EVALUATION OF AN INTERVENTION TO IMPROVE PARENT/CARER AWARENESS OF CHILD PEDESTRIAN RISK

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ABSTRACT

Child pedestrian safety is a continuing road safety problem. This research is an evaluation study of the effects of a knowledge-based intervention suitable for community use to address child pedestrian safety. The objective of the intervention was to increase awareness of parents/carers of young children about the risk of child pedestrian fatalities and about their role in limiting children's exposure to risks around roads and vehicles. The intervention included posters, signage and information booklets for parents/carers containing messages about managing safety risks for children around vehicles around roads, carparks and driveways. The evaluation involved anonymous, electronic pre and post intervention surveys of parents/carers of children who attended daycare or preschools in seven Local Government areas in NSW, Qld and Victoria. The results provided evidence that the intervention was effective for increasing parents/carers awareness about their role in keeping child pedestrians safe. Comparing pre-and post-intervention surveys, more parent/carer participants judged that children were not safe to cross a road independently until 10 to 11+ years of age after they had seen the intervention. After the intervention, parents/carers also showed increased awareness of the risk for children around carparks, driveways and roads compared to pre-intervention. Importantly, these improvements in judgements of risk for child pedestrians were shown by survey participants who could recall seeing the intervention materials, but not by participants who did not recall the intervention so confirming that the intervention was of benefit. Awareness of risk around driveways was markedly lower than for roads and carparks both before and after the intervention suggesting that driveway safety needs more action. The study also provided insights into parent/carer's views about strategies for supervising child pedestrians which may be useful in designing further interventions to reduce the serious issue of child pedestrian fatalities.

INTRODUCTION

Child pedestrian safety is continuing problem in Australia and globally. The WHO estimates that across the world, a child is killed on roads around every four minutes (WHO, 2015) and that in 38 percent of these, the child was a pedestrian. In Australia, land transport crashes are the leading cause of death for children between the ages of 1 and 14 years (AIHW, 2021) and while most (59%) occur when the child is passenger, or bystander to the crash, a significant percentage (29%) occur when the child is a pedestrian and may play an active role in the crash (AIHW, 2020). These statistics demonstrate the need to do more to prevent these injuries.

It is well-recognised that children when pedestrians are especially vulnerable to crashes because their smaller stature makes them physically vulnerable and their early stage of development which means they lack the skill and cognitive maturity to cope with the demands of the road environment makes them functionally vulnerable (Peden, 2004; Stevenson, Sleet and Ferguson, 2015; Muir, et al. 2017). These are fixed and unchangeable characteristics of the child at the time of the crash, but the causes of child pedestrian crashes involve more than factors relating to the child.

In-depth studies of the circumstances of child pedestrian fatalities show that multiple factors are involved. A study of child road traffic fatalities between 2001 to 2012 in Victoria using coronial case information found that the causes of child pedestrian injury involved multiple factors, with the most common being rural areas, the child attempting to cross the road and no supervision (Chang, et al., 2018). A national study of child pedestrian fatalities in Australia using the same coronial information system over a longer period, 2001 to 2019, also found that the circumstances of these crashes involved a complex set of contributing factors (Williamson, Koch et al, 2023). This study showed that all crashes involved a set of interacting factors that coming together to make the crash possible. These included factors relating to the driver and vehicle involved, the environmental circumstances of the location of the crash and the factors that allowed the child to be in a risky situation near roads and vehicles.

This last set of factors is often summarised as the level of supervision of the child and is a potentially contentious contributor to the causes of crashes. For example, in the WHO's guidance document on the 10 Strategies for Keeping Children Safe on the Road (WHO, 2015), supervision is listed tenth, with the additional caveat that supervision alone cannot replace the other nine interventions. Unfortunately, this view fails to acknowledge that for child pedestrian safety, especially for young children, supervision can reduce or at least manage the child's exposure to road and vehicle risk so in most cases, crashes are avoided. The cautious acknowledgement of the role of supervision put forward by the WHO and by others may be a response to the argument that parents and carers cannot actively supervise children 24 hours a day and seven days a week. This stance, however, should not lead to downplaying supervision as an important component of actions to keep children safe.

This argument is reinforced by evidence from multiple studies that, in a very large proportion of child pedestrian fatalities, the child was not being supervised. For example, Routledge et

al (1974) in a study of found that only 10 percent of children were accompanied by an adult when they were injured in a pedestrian crash. The two coronial studies described above both found lack of supervision by an adult was a factor in the majority of fatal pedestrian crashes (Chang et al, 2018; Williamson et al, 2023). In addition, a New Zealand study of child pedestrian injuries occurring on the journey between home and school showed that when accompanied by an adult, the risk to children was half that of children who were not accompanied (Roberts, 1995). Supervision is clearly an important factor in child pedestrian injury crashes and strategies are needed to improve supervision of children around roads and vehicles.

Many road safety campaigns focus on increasing the awareness of road users about the risks around roads and vehicles. For children, the focus is on raising awareness of parents and carers about risk for children around roads and vehicles and encouraging them to supervise and take action to keep children safer. Parents/carers are the target here because children under around 11 years are often developmentally not yet able to interpret risk. Awareness-raising campaigns have been challenged, however, by arguments that raising awareness produces little, if any, benefit in road safety outcomes. As pointed out by Job (2023), 'in road safety, attempts to change behaviours through increasing awareness of risk fail to achieve the desired behaviour change even though self-reports of attitudes change and approval of such campaigns is high'. While it is important to recognise the limitations of raising awareness of risk, it is a first and integral step in encouraging safe behaviour, especially without the motivating influence of enforcement. In the absence of penalties and enforcement, road users will not engage in behaviours necessary to increase safety if they do not believe the behaviour is necessary or are not aware of the risk associated with failing to engage in the safe behaviour. This applies in the case of supervision of children around roads and vehicles, where parents/carers who do not think there are risks for children around their local roads, driveways and carparks, are far less likely to take steps to protect them. Raising parent/carer awareness of risk for children around vehicles and roads and the need to supervise and protect children is therefore one justifiable approach to reduce child pedestrian injury.

In practice, there have been relatively few studies of the effects of educational interventions to increase awareness of risk of child road injury, although some studies have examined child injury in general. A systematic review of parenting interventions to prevent unintentional injuries for children (Kenrick et al, 2013) found 22 relevant studies, but most targeted socially and economically disadvantaged communities rather than the community in general and only two assessed the effects of knowledge-based or educational interventions, although both studies showed benefits of their intervention. A more recent randomised control study of the effects of an educational video on paternal involvement in childcare showed reductions in unintentional child injury in the home (Kawahara, et al, 2022). These results suggest that a knowledge-based or educational intervention may be successful for enhancing awareness of risk relating to roads and vehicles as well.

Two Australian surveys of parental beliefs about risk for child pedestrians suggest that many parents and carers under-estimate risk for their children around roads and vehicles. For example, Muir et al. (2010) found that while 85 percent responded that it was unsafe for a

child walking onto a road from behind parked cars, this dropped to 59 percent for crossing a local street with no pedestrian crossing and 27 percent for walking across a neighbour's driveway. Soole et al (2011) showed that although most parents felt children should be at least 10 years old to cross the road independently (68%), 25 percent of parents would allow 8- to 9-year-olds to cross the road alone. Further, parents reporting that they hold their child's hand all or most of the time dropped from 100 percent for five-year-olds to just over half for 8-year-olds (59 percent). These results suggest that a knowledge-based intervention is needed to improve parent/carer awareness of risk for child pedestrians.

The objective of this study was to evaluate the effectiveness of a knowledge-based intervention for parents and carers of children for increasing awareness of the risk of vehicles and roads for children. The study involved a pre- and post-intervention survey design using a multiple baseline approach. It involved ten childcare or preschool centres in each of seven of the local government areas with the highest numbers of child pedestrian fatalities. The aim of the study was also to investigate in more depth parent/carer's beliefs about strategies that should be used for managing risk for child pedestrians.

METHOD

Study design

The intervention involved a public awareness campaign conducted in seven Local Government Areas (LGA's). The LGA's were selected as they were in the top 20 LGA's in Australia for child pedestrian fatalities based on Australian Bureau of Statistics data. These include: Campbelltown (NSW), Georges River (NSW), Midcoast (NSW), Central Coast (NSW), Hawkesbury (NSW), Logan City (QLD) and City of Casey (VIC). Each LGA was invited to participate in the project, and all agreed. Each LGA agreed to recruit 10 preschools or childcare centres in their area.

The evaluation used a Stepped wedge or multiple baseline approach in which the intervention occurred in a staggered fashion with a randomly selected pair of LGA's participating first, followed by a further two rounds involving two, then three LGA's respectively (see Table 1). For each round of sites, the evaluation commenced with a short, anonymous online survey in each childcare centre involving parents/carers relating to their awareness of child pedestrian fatality risk. The survey was advertised widely especially in media relevant to parents and carers of children aged up to the age of 11 years.

For each round of LGA's and childcare centres, the survey was open for two weeks then the information intervention commenced. The intervention included a variety of media both electronic, print and signage, each conveying short messages relating to child pedestrian safety. Two weeks after the intervention commenced, a post-survey was conducted to evaluate any changes in parent/carer community awareness of child pedestrian safety following the intervention. The post-survey was available for a two-week period. The same approach of pre-survey, information intervention then post-survey was used for the next two rounds of two, then three LGA's. The commencement of the study in the final LGA (LGA 7) was delayed by two weeks to allow for approval processes to be completed in all participating childcare centres.

The research had ethics approval from the UNSW Sydney Human Research Ethics Committee (Approval number: HC 220742).

Table 1: Evaluation plan showing timing of Pretest (X) and Posttest (✸) for each pair of LGA sites. Shaded area shows Intervention in operation.

		Time in 2-week blocks									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Round 1	**LGA 1**	X		✸							
	LGA 2	X		✸							
Round 2	**LGA 3**				X		✸				
	LGA 4				X		✸				
Round 3	**LGA 5**							X		✸	
	LGA 6							X		✸	
	LGA 7								X		✸

Survey instruments and participant recruitment

Both pre- and post-surveys were electronic using Qualtrix software. Parent/carers in each childcare centre in each LGA were invited to participate in the survey using advertisements in print and electronic social media for each preschool and childcare centre as well as local newspapers and community newsletters. Recruitment involved an initial invitation and two reminders over the two-week period that the survey was open. The surveys were anonymous and brief to encourage participation. The survey made clear that it was being conducted by the not-for-profit Little Blue Dinosaur Foundation with the assistance of the UNSW Sydney.

The pre- and post-intervention surveys contained the same questions relating to the age at which the parent/carer believes a child is able to cross the road independently, a series of questions on how risky they believe it is for a child under 11 years of age to be around local roads, carparks and driveways as well as questions about whether they have children or grandchildren. The post-intervention survey also contained questions about what they believe parents and carers of young children should do to keep the child safe around roads and vehicles. These questions focussed separately on children aged 1 to 4 years, 5 to 7 years and 8 to 11+ years as well as on different locations: roads, carparks and driveways.

Analysis

The analysis looked first at the effect of the study design by comparing responses for each Round of the data collection. It then looked at the effect of the intervention on two main dependent variables: age that children can cross a road independently and ratings of risk around roads, carparks and driveways. It then looked at the influences of other factors, whether the participant had children, the number of children and whether they were older or younger (above or below 5 years of age). The final analysis looked at participants beliefs about strategies that should be adopted for younger and older children around different locations: roads, carparks and driveways. Where the measure involved frequency or count data, Chi-squared tests were used and when it involved interval or ratio data, t-tests, analysis of variance (ANOVA) or Multivariate analysis of variance (MANOVA) was used.

RESULTS

A total of nearly 700 responses were made to the surveys. The pre-intervention survey attracted over 450 responses, whereas response to the post-intervention survey was considerably smaller, with around half of the responses as for the presurvey. The participation varied by the round of recruitment, with most responses in total from the three LGA's in the third and last round but this round also generated proportionately the greatest response to the post-survey (see Table 2).

Table 2: Participation in pre and post surveys at each round of the research.

	Round			
PRE/POST Survey	1	2	3	**Total**
Pre-survey	119 (68.4%)	115 (87.7%)	222 (60.9%)	456 (69.5%)
Post-survey	55 (31.6%)	16 (12.3%)	142 (39.1%)	213 (31.8%)
Total	174 (100%)	131 100%)	364 (100%)	669 (100%)

The first stage of the analysis was to check for differences between participant's views about child pedestrian safety between Rounds of the survey. Analysis by Chi-square test of survey participant's judgements about the age children can independently cross the road showed no statistically significant difference between Rounds of the study ($X^2_{(22)}$=29.27, ns, see Table 3). Similarly, analysis of participant views of the riskiness for children up to the age of 11years around local carparks, driveways and roads showed no statistically significant differences between Rounds (Repeated measures MANOVA: $F_{(2,409)}$=0.52, ns). As there were no differences between Rounds, the results for all Rounds of the survey distribution were combined for analysis of the effects of the intervention.

Table 3: Participants response on the age a child is able to cross the road independently for each Round of the survey.

Childs Age	**Round 1**		**Round 2**		**Round 3**		**Total**	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
1 year	1	0.8%	0	0.0%	1	0.5%	2	0.4%
2 years	0	0.0%	1	0.9%	3	1.4%	4	0.9%
3 years	1	0.8%	1	0.9%	1	0.5%	3	0.7%
4 years	1	0.8%	2	1.7%	4	1.8%	7	1.5%
5 years	2	1.7%	1	0.9%	4	1.8%	7	1.5%
6 years	1	0.8%	6	5.2%	14	6.3%	21	4.6%
7 years	7	5.9%	9	7.8%	21	9.5%	37	8.1%
8 years	26	21.8%	14	12.2%	24	10.8%	64	14.0%
9 years	1	0.8%	8	7.0%	14	6.3%	23	5.0%
10 years	22	18.5%	21	18.3%	51	23.0%	94	20.6%
11 years	44	37.0%	36	31.3%	70	31.5%	150	32.9%
Missing	13	10.9%	16	13.9%	15	6.8%	44	9.6%
Total	119	100.0%	115	100.0%	222	100.0%	456	100.0%

Table 4: Participant responses on a scale from 0 (no risk) to 100 (highly risky) to the question: How risky do you believe it is for children under 11 years to be around different locations, showing mean (and standard deviation) ratings.

Location	Round	n	Mean	Std. Deviation
Your local Carparks	1.00	106	84.92	16.58
	2.00	100	82.48	19.86
	3.00	210	83.81	18.99
	Total	416	83.77	18.60
Your Driveway	1.00	106	64.88	29.15
	2.00	99	62.06	28.31
	3.00	208	64.26	28.16
	Total	413	63.89	28.41
Your local roads	1.00	105	85.66	18.53
	2.00	100	83.74	20.33
	3.00	209	84.71	19.82
	Total	414	84.71	19.59

Analysis of the effectiveness of the knowledge-based intervention

Comparison of participant's views of child pedestrian safety before and after the knowledge-based intervention showed a small, but statistically significant improvement in the percentage of participants judging that children should be aged 10 or more to cross the road independently ($X^2_{(11)}=20.73$, $p<0.036$, see Figure 1).

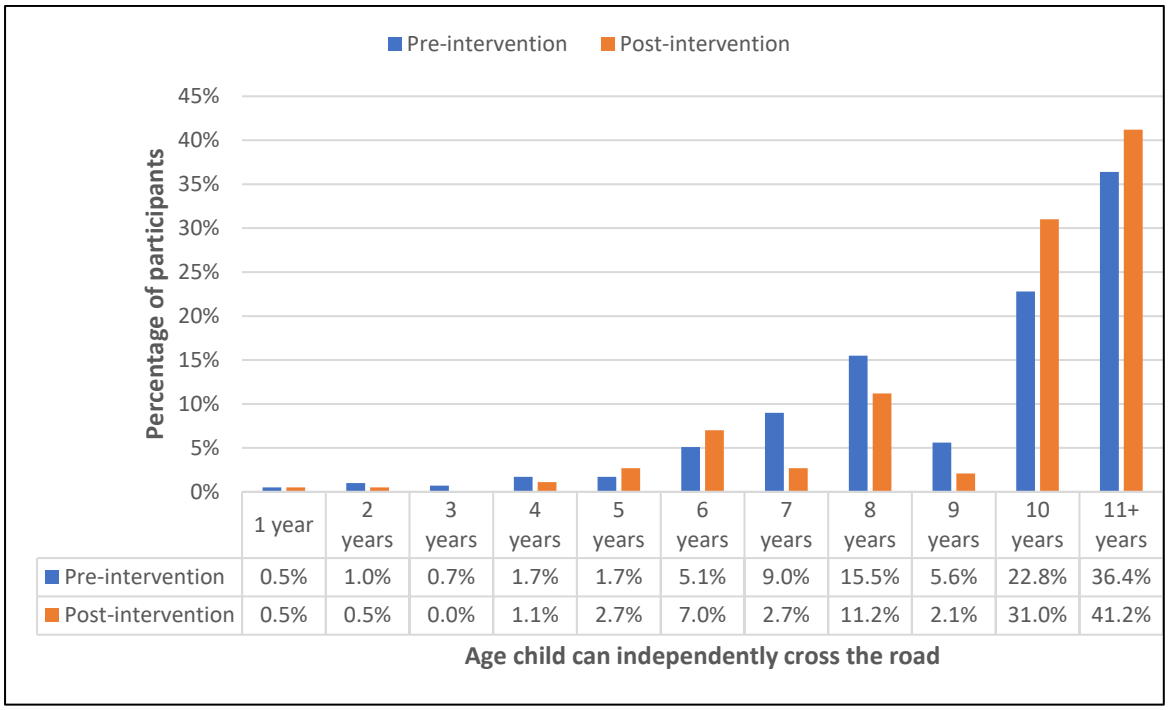

Figure 1: Comparison of participant's judgements of the age children are able to independently cross the road pre and post the knowledge-based intervention.

Participant ratings of the riskiness for children around areas where they might encounter vehicles also increased significantly between pre-intervention and post-intervention surveys (see Figure 2). Analysis showed a significant overall increase in risk ratings for all locations post-intervention compared to pre-intervention (MANOVA: $F_{(1,597)}=4.96, p<0.026$). Overall ratings also differed significantly between locations. Participant ratings of risk around driveways for both pre and post-intervention surveys were significantly lower than for carparks or roads which did not differ ($F_{(1,597)}=332.45, p<0.0001$).

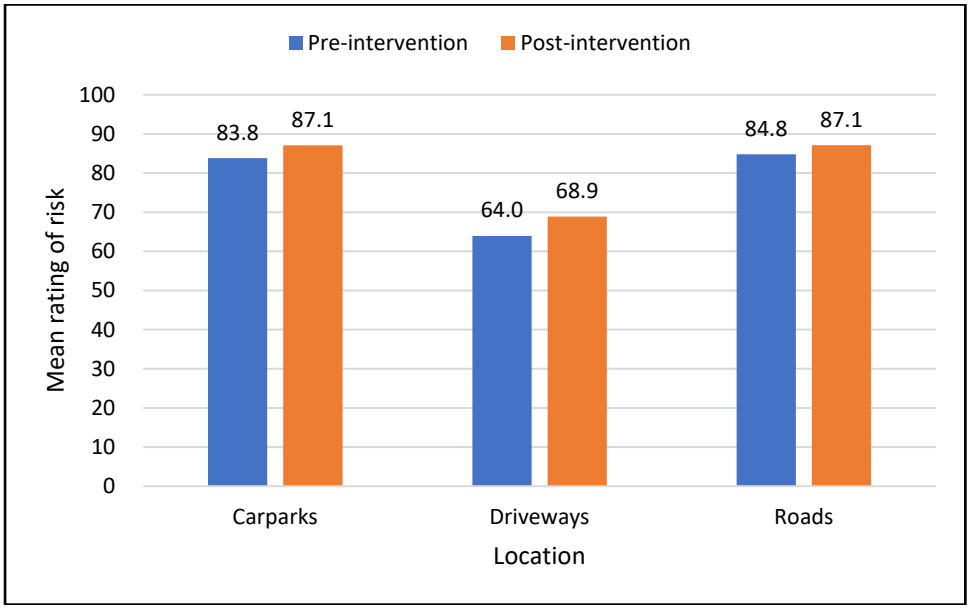

Figure 2: Mean participant ratings of riskiness on an increasing scale of 0 to 100 for children up to 11 years of age around local carparks, the driveway and local roads when surveyed pre and post the knowledge-based intervention.

The analysis investigated the relationship between recall of the intervention in the post-intervention survey and changes in participant's responses. There was good recall of intervention materials amongst participants, with around 85 percent recalling at least one element (see Table 5). Most recalled just one element (49.5%) but around one-fifth recalled two or three (20.6%). The element recalled most often was the poster/signage displayed around the childcare centre followed by the newsletter, then Facebook.

Table 5: Recall of intervention materials by participants showing number and percent recalling seeing each type of element.

	n	%
Recall some element	183	85.9%
- **Signage**	128	60.1%*
- **Facebook**	23	10.8%
- **Newsletter**	50	23.5%
- **Other**	9	4.2%
No recall	30	14.1%
Total	213	100%

* Recall across elements does not sum to 100% as multiple responses were possible.

The analysis investigated whether there was a difference in views about child pedestrian safety between the participants who could recall seeing the intervention materials and those who could not (see Table 6). This showed that participants who did not recall the campaign were statistically significantly more likely to respond that younger children were able to cross the road independently ($X^2_{(3)}$=10.99, p<0.012). Three-quarters of participants who did not recall the intervention campaign judged that children between 6 and 10 years of age could cross the road independently compared to half of those who recalled the campaign.

Table 6: Participant judgements of the age when children can independently cross the road for participants who could recall the information campaign and those who could not.

		Campaign recalled at all?	
Age of independent road crossing		**Yes**	**No**
0yrs -5yrs	n	8	0
	%	5.4%	0.0%
6yrs-8yrs	n	25	12
	%	16.9%	41.4%
9yrs-10yrs	n	49	10
	%	33.1%	34.5%
11+ yrs	n	66	7
	%	44.6%	24.1%
Total	n	148	29
	%	100.0%	100.0%

Similar analysis for judgements of the riskiness of carparks, driveways and local roads for children under 11 years (see Table 7) showed that although ratings of risk for both carparks and local roads were higher for those who recalled the campaign than those who did not, these differences were not statistically significant in any of the three locations ($t_{(177)}$=1.0,ns; $t_{(177)}$=-0.33,ns; $t_{(177)}$=1.54,ns).

Table 7: Judgments of risk around carparks, driveways and local roads for participants who recalled the campaign and those who did not.

Location	Campaign recalled	n	Mean	Std. Deviation
Risky carparks	Yes	149	87.13	14.09
	No	30	84.23	16.48
Risky driveway	Yes	148	68.41	27.89
	No	30	70.23	27.65
Risky roads	Yes	148	87.85	17.65
	No	30	82.43	17.19

Analysis of factors that influence participants views of child pedestrian safety risk.

The analysis examined factors that might influence participant views of the age at which children are able to cross the road independently. This included the participant's number of children and whether they had young children on the basis that experience with children, especially current experience with young children, may increase awareness of child pedestrian safety risk. Analysis of the influence of the number of children showed a difference between result for the pre-intervention and post-intervention surveys. As shown in Figure 3, participant views about the age at which children can cross the road independently in the pre-intervention survey did not vary with the number of children ($X^2_{(6)}$=6.12, ns), but did vary with the number of children in the post-intervention survey ($X^2_{(6)}$=13.11, p<0.04). In the post-intervention survey, participants with more than three children were significantly more likely to report that younger children can cross the road independently compared to participants with fewer children. At post-intervention, most participants with more than three children judged independent crossing at less than 10 years whereas at pre-intervention this group, like participants with fewer children at both pre- and post-intervention, cited 10 or 11+ years as the age a child can independently cross the road.

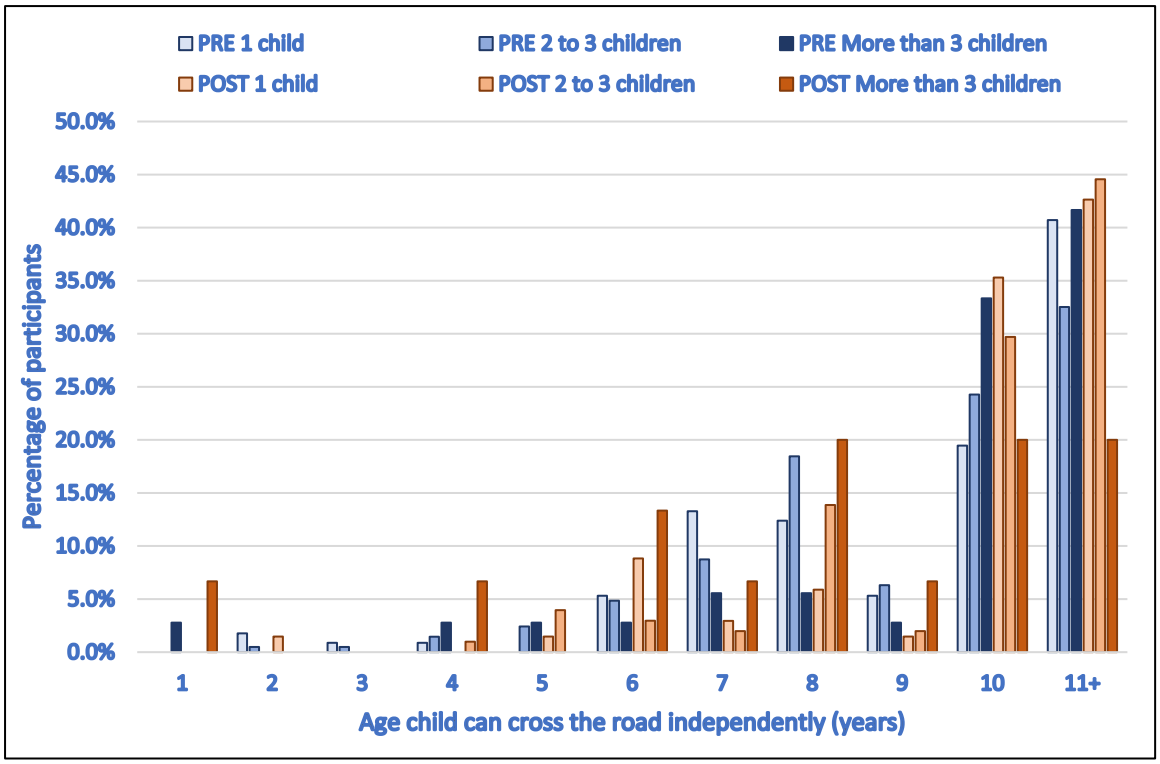

Figure 3: Participant judgements made pre- and post-intervention of the age a child can cross the road independently for participants with one, two to three and more than three children.

Similar findings were shown for participants ratings of risk for children around various locations (see Figure 4). This analysis showed that risk ratings varied with increasing number of children but differed between pre- and post-intervention surveys. At pre-intervention there was no difference between participant's risk ratings in any location ($F_{(2,413)}$=0.19,ns; $F_{(2,410)}$=0.70,ns; $F_{(2,411)}$=0.73,ns for carparks, driveways and local roads respectively), but did vary in the post-intervention survey ($F_{(2,186)}$=9.23,$p<0.001$; $F_{(2,185)}$=5.72,$p<0.004$; $F_{(2,185)}$=3.16,$p<0.045$ for carparks, driveways and local roads respectively). Again, at post-intervention, participants with more than three children judged the risk for children as lower in all locations, especially for carparks and driveways.

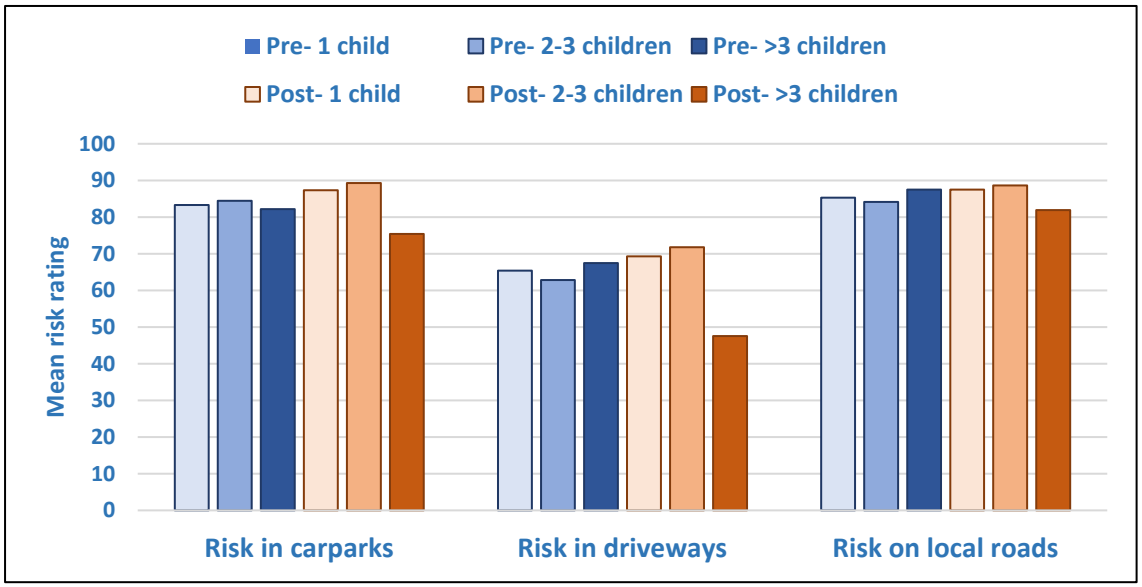

Figure 4: Participant ratings of the risk children in carparks, driveways or local roads pre- and post-intervention for participants with one, two to three or more than three children, showing mean risk ratings on a scale of increasing risk from 0-100.

Analysis of the influence of experience with young children showed no significant differences between the views of participants with children 5 years and younger and those who have older children at pre- or post-intervention.

Post-intervention beliefs about the strategies needed to keep child pedestrians safe.

The post-intervention survey included questions about participant's beliefs about what parents/carers should do to keep children safe around roads and vehicles. Figure 5 shows the participant's beliefs about strategies for supervision including holding the child's hand, walking closely and allowing them to walk unsupervised for carparks, driveways and local roads.

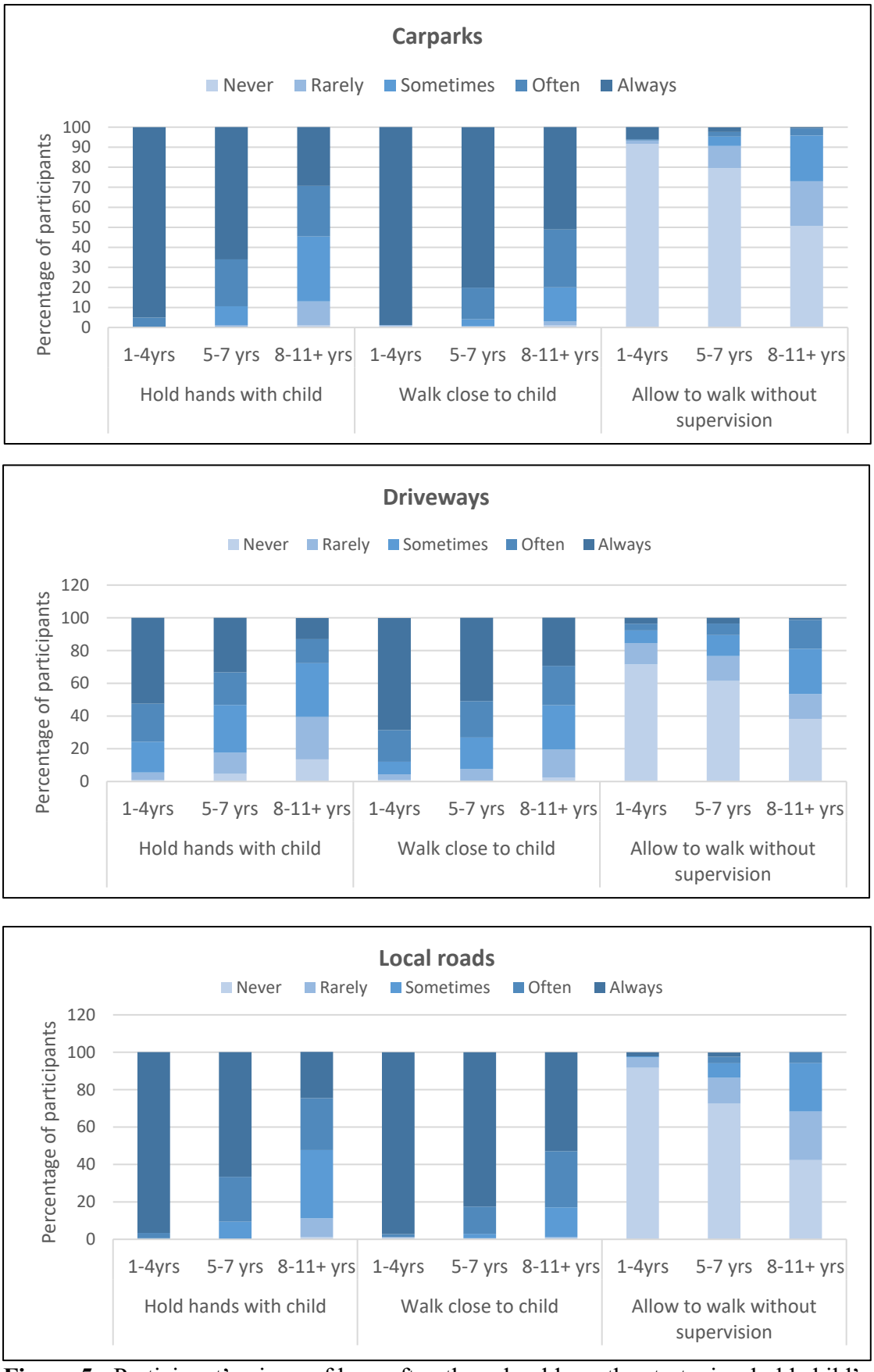

Figure 5: Participant's views of how often they should use the strategies: hold child's hand, walk close to the child, and allow the child to walk without supervision for children aged 1 to 4, 5 to 7 and 8 to 11+ years when they are around carparks, driveways or local roads.

For the analysis of these results, the participant's ratings were converted to ordinal scores (where never=1 and always=5) and a MANOVA performed to look at whether ratings varied with the age of the child and location. These results showed a main effect of the age of the child for each strategy ($F_{(2,1545)}$=295.8,$p<0.0001$; $F_{(2,1545)}$=121.7,$p<0.0001$; $F_{(2,1545)}$=67.9, $p<0.0001$ for holding hands, walking closely and allowing no supervision respectively). With increasing age of the child, there was a reduction in participants reporting that they should always hold the child's hand or walk closely, and a similar increase in participants responding that they should never allow the child to walk without supervision for all locations. Around local roads and carparks almost all participants responded that they should always hold the child's hand and walk closely for 1- to 4-year-old children, but for 8 to 11+ year olds, this dropped to half reporting that they should walk closely and only around one-quarter that they should hold the child's hand. While almost all participants reported that they would never allow a 1- to 4-year-old to walk without supervision, this had dropped to around half for 8 to 11+ year olds.

The results also showed a main effect for location ($F_{(2,1545)}$=147.1,$p<0.0001$; $F_{(2,1545)}$=95.4, $p<0.0001$; $F_{(2,1545)}$=23.2, $p<0.0001$ for holding hands, walking close to the child and allowing no supervision respectively). For local roads and carparks participant's responses were very similar, but the pattern of responses was different for driveways for all three strategies. Participants made more risky judgements in the strategies they should adopt around driveways compared to the other locations. While the age-related patterns also occurred for driveways, fewer participants reported that they would use the safest strategies. Only two-third of participants reported that for 1- to 4-year-olds they should always walk closely and never allow a child to be unsupervised in a driveway and even fewer (around half) reported they should always hold hands with a 1- to 4-year-old in a driveway.

The analysis also looked at the relationship between the participant's number of children and their views about strategies that should be used for children in each age group and location and found no statistically significant differences between participants with one, two to three and more than three children.

DISCUSSION

This study demonstrated that a knowledge-based intervention can increase the awareness of the risk for children around vehicles and roads. After the intervention significantly more participants judged that children need to be 11 years of age or higher before they can independently cross a road compared to responses before the intervention. Ratings of the level of risk also increased significantly post-intervention compared to ratings of risk before the intervention and this occurred for all locations tested: roads, carparks and driveways. These results suggest that the intervention did increase the awareness of risk for many of the parents/carers who participated in the survey. This conclusion is reinforced by the finding that the intervention was recalled by most participants and, most importantly, there was evidence of greater awareness of risk for those who recalled seeing the intervention compared

to those who did not. This strengthens the evidence that the intervention itself was responsible for the increase in perceptions of risk around vehicles and roads and for the wider acknowledgement amongst parents and carers that children need to be at least 10 to 11 years of age to be able to safely cross the road on their own. The research therefore supports the use of knowledge-based interventions as a productive aspect of a road safety campaign to improve parent/carer awareness of the risk for children when they are pedestrians.

While the improvements in awareness were consistent across each of the locations tested, the judged level of risk was not the same in all locations. Awareness of risk around roads and carparks was high but risk around driveways was judged significantly lower from pre-intervention and improved after the intervention only to the same extent as for the other two locations. This finding is consistent with those of the earlier study by Muir et al (2010) which also showed much lower ratings of risk around driveways. As recent analysis shows little change in the number of child pedestrian fatalities in driveways in Australia over the last two decades (Williamson et al., 2023), these findings are concerning. They suggest that parents and carers are continuing to underestimate the risk for young children around driveways and this may be a major reason for the lack of improvements in the number of driveway deaths involving children. While this study demonstrated that awareness of risk around driveways can be increased by an intervention, much more action is needed to enhance awareness at least to the levels seen for roads and carparks. The results show that driveway safety should be a specific target to improve child pedestrian road safety.

As discussed earlier, raising awareness of risk is a start, but is only one component of action needed to encourage active supervision of children to keep them safe around roads and vehicles. Furthermore, while the effect of the intervention in this study significantly improved awareness, the effect was comparatively small. More work is needed to strengthen the effect and encourage parents/carers to increase supervisory behaviour of children around roads and vehicles.

The results of this study provide some further evidence of directions for further action. The analysis showed that while most parents/carers reported that they would not allow independent road crossing until 10 or 11 years as of age and most rate risk as high, at least around roads and carparks and this strengthened after the intervention, some parents have a less cautious view. Parents/carers with more than three children showed less prudent views about risk in the survey following the intervention even though their views were no different from parents with fewer children before the intervention. It seems that parents with the most children responded differently to the knowledge-based intervention to parents with fewer children. This suggests that parents with greater experience with children may develop different perceptions about whether young children can cope with road safety risk, although these parents did not differ in their views on the strategies that should be used for children to manage safety at different ages and different locations.

The reason for these differences in risk perception for parents with more children is not clear. Possible reasons include greater experience with children with no adverse effects around roads and vehicles which may mean they have a lower perception of risk for children in these circumstances. It could be that parents with more children are busier that parents with fewer

children and so may be more tolerant of allowing children to be independent at an earlier age. Neither of these reasons however explain why parents with more children differed from others only after the intervention. Further research is needed to attempt to understand the reasons for parents with more children perceiving risk for their children differently from parents with fewer children and to understanding how the intervention might be better targeted to encouraging parents with more children to be aware of child pedestrian safety risk.

A possible limitation of the study was the relatively lower response to the post-intervention survey which was around half that of the initial pre-intervention survey. A four-week period elapsed between the invitations to participate in the pre and post intervention surveys with the intervention in-between and the invitations for the post-intervention survey made it clear that this was a follow-up survey. It may be that some participants were confused by the two surveys and so did not participate in the second. It may also be that they were simply busy and could not give up the time to complete both surveys. The number of post-intervention surveys returned, however, was sufficient to complete the analysis.

Overall, this evaluation demonstrated that the signage, and print and electronic messages about child pedestrian safety in various locations was successful in obtaining greater awareness by parents and carers of the risks for young children and of their role in reducing those risks. Although the size of the improvement in perceived risk was only moderate, the study showed that a simple one-off intervention is worthwhile. These results also highlight that more effort is needed to build on the foundations of the improvement in awareness to both increase the size of the effect and to encourage parents/carers who are still overestimating the skills of children as young as five or six years to manage road crossings independently and road and vehicle risk in general around carparks, local roads and driveways. Much more action is needed to make parents/carers aware of risk around driveways in particular as this study shows marked underestimation of risk for children in this location.

It is also important that knowledge-based interventions for parents/carers about child pedestrian safety risk are more than a one-off. For parents, the early vulnerable years of a child's life pass quickly, but at any time there are new parents with children entering them. It is essential that as parents move into the period of childrearing where their child may independently encounter roads and vehicles that parents and carers are aware of the risk and adopt the strategies needed to keep children safe. This means campaigns to increase awareness about child pedestrian risk must be ongoing and recurrent. It is not sufficient to mount campaigns every decade or so or even every few years. Child pedestrian fatalities are preventable and strategies like the intervention evaluated in this study are essential to ensure children are protected from access to roads and vehicles through enhancing parent/carer awareness and supervision.

REFERENCES

Australian Institute of Health and Welfare (2020). Australia's children. Cat. no. CWS 69. Canberra: AIHW.

Australian Institute of Health and Welfare (2021). Deaths in Australia. Cat. no. PHE 229. Canberra: AIHW. Viewed 25 June 2021, https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia

Chang, SSM. Symons, RCA. Ozanne-Smith, J. (2018). Child road traffic injury mortality in Victoria, Australia (0-14 years), the need for targeted action. Injury: 49, 604-612.

Job, RFS, 2023. Campaigns, Promotion, Awareness Raising, Education, or Training: When Are These Useful, and When Are They Not? https://www.aprso.org/document/campaigns-promotion-awareness-raising-education-or-training-when-are-these-useful-and-when

Kawahara, T. Doi, S. Isumi, A. Ochi, M. Fujiwara, T. (2022). Interventions to change parental parenting behaviour to reduce unintentional childhood injury: A randomised controlled trial. Injury Prevention, 1-8.

Kendrick D, Mulvaney CA, Ye L, Stevens T, Mytton JA, Stewart-Brown S. Parenting interventions for the prevention of unintentional injuries in childhood. *Cochrane Database of Systematic Reviews* 2013, Issue 3. DOI:10.1002/14651858.CD006020.pub3.

Muir, C., Devlin, A., Oxley, J., Charlton, J., & Koppel, S. (2010). Parents as role models in road safety. Australia: Report prepared for the RACV.

Muir, C. O'Hern, S. Oxley, J. Devlin, A. Koppel, S., Chalton, J. (2017). Parental role in children's road safety experiences. Transportation Research Part F, 46, 195-204.

Peden, M., Scurfiled, R., Sleet, D., Mohan, D., Hyder, A., Jarawan, E., & Mathers, C. (2004). World report on road traffic injury prevention. Geneva; Switzerland: World Health Organization.

Roberts I. Adult accompaniment and the risk of pedestrian injury on the school-home journey. *Injury Prevention*. 1995;1(4):242-244.

Routledge DA, Repetto-Wright R, Howarth CI. (1974). The exposure of young children to accident risk as pedestrians. *Ergonomics*. 17, 457-480.

Soole, DW. Lennon, A. Haworth, N. (2011). Parental beliefs about supervising children when crossing roads and cycling. International Journal of Injury Control and Safety Promotion, 18:1, 29-36.

Stevenson, M. Sleet, D. Ferguson, R. (2015). Preventing Child Pedestrian Injury: A Guide for Practitioners. State of the Art Reviews, American Journal of Lifestyle Medicine, 9:6, 442-450.

Williamson, A. Koch, FC. Boufous, S. Olivier, J. (2023). Analysis of the causes of fatal child pedestrian crashes for 0- to 14-year-olds in Australia, 2001 to 2019. Report for National Road Safety Innovation Fund project.

World Health Organisation (WHO), (2015). Ten strategies for keeping children safe on the road. WHO/NMH/NVI/15.3.