national data, and risk and protective factors	1=Recommendation does not include a problem definition, local, state, and national data, or risk and protective factors 2=Some problem definition provided, but only case specific or vague, and no reference to local data on other deaths or injuries 3=Problem definition and some local data, but does not provide broader context with state and national data, or risk and protective factors 4=Problem definition, local data, some state and national data, and some risk and protective factors 5=States problem clearly and provides local, state, and national data, and risk and protective factors
Intervention focus (IF)	Recommendation identifies the recipient (eg, person, agency, policy, and/or law) of the intended action (ie, to whom or on what) in a manner consistent with issues identified in problem assessment	1=Recommendation does not identify the recipient of the intended action 2=Only the most distal recipient (eg, children) of the recommended action is identified, with no mention of the necessary mediating agent(s) (ie, actual recipient) to make the changes that will affect the distal recipient, or the recommendation confuses the recipient with the actor, appears inconsistent with problem statement, or cannot determine consistency due to incomplete problem statement 3=Appropriate (level of) recipient for the recommended action is identified, but only in vague or overly broad terms, and recommendation appears consistent with problem statement 4=Recipient of the intended action is clearly identified, and is consistent with problem assessment 5=Clearly states the recipient of the intended action, justification given, and consistent with problem assessment

recommendations in the report. Of the 10 dimensions that were scored, six generated both group and individual scores:

- Problem statement
- Best practices
- Capacity
- Intervention actor
- Intervention focus
- Specificity.

The remaining four dimensions were only scored at the group recommendations level because they reflected a comprehensive assessment of the totality of the individual recommendations making up the group:

- Accountability
- Spectrum of prevention
- Dissemination
- Outcomes/impacts.

RESULTS

Based on our solicitations, 214 CDRT reports from states and counties in the USA were received, but only 76 met selection criteria. Of these, 21 were randomly selected for detailed review.

The final set of recommendations identified in the reports included 941 individual recommendations and 175 groups of recommendations, with 23 of the recommendations considered as both single and group recommendations, for a total of 1093 analysed recommendations. The majority of these recommendations were preventive in nature. They covered a wide range of death causes, with intentional injuries (child abuse and neglect, homicide, suicide), sudden infant death syndrome (SIDS), and motor vehicle crashes having the highest number of recommendations.

The results presented in tables 4 and 5 are the average dimension scores for all 21 reports for the individual recommendations and the group recommendations, respectively. No statistical tests were applied because of the relatively small number of CDRT reports (n=21) and the wide range of average report scores on the dimensions.

In table 4, the highest mean scores of the report recommendations among the six dimensions scored individually were the problem statement, followed by best practices, and specificity. Intervention actor was the lowest dimension among the individually score recommendations, followed by capacity and intervention focus.

Comparing the two tables, the rankings of the six dimensions that were scored as both individual and group recommendations remained consistent across both sets of scoring. The group

Table 3 Application of the guidelines to improve a written recommendation

Written recommendation	Intervention actor	Intervention focus	Specificity	Accountability	Spectrum of prevention
Poor: Parents should supervise their children around water	Confusion of actor with focus		Low	None	Individual
Better: All new pool owners should receive pool safety materials, including Water Watcher kits	Not stated	New pool owners	Reference to a specific promising educational approach, but no distribution mechanism	None	Individual
Better Yet: The Drowning Prevention Committee of the local Safe Kids Coalition should work with the Building Code Office to develop a sustainable distribution system to ensure that all new pool owners receive an educational packet on pool safety at the time a building permit is issued, that includes information on the dangers of toddler drowning, local laws, and includes a Water Watcher kit. The team's Safe Kids representative will report back on progress and challenges in 3 months	Safe Kids & Building Code Office are both specified	New pool owners	Specific focus on developing distribution mechanism, timing and content of educational materials	Safe Kids representative responsible for follow-up	Individual and institutional levels involved; a more comprehensive approach, if feasible, might involve additional levels

Table 4 Individual recommendation mean scores based on a five point scale

Components and dimensions	Mean	SD	Range	Rank
Problem assessment				
Problem statement	3.15	0.85	1.65–4.87	1
'Best' practices	3.00	0.28	2.60–3.70	2
Capacity	2.58	0.84	1.00–3.94	5
Written recommendations				
Intervention actor	2.02	0.73	1.00–3.75	6
Intervention focus	2.71	0.55	1.90–4.02	4
Specificity	2.95	0.30	2.53–3.81	3

N=21 based on 941 individual recommendations.

scoring showed the same three top ranked dimensions as in the individual ranking, but added the Spectrum of Prevention dimension in the top as well. Based on the size of the standard deviations, best practices, specificity, and Spectrum of Prevention were the most consistent scoring dimensions across reports in both the individual and group scoring. Three of the four dimensions scored only for the group recommendations (ie, outcomes/impacts, accountability, and dissemination) ranked in the bottom four, along with the intervention actor dimension.

Overall, of the three broad components used to group the dimensions, the problem assessment scores were the highest on average (mean 2.7/dimension), with written recommendations (2.2/dimension) and action on recommendations (1.9/dimension) placing second and third, respectively.

DISCUSSION

This analysis showed general consistency within the 21 reports across the 10 dimensions. Reports that received high scores in certain dimensions also seemed to excel in several other dimensions. At the same time, reports that showed a tendency to receive low scores in a dimension were consistently low in many of the other dimensions as well.

Within the public health planning model, the results from the individually scored recommendations suggest that CDRTs are doing a better job of 'assessing the problem' than in 'proposing solutions' as indicated by their written recommendations. However, even among the highest ranked dimensions, the average scores were only slightly higher than 3 on our five point scale, and variability was high, suggesting room for improvement on the quality of recommendations contained in the study CDRT reports for nearly all reports.

Table 5 Group recommendation mean scores based on a five point scale

Components and dimensions	Mean	SD	Range	Rank
Problem assessment				
Problem statement	3.13	0.87	1.63–4.91	1
"Best" practices	3.05	0.33	2.50–3.91	2
Capacity	2.63	0.90	1.00–4.00	6
Written recommendations				
Intervention actor	2.02	0.74	1.00–4.00	8
Intervention focus	2.76	0.57	2.00–4.09	5
Specificity	2.96	0.37	2.50–3.82	4
Accountability	1.55	0.71	1.00–3.00	9
Spectrum of prevention	3.03	0.39	2.00–3.80	3
Action on recommendations				
Dissemination	2.46	1.12	1.00–4.33	7
Outcomes/impacts	1.45	0.65	1.00–3.00	10

N=21 based on 152 group recommendations for first six dimensions. N=21 based on 175 group recommendations for last four dimensions.

Adding the results from the four dimensions assessed at the group level does not change this finding. Only the Spectrum of Prevention dimension score reaches into the higher ranking. The other three group assessed dimensions (dissemination, accountability, and outcomes/impacts) had some of the lowest scores. This further suggests that CDRT reports often do not address these follow-up aspects of their written recommendations.

These results confirm our concerns about the quality of CDRT recommendations and highlight the untapped potential of thoughtful, well-written recommendations. To improve the recommendation generation process, we used the study assessment tool as guidelines for writing effective recommendations in a training programme used throughout California and the USA to help CDRTs write more effective recommendations.

Application of the guidelines starts with a focus on several structural and functional aspects of the CDRT process that can enhance the likelihood that recommendations are effective. First, teams must make prevention a priority by valuing and embracing the process of developing and writing recommendations. Second, teams need to fit the recommendation process into their team functioning with sensitivity to member priorities. For example, teams can bundle the review of similar cases (eg, teen motor vehicle crashes) together so that recommendations can be based on multiple child deaths. One evidence based solution is to use a two-tier process consisting of a technical team that reviews cases and an action team to create and promote recommendations. A national study of the Fetal Infant Mortality Review Programs (over half of which were combined with CDRTs) documented that on average two-tier systems "were more likely to report implementation (of recommendations)…than those with one-tier systems (88% vs 56%, $p<0.001$)". Two-tier systems also conducted significantly more activities associated with all five essential maternal child health services.[26 27] Third, team leadership is critical to facilitating an effective team structure and ensuring the recommendation process gets the attention it deserves. Finally, tracking team successes is an important function not only to celebrate the accomplishments of the team and its community partners, but also to document the relevance and effectiveness of the CDRT process.

As an example, the state of Michigan has a system of 78 county review panels and a state advisory board. State law required this state board to issue annual recommendations to the governor and Michigan legislature on improvements to policy and practice that could prevent child deaths. For 3 years, the state board issued a comprehensive annual report on child mortality, review team findings, and a set of recommendations. Each year more than 50 recommendations were presented, addressing the investigation, provision of services, and the prevention of the major causes of child deaths. In 2001 the state panel assessed the progress made on implementing their recommendations. The sobering conclusion was that little to no progress had been made—few recommendations were even being addressed by state policymakers.

The state panel asked the newly appointed state director of social services for her leadership in moving the recommendations forward. She agreed but asked that the State Child Death Review Board ensure that in developing their recommendations they:

- Explicitly state what state agency should be responsible for implementation
- Share the recommendation(s) with those agencies ahead of publication to identify and address potential barriers to implementation

Table 6 Michigan's success at improving the recommendations process to improve results

2001 recommendation[24]	Improved 2004 recommendation[25]	Progress
Support collaborative efforts between the county medical examiners, law enforcement agencies, the Prosecuting Attorney's Association of Michigan and the Michigan Association of Counties to ensure utilisation of state standards for child death investigations in all counties	In every county, the prosecuting attorney, law enforcement agencies, medical examiner and the family Independence agency should jointly adopt and implement a child death scene investigation protocol using the *State of Michigan Protocols to Determine Cause and Manner of Sudden and Unexplained Child Deaths* as a model	A state law went in effect in 2006 requiring local communities to use the death investigation protocol or a reasonable facsimile. The state CDR programme provides ongoing training on the protocols to local investigators throughout the state. Almost all 83 counties are using the protocols
Build upon the success of the statewide 'Back to Sleep' campaign to emphasise safe infant sleeping environments following the recommendations of the Consumer Product Safety Commission	The Michigan Department of Community Health and the Family Independence Agency (Social Services) should collaborate to implement a statewide campaign that promotes safe infant sleep environments and explicitly describes the dangers posed to infants in bed sharing and other unsafe sleep environments	A state coalition was organised in 2005 and meets regularly to coordinate, plan, and implement safe infant sleep programmes for professionals, the general public, and young families
Support steps to enforce and strengthen the current graduated licensing law in Michigan.	The Michigan legislature should amend the current graduated licensing law to place limits on the number of teen passengers allowed in vehicles driven by teens with level 2 intermediate licences. This limitation should apply at all times of the day	State legislation was introduced to limit the numbers and types of passengers for new teen drivers and will be voted on by the full legislature in 2010

- Ensure that all recommendations be based on state and/or the local reviews of child deaths
- Ensure that all recommendations be developed after a study of evidence based and promising practices as well as current state initiatives.

The state board recommitted themselves to the recommendations process. The following year they had 22 recommendations, all of them more specific. Although all of the board's recommendations have yet to be implemented, there is now more action and accountability within state agencies in addressing all of the recommendations as they are developed and reported each year. Table 6 shows the progress made after the full panel improved their recommendation process.

CONCLUSIONS

CDRTs have a critical role to play in ensuring that the knowledge they gain from child death reviews is translated into effective prevention interventions that actually make a difference. As mentioned above, many teams already have a strong track record of successfully taking their findings to action. However, our study demonstrates that not all teams are successful in writing quality recommendations which enhance the likelihood of producing meaningful change.

These guidelines can be used as a practical tool to help CDRT practitioners be more successful in transforming their findings from child death reviews into actions to prevent future child injuries and deaths. While these guidelines have only recently begun to be evaluated,[6] they are based on extensive field experience by CDRT practitioners and have been endorsed and used widely as a training tool by the NCCDR[28 29] in its work throughout the USA and the international community. Our premise is simply that change is more likely to occur if CDRTs take the time to fulfil their promise as advocates for prevention and agents for change.

Addendum

The Action on Recommendation component of the guidelines originally had two dimensions, *Dissemination and Outcomes/Impacts*. However, feedback during our subsequent trainings led us to expand the guidelines to address *Prioritisation*. Prioritising requires an assessment of the relative importance of the problem (eg, magnitude, severity), the availability of viable solutions and resources to implement them, political will, and opportunity, to determine the feasibility and timeliness of effective action. Prioritisation permits a realistic assessment of what recommendations to make and when, and promotes the practical allocation of resources. Dr Neil Maniar, from the Massachusetts Department of Public Health at the time, included prioritisation in his decision matrix training materials shared at one of our trainings, citing Fowler CJ.[30] The authors wish to thank Dr Maniar for this important addition to our work.

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Collaborative process improvement to enhance injury prevention in child death review

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Collaborative process improvement to enhance injury prevention in child death review

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ABSTRACT

Objective To increase the number and quality of injury prevention recommendations made by Washington State (USA) child death review teams.

Design Before and after study design involving four intervention teams and 21 comparison teams.

Methods Intervention teams received injury prevention training, collaborative process improvement coaching, and access to web based prevention resources. An equal number of randomly selected child death review case reports filed with the state before the intervention by the intervention and comparison teams were included in the baseline sample. All reports submitted by the intervention and comparison teams after the intervention were included in the follow-up sample. Reports were scored on the completeness of prevention related data elements and on the quality of written prevention recommendations.

Results Data completion for prevention relevant items increased in intervention teams from 73% at baseline to 88% at follow-up. In comparison teams, this measure fell from 77% to 56% over the same period. The quality of written recommendations produced by intervention teams increased from 4.3 (95% CI 3.4 to 5.1) to 7.6 (95% CI 6.7 to 8.5), while comparison teams showed no significant change (4.0 (95% CI 2.5 to 5.3) to 3.7 (95% CI 2.2 to 5.2)). Specifically, improvements were noted in the identification of evidence based best practices and the development of clear, actionable written recommendations.

Conclusion Injury prevention recommendations are generated in the systematic local review of child deaths. This process can be analysed, measured, supported, and improved.

BACKGROUND

Child death review (CDR) teams are multidisciplinary, multi-agency bodies convened at a local or state level and charged with the review of all traumatic or unexpected child fatalities within a specified geographic jurisdiction. The CDR process was developed in 1978 in response to concerns over the lack of identification and incomplete investigation of potential intentional (violent or abusive) and neglect related childhood deaths.[1] But the medico-legal investigation of traumatic injury deaths overlaps substantially with the epidemiologic approach to understanding these events[2] and most CDR teams now include review of unintentional injury fatalities in their scope of service.[3 4]

The functions of a CDR team may be envisioned as a series of concentric circles emanating from the sentinel event of an unexpected child death (figure 1). The initial role of the CDR team is investigative, reviewing the process and outcome of the death investigation. The next function of the CDR team is quality improvement for child focused systems and agencies in place in the community. Finally, CDR teams have taken on a prevention role. This prevention function is seen as a major role for CDR teams by 90% of those participating in the process.[4 5]

After the first year of life, injuries are by far the most common causes of death in childhood. There is ample evidence that implementation of effective prevention programmes will reduce injury and injury related mortality.[6 7] Efforts to promote the adoption of evidence based prevention interventions are an important step in the translation of prevention science into public health practice.[8]

CDR teams are in a unique position to bolster community understanding and awareness of local injury risks and to recommend community based prevention activities.[4 9–11] Multidisciplinary CDR investigations are, in theory, of greater use in planning interventions than is the review of death certificate data fields[3 12] or unstructured medical chart entries.[13] In addition, teams have intimate knowledge of local child death trends, community priorities, assets, and opportunities to work collaboratively to prevent injury death. While there have been many examples of CDR teams acting to catalyse local injury control initiatives (see state reports on http://www.childdeathreview.org/ and Onwuachi-Saunders *et al*[10]), very little has been published to suggest that teams are routinely successful in this regard.

Barriers to effective injury prevention in CDR include: team membership designed to facilitate forensic investigation[14] but not public health based injury prevention; lack of access to information required to conduct a prevention oriented death review (injury circumstances, mechanisms, and use of potential countermeasures)[3]; forms and protocols that fail to prompt or foster prevention oriented discussion; lack of access to evidence based injury prevention resources or local injury prevention expertise; lack of awareness among team members as to how to serve as catalysts for change; and lack of training, funding, and infrastructure required to make effective recommendations to appropriate action-taking agencies.

As a result, the quality and strength of injury prevention recommendations generated by local teams in response to an injury death are quite variable.[11] Many CDR team recommendations are unlikely to be turned into meaningful injury prevention activities because they are global, generic, and not clearly tied to a specific, evidence

Figure 1 Functions of child death review.

based intervention. Worse, the promotion of injury prevention strategies that are not based on best practice and have not been subject to rigorous evaluation can result in both squandered resources and, in some cases, an inappropriate advocacy of interventions that are not only ineffective, but even harmful.

We sought to address these identified shortcomings with a multifocal intervention that asked CDRs to identify a member whose focus was prevention, and provided strength based training, interactive online resources, and templates to guide and promote prevention capacity in death review. Our goal was to increase the number, quality, and impact of injury prevention recommendations made by participating Washington State (USA) CDR teams.

DESIGN AND SETTING

We conducted a before and after assessment of CDR team function with a concurrent comparison group. The intervention group included four county-level CDR teams and the comparison group was 21 non-intervention teams from Washington State (figure 2).

Teams participating in the intervention were selected from among those expressing interest and a willingness to commit to a schedule of training events and technical assistance calls. Because we were limited by budget to recruit and train only five teams, we favoured teams from larger counties that reviewed a greater number of child deaths. We also sought diversity in geography (eastern vs western Washington) and demography (urban vs rural communities).

We initially identified five county CDR teams as intervention teams. Before the start of grant activities, however, all Washington State teams experienced a major funding cut and one intervention team asked to be moved to comparison status because they could not guarantee staff time for intervention activities. The remaining four intervention teams represented counties profiled in table 1.

The 21 teams not selected for the intervention, but which continued to meet and submit reports to the state CDR programme, were placed together in a comparison group. This comparison group was created to allow us to compare changes in the intervention group to secular trends in non-intervention teams. Intervention and comparison teams received the same level of state support and assistance and almost all had been operating for 5–7 years at the time of the intervention. Although team composition varied by county, the core membership of each team was specified by state administrative code.

METHODS

Through collaborative process improvement,[17] training, and technical assistance, intervention teams worked with project staff to develop resources and capacity in injury prevention.[18] Specifically, an injury prevention liaison was identified on each of the intervention CDR teams. This individual was not required to have injury prevention expertise but was charged with coordinating capacity development in this area for the team as a whole.

We conducted a series of technical assistance and training activities including teleconferences and annual, in-person training events. The focus of these training sessions was on

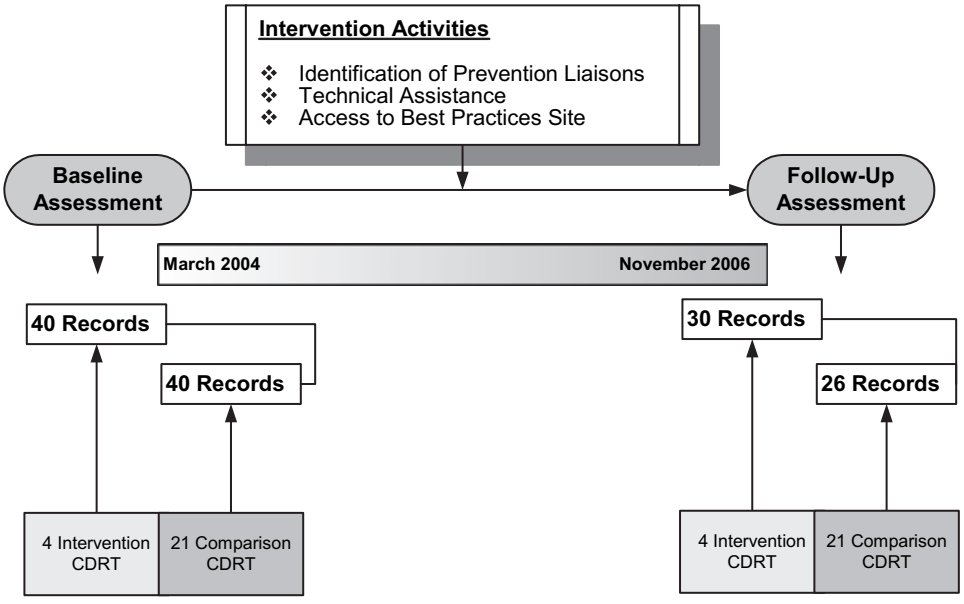

Figure 2 Intervention timeline and activities. CDRT, child death review team.

Table 1 Characteristics of Washington State counties whose child death review teams received intervention. Note team one reviewed deaths from two counties

	Population (in 2000)	Population density (per sq mile)	White, non-Hispanic race/ethnicity (%)	Living in poverty (%)	Children under 18 (%)	Child deaths (per 100 000/year)	Share of total state child deaths (%)
Team 1	142 478	83.7	76.9	12.5	27.1	51.9	3.1
	49 347	39.7	44.7	17.4	34.9	48.9	1.3
Team 2	231 966	585.8	81.7	10.1	22.6	42.4	3.5
Team 3	700 819	417.4	72.6	11.3	24.7	55.6	14.5
Team 4	417 939	236.9	87.8	13.9	23.2	49.4	7.1
Washington	5 894 143	**88.6**	**74.6**	**11.3**	**23.6**	**48.8**	

Data from references 15 *and* 16.

identification and remediation of team processes and structures that were identified as barriers to effective injury prevention. The intervention teams identified the issues and offered solutions to share with the group. Before each training session we surveyed teams to identify gaps and assets and to help us understand what capabilities existed at the local level. We used a mix of intervention team members and national experts as speakers and conducted the trainings both in person and by conference call.

Finally, a number of resources were made available for teams to use in the context of their injury prevention discussions. We created a website that rated evidence for injury prevention interventions for five mechanisms of injury related child death: motor vehicle (which accounted for 21.4% of child deaths reviewed by state teams), firearms (9.6%), youth suicide (9.2%), drowning (8.3%), and homicide (8.2%). For each injury mechanism we created a logic model to help us identify interventions most likely to be useful to CDR teams operating in a public health system.

To rate the evidence underlying each of these interventions, we conducted a search of the published literature and screened retrieved citations for relevance. Only studies that measured effectiveness against a comparison group were included. Two study personnel abstracted the full text of each relevant study and rated the suitability of the study design, the quality of study execution as reported in the manuscript, and the size of the intervention effect reported. We preferentially weighted studies that were methodologically rigorous (eg, randomised trials), carefully conducted, or used serious injury and mortality as outcome measures. Studies of lesser methodological rigour or those that tracked intermediate outcomes (such as behaviour change) were included in our reviews but were not as influential in determining our ratings. We categorised interventions as 'recommended' (those that should be the first consideration for CDR teams wanting to take action to address a local child injury concern); as 'promising' (newer approaches that have not been fully evaluated); as 'unproven' (those with limited empirical support); or as 'ineffective' or 'harmful.' Examples are shown in table 2. All final ratings and summaries were shared with content experts for comment and correction as required.

The final best practice evidence reviews, and a detailed description of their development, are available online (http://www.childinjuryprevention.org/). Access to these resources was restricted to intervention teams during the period of study. According to self report in bimonthly technical assistance teleconferences, teams used these resources variably. Some used the programme interactively during case discussion while others prepared for meetings or grouped case reviews by searching for applicable prevention interventions.

Table 2 Examples of prevention recommendations rated as 'best practice' or 'promising' after literature review

	Best practices	Promising practices
Drowning	► Pool fence legislation/enforcement (isolation fencing)	► Increase appropriate adult supervision ► Community cardiopulmonary resuscitation (CPR) knowledge ► Increase life guard presence ► Pool alarms and other monitoring devices ► Promote approved personal flotation device (PFD) use
Motor vehicle occupant	► Primary enforcement of seat belt laws ► Passage of intermediate license laws ► Enforcement of graduated licensed laws ► Child safety seat laws ► Minimum legal drinking age laws ► Drink driving mass media campaigns ► Sobriety checkpoints ► Traffic calming to reduce vehicle speeds	► Community campaigns to promote booster use ► Zero tolerance laws/enforcement ► Alcoholic beverage server education ► Red light cameras ► Speed regulator reset
Unintentional firearm	► Promotion of safe firearm storage	► Integrate safety features in gun design ► Gun design legislation ► Child access prevention (CAP) legislation ► Safe storage of firearms: low cost supplies
Suicide	► Assessment and referral training ► Media guidelines ► Skills training	► Gatekeeper training ► Crisis postvention ► Restricting access to lethal means ► State level programmes
Homicide/abuse	► Nurse home visiting ► Therapeutic foster care ► Bullying prevention programmes ► Functional family therapy ► Multisystemic therapy ► "Communities that care" intervention	► Safe storage of firearms: low cost supplies ► CAP legislation ► Youth mentoring programmes (big brother/big sister) ► Promoting alternative thinking strategies (PATHS) ► "Incredible years" intervention series ► Seattle Social Development Program (SSDP)

In addition, we provided a recommendation writing template based on available guidelines.[19] This template prompted teams to consider local injury data, to refer to best practices when formulating a recommendation, and to specify the recipient of the recommendation. It also asked teams to document plans and accountability for follow-up on CDR recommendations.

This project was reviewed and approved by the University of Washington Human Subjects Review Committee.

EVALUATION

Because the primary goal of this project was to increase the quality of injury prevention recommendations generated by CDR teams, the evaluation was a blinded retrospective assessment of CDR records submitted to the Washington State Department of Health by local teams using the state's standardised CDR data collection form.

All Washington CDR standard reporting forms detailing a child death due to one of the five injury mechanisms under study and submitted to the state between January 2000 and March 2004 were considered 'baseline' reports. Reports submitted between November 2005 and November 2006 were classified as 'follow-up' reports. Each report was assigned to 'intervention' status if it was submitted by one of the four intervention teams and to 'comparison' status if submitted by one of the 21 non-intervention teams. Four groups of reports were thus created (baseline intervention, baseline comparison, follow-up intervention, and follow-up comparison). We randomly selected 40 completed intervention report forms and 40 comparison team report forms for analysis during the baseline period. Because the period of follow-up was shorter, we were only able to identify 30 intervention and 26 comparison report forms. All of these were included in the analysis.

Report abstraction focused on the content of the review and the quality of prevention recommendations recorded in the standard data collection instrument. De-identified case reports were reviewed by one trained staff member from the Department of Health, Office of Maternal and Child Health.

On the state reporting form in use at the time of the intervention there were a number of mechanism specific questions or data elements to be completed for each injury death review. There were 15 injury specific data elements for a motor vehicle death, seven specific to a firearm death, nine specific to drowning, and five each for homicide and suicide deaths. These injury specific data elements were considered important for prevention assessment (in the drowning domain, for example, questions included "had child taken organised swimming lessons?", "was the area gated?", and "was the child wearing a personal flotation device?").

We hypothesised that intervention teams would place more weight on these data elements and would strive to find relevant information. For each case, we calculated the proportion of these data elements completed (versus left blank) and compared the mean proportion complete at baseline and at follow-up.

We also scored the quality of written recommendations generated by the team at the conclusion of a case review. Based on a template used in previous death review quality assessments,[19] we analysed each prevention recommendation and assigned points in each of four domains, *context*, *best practices*, *written recommendation*, and *follow-up* (the scoring template is available as an online supplement). Recommendations were expected to describe the injury problem and place it in a local epidemiological *context* (4 points); identify evidence based *best practices* (7 points); contain a clear and actionable *written recommendation* (5 points); and include accountability for delivery and *follow-up* on the recommendation (4 points). Recommendations could thus be scored in terms of quality on a scale from 0 to 20 points. We compared baseline and follow-up quality, across groups, in terms of a mean total score and mean scores by domain.

All analyses were conducted using SAS software (SAS Institute Inc). Confidence intervals (95% CI) were adjusted to account for clustering of cases within CDR teams through the use of robust variance estimates.[20]

RESULTS

There was no significant difference in the proportion of injury specific data elements completed between comparison (0.73, 95% CI 0.71 to 0.83) and intervention (0.77, 95% CI 0.65 to 0.81) teams at baseline. However, completion rates were higher among intervention team cases at follow-up. The mean proportion complete for intervention team cases in follow-up was 0.88 (95% CI 0.79 to 0.96), while in comparison team cases this proportion was 0.56 (95% CI 0.53 to 0.60). Within each intervention group, completion of prevention relevant data elements varied by injury type (table 3).

Scores of the quality of injury prevention recommendations generated also differed by intervention group status. As shown in table 4, the mean quality score in recommendations generated by intervention teams increased significantly from 4.3 to 7.6. Comparison team recommendation scores were 4.0 at baseline and 3.7 at follow-up, a change that was not statistically significant. The quality of prevention recommendations submitted by intervention teams improved in the domains 'reference to best practices' and 'specificity and clarity of written recommendations'. No change was noted in any domain among comparison group teams.

DISCUSSION

CDR teams can contribute to injury prevention by analysing local child injury risks and catalysing an appropriate response. An intervention building off the strengths and resources present in most teams (or in their communities) was associated with improved collection of prevention relevant data elements as well as improvement in the quality of injury prevention recommendations thus generated.

Our intervention included process improvement and collaborative learning techniques that have become commonplace in quality improvement circles.[17] In addition, we provided access to decision support resources and promoted the use of templates[21] and prompts to focus the team on crafting an effective written recommendation. Team members were enthusiastic and creative in identifying barriers to prevention efficacy as well as proposing solutions that could be adopted and trialled by the group of intervention teams as a whole.

Table 3 Mean proportion of prevention oriented data elements completed at follow-up by intervention status and injury death mechanism

	Comparison		Intervention	
	Mean	95% CI	Mean	95% CI
Overall	0.56	(0.53 to 0.60)	0.88	(0.79 to 0.96)
Drowning	0.59	(0.45 to 0.73)	0.75	*
Homicide	0.73	*	0.82	(0.66 to 0.97)
Suicide	0.41	*	0.94	(0.92 to 0.95)
Motor vehicle occupant	0.55	(0.50 to 0.61)	0.95	(0.90 to 1.00)

*Too few cases to calculate accurate CIs.

Table 4 Mean quality of recommendation score (possible range 0–20), by intervention status and domain

	Comparison				Intervention			
	Baseline		Follow-up		Baseline		Follow-up	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Overall	**4.0**	**(2.5 to 5.3)**	**3.7**	**(2.2 to 5.2)**	**4.3**	**(3.4 to 5.1)**	**7.6**	**(6.7 to 8.5)**
Context	0.6	(0.4 to 0.9)	1.0	(0.8 to 1.3)	0.7	(0.6 to 0.8)	0.8	(0.7 to 1.0)
Best practices	2.1	(1.5 to 2.8)	1.6	(0.2 to 2.9)	2.0	(1.2 to 2.7)	3.8	(3.0 to 4.6)
Written	1.1	(0.5 to 1.6)	1.1	(1.0 to 1.3)	1.2	(0.9 to 1.6)	2.7	(2.3 to 3.2)
Follow-up	0.1	(0.0 to 0.3)	0.0	(0.0 to 0.0)	0.1	(0.0 to 0.2)	0.3	(0.0 to 0.7)

Our before and after measures of impact are, of course, limited in scope and generalisability. Although all intervention teams wanted to participate in the project, not all of the similarly motivated and functional county teams were selected; we opted to maximise geographic and sociodemographic diversity, thus overcoming some bias attributable to self selection. Our intervention was also overshadowed by a dramatic change in state level funding for the CDR process. Some comparison teams not receiving intervention benefits may have underperformed in the face of limited state support.

Our data abstraction was conducted by a single reviewer. This served to improve consistency in abstraction practices but could also propagate undetected errors. In addition, although reports were de-identified to protect subject confidentiality, the reviewer might have been able to deduce which CDR team submitted each report. We thus could not guarantee that the reviewer was always blinded to intervention status.

We cannot point to specific intervention elements that were associated with changes in the outcomes we measured. We understand that teams differed in their use of resources and processes but we did not measure this in a way that could be used to interpret our results. In addition, some outcomes (such as a documented plan for 'follow-up' of recommendations) may have been falsely low in both groups because the state data collection form had no field suitable for recording this information. Finally, although it seems a necessary intermediate step, we do not know whether improvements in the quality of prevention recommendations generated by local child injury death review will actually result in better local policies or support for proven injury prevention programmes.

Our study suggests that modest changes in CDR team structure and function can result in measurable increases in the quality, specificity, and prevention utility of completed case reviews. A consistent and sustained focus on injury prevention was reflected in the increase among intervention teams in the areas of data collection and reporting with respect to injury specific circumstances and potential countermeasures. The quality of written recommendations generated was also significantly improved. Teams are best positioned to advocate for effective prevention strategies if they are aware of available best practices and have the skills to formulate effective recommendations.

In the USA, most CDR teams were originally convened to perform an investigative role in reviewing child deaths. Core membership often reflects this emphasis, and typically includes representation from public health, the medical examiner's office, law enforcement, child protection, and criminal prosecution. Intervention teams added new members to deepen their prevention expertise. Examples include injury prevention personnel from local health departments or emergency medical services; traffic safety engineers; prevention advocates (Safe Kids, Injury Free Coalition for Kids, SIDS Foundation); and health promotion personnel from local schools.

Because most CDR teams do not carry out specific prevention programmes in their communities, recommendations about prevention strategies need to be carefully crafted, evidence based and directed towards individuals or organisations able to implement the suggestion. Some teams opted to hand their findings over to a 'prevention action team' composed of members ready to implement prevention oriented policies and programmes. Others used a structured template for writing recommendations to allow them to approach this task in a disciplined manner.

Teams thus moved from ineffective recommendations, such as "More teens should wear seat belts" , to recommendations that are specific, actionable, and assigned to a responsible actor, such as "The CDR Team Coordinator will write a letter to the State Patrol asking for county-specific data on enforcement of primary seatbelt laws among teens with intermediate licenses".

A large proportion of CDR in the USA involves injury related death. Because CDR teams have access to local data and an appreciation of the local environmental and political context, they may be ideally positioned to turn the tragedy of child

What is already known on the subject

- Child death review (CDR) teams commonly encounter injury related child deaths.
- There are few published examples of injury prevention activities undertaken in response to CDR findings.
- Elements of CDR team membership, functioning, and reporting may contribute to limited effectiveness and documentation of injury prevention activities.

What this study adds

- CDR teams are adept at identifying barriers to their prevention effectiveness and suggesting improvements to address these barriers.
- Collaborative process improvement and web based access to injury prevention decision support resources led to measurable improvements in team function and in the quality of recommendations generated.
- Carefully crafted findings and recommendations are an important tool for CDR teams to effect injury prevention in their communities.

injury death into a catalyst for evidence based and locally relevant injury prevention activities. An important component in this process is the generation of carefully crafted findings and targeted recommendations. Our work suggests that this process can be analysed, measured, supported, and improved.

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Competing interests None.

Ethics approval This study was conducted with the approval of the University of Washington Human Subjects Review Committee.

Contributors BDJ conceived the project, designed the study, obtained funding, oversaw the project and drafted the manuscript; DP participated in the data collection, conducted the analyses, drafted sections of the manuscript, and critically reviewed the manuscript for content; EB, SJW, LQ participated in the study design and data collection, and critically reviewed the manuscript for content.

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