Is a focus on low level speeding justified? Objective determination of the relative contributions of low and high level speeding to the road toll

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Abstract

Speed is the largest single behavioural contributor to the road toll both in Australia and globally. While the community accepts that high level speeding (say 30+ km/h over the speed limit) is dangerous, there is more acceptance of low level speeding (say within 10 km/h of the speed limit) and considerable debate about the risk it poses. Broadly, the debate has not had an objective base.

Objective evidence can be reconstructed. Explicitly, data on the increasing risk of a serious crash for each increment of speeding can be combined with objective on road surveys of actual speeding behaviour. The direct multiplication of the increased risk for each 5 km/h above the speed limit by the number of drivers speeding by that amount reveals the total risk in each category.

We conducted this analysis using speed surveys from every speed limit in NSW, and several studies of relative risk of speeding. Kloeden et al.'s studies of speeding and crash risk in urban and rural environments and the Nilsson Power Model were used as the basis for determining the contribution of low and high level speeding to road related fatalities and injuries. These analyses reveal that despite the much lower risk per driver, the large number of drivers speeding at low levels makes this category of speeding a major road safety problem.

Results are discussed with regards to public attitudes to speeding and implications for policies aimed at reducing the involvement of speeding in the road toll.

Keywords

Speed, Speeding, Low Level Speeding, Relative Risk, Behavioural Factors, Attitudes to Speeding

Introduction

Speeding is a major behavioural factor contributing to road related deaths and injuries. Speed contributes to both the risk of being involved in a crash and also the severity of a crash. In NSW speeding is a contributing factor in around 40% of fatal crashes and 17% of crashes that result in an injury.

As speed increases, so does the risk of having a crash. Firstly, it is logical that as speed increases the possibility of avoiding a crash decreases due to the increase in stopping distance at higher speeds. Secondly, increases in speed can make it impossible for a vehicle to successfully negotiate even a small radius curve. It is also well known that as speed increases the risk of fatality or injury increases due to the limits of the human body to tolerate physical force. Additionally, a number of studies have quantified this relationship between increasing speed and increasing crash risk. Aarts and van Schagen[1] reviewed the available research regarding the relationship between driving speed and crash risks and concluded that of all the studies that examined the relationship between individual vehicle speed and crash risk, the studies by Kloeden et al.[2,3,4] are the most empirically sound and best describe this relationship.

Kloeden et al. employed a case-control methodology to examine the risk associated with speeding and demonstrated that there is an exponential relationship between speeding and the risk of being involved in a casualty crash. Kloeden et al.'s[2,4] study on 60 km/h urban roads demonstrated that each increase in speed of 5 km/h approximately doubled the risk of being involved in a casualty crash. Kloeden et al. later investigated the risk of speeding on rural roads with a speed limit of 80-110 km/h. This study demonstrated that the risk of

being involved in a casualty crash approximately doubled for each increase in speed of 10 km/h. These relationships are demonstrated in Figure 1.

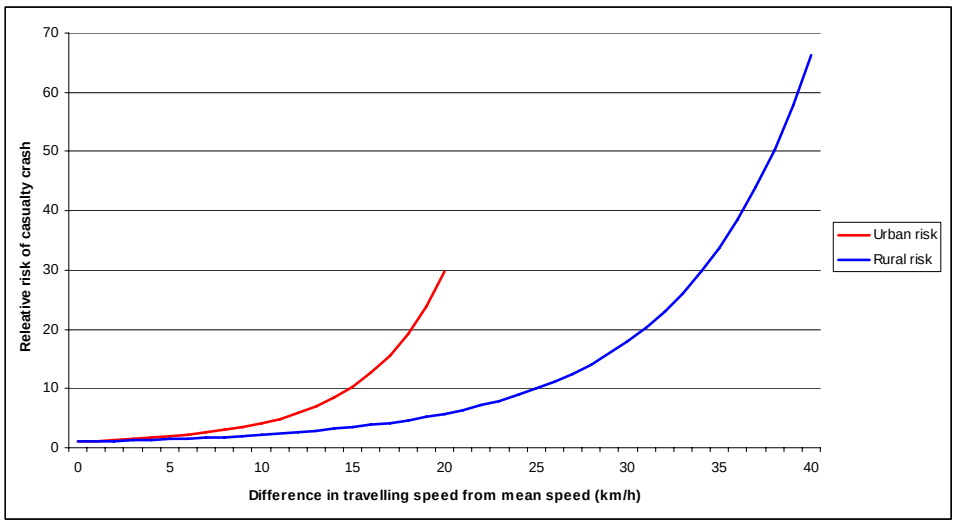

Figure 1: Risk of involvement in a casualty crash relative to the mean speed
Source: Kloeden et al.[2,3,4]

The relationship between driving speed and crash risk has also been examined by looking at the impact of a change in average speed due to a speed management initiative such as a change in speed limit. The Power model, a modified version of the formula for kinetic energy, was developed by Nilsson[5] based on the change in risk associated with reducing mean speeds due to changing the speed limit in Sweden. This model indicates that the number of crashes will increase in proportion to a specified power of the change in mean speed of vehicles. This model demonstrates that an increase or decrease in mean speed of vehicles has a significant impact on fatal and casualty crashes[6,7]. For example a mean speed increase from 100 km/h to 105 km/h would be expected to result in an increase in fatal crashes by around 20% and an increase in injury crashes by around 10%. This relationship is graphically represented in Figure 2.

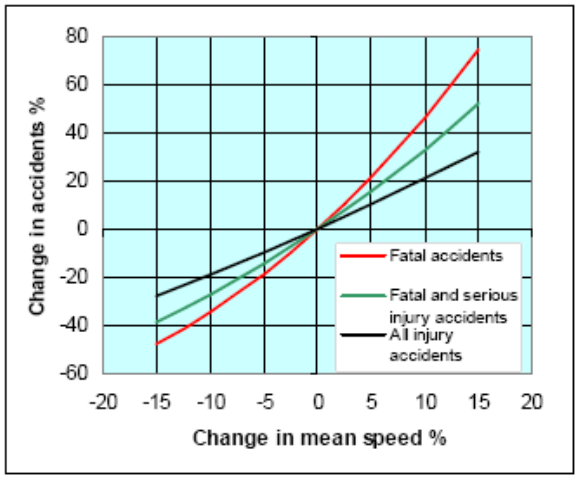

Figure 2: The relationship between mean travel speeds and crashes, the Power model
Source: Nilsson

Speed survey results and community attitude surveys demonstrate that speeding is a common behaviour. A survey of NSW drivers indicates that only 6% of drivers report never speeding, while a further 35% of drivers indicate they speed by an average of 1-4 km/h and 45% report speeding by an average of 5-9 km/h[8]. Speed surveys in developed countries show that a large proportion of drivers exceed the speed limit[9]. This is supported by speed surveys in NSW that demonstrate that only a small number of drivers exceed the speed limit by a large amount, with a large proportion of drivers exceeding the speed limit by a smaller margin (up to 10 km/h).

Despite this high level of self reported speeding behaviour, there is a strong understanding that speeding increases your risk of a crash. The 2009 national survey of community attitudes to road safety showed that 92% of Australian drivers believe that a crash will be more severe if travelling at 70 km/h rather than 60 km/h[10]. High level speeding, say at least 20 or 30 km/h over the speed limit, is certainly considered as less acceptable than speeding by a lower margin, demonstrated with 40% of drivers rating exceeding a 100 km/h speed limit by up to 10 km/h as acceptable compared to only 10% of drivers rating exceeding a 100 km/h speed limit by more than 20 km/h as acceptable.

Whilst high level speeding is undoubtedly a reckless, high risk behaviour, there is little understanding about how high and low level speeding contribute to the overall risk of speeding. Kloeden et al. reported that nearly 60% of the crash risk could be reduced if speeding up to 15 km/h over the speed limit was reduced. This highlights that low level speeding is likely to contribute a large proportion to the risks associated with speeding due to the large number of drivers speeding at low levels. More recently Paine[11] investigated the issue of low level speeding and indicated that substantial savings could be gained from reducing low level speeding.

The aim of this paper is to quantify the overall population risk associated with speeding, by analysing speed survey results in combination with our understanding of the risks associated with speeding at each speed increment bracket. Specifically, this was accomplished through direct multiplication of the increased risk of travelling above the speed limit by the number of drivers speeding by that amount to reveal the total risk by level of speeding.

Methods

We conducted this study using speed surveys conducted in NSW in 2008, NSW crash data from 2006-2008 and estimates of risk associated with speeding based on Kloeden et al.'s studies[2,3,4] and Elvik et al.'s estimates of crash risk based on the Power model.

Speed surveys

The NSW Centre for Road Safety conducts speed surveys annually. In 2008, speed surveys were conducted in August and September in 151 locations in 50 to 110 km/h speed limit zones. A 7 day sample at each location was collected (except in a small number of locations where instrument errors made a 7 day sample unattainable). Vehicle speeds were filtered to include only 'free' travelling speeds with a headway of 4 seconds or greater and speeds lower than 30 km/h and greater than 200 km/h were filtered to ensure data accuracy. It should be noted that speeds recorded above 200 km/h in speed surveys are very rare and that in this study most speeds filtered from survey data relate to vehicles with a headway of less than 4 seconds. Speeds of all vehicle types are included in the annual speed survey. For the purposes of this paper, only light vehicles were included in the analysis, as this is comparable to the vehicles selected in Kloeden et al.'s [2,3,4] studies. A summary of the speed survey data by speed limit is provided in Table 1 below.

Table 1: Speed surveys in NSW, 2008, light vehicles only

	Speed limit						
	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h
Number of sites	26	30	8	19	5	43	22
Number of observations	735,634	1,481,161	701,673	853,145	256,297	1,039,924	842,001
Mean speed	54 km/h	59 km/h	70 km/h	78 km/h	89 km/h	98 km/h	110 km/h
Standard deviation	8.1 km/h	8.4 km/h	9.4 km/h	10.0 km/h	10.1 km/h	10.2 km/h	9.6 km/h
Percentage of vehicles exceeding the speed limit	67%	39%	46%	39%	43%	41%	49%

Estimate of casualty risk based on Kloeden et al.'s studies

The relative risk of casualty crash involvement determined in Kloeden et al.'s reanalysis of travelling speed and risk of crash involvement on urban roads was used to apportion risks associated with speeding on roads with a 50, 60 and 70 km/h speed limit. Whilst Kloeden et al.'s study relates specifically to an urban 60 km/h speed limit environment, it was decided to apply these risks in 50 km/h and 70 km/h speed limit zones as these speed limit environments have a similar types of vehicle travel and could be expected to have a similar pattern of risk associated with speeding. Equation 1 from Kloeden et al.'s[4] study was used to apportion risk in these speed limits.

Equation 1

$$\text{Relative Risk of } (D) = e^{(0.1133374D + 0.0028171D^2)}$$

Where D = difference in travelling speed relative to the mean speed

The relative risk of speeding in speed limits of 80, 90, 100 and 110 km/h were based on Kloeden et al.'s study of travelling speed and risk of crash involvement on rural roads. Equation 2 from Kloeden et al.'s study was used to apportion risk in these speed limits.

Equation 2

$$\text{Relative Risk of } (D) = e^{(0.07039D + 0.0008617D^2)}$$

Where D = difference in travelling speed relative to the mean speed

For this analysis the relative risks associated with speeding were capped for vehicles detected speeding at high levels. This was done for two reasons, firstly Kloeden et al.[3,4] reported that the risk model for urban areas is accurate for speeds of up to 20 km/h over the mean speed, and that the model of risk in rural areas is accurate for speeds up to 40 km/h over the mean speed. Beyond these speeds the difference between the upper and lower confidence limits become increasingly large, and the relative risk increases to a level which appears unrealistically large (eg a risk of 8,440 times the relative risk for a speed difference of 40 km/h and 71,289 times the relative risk for a speed difference of 45 km/h in urban areas). Secondly, it is apparent from studies of fatality crash risk and impact speed that the risks reach a limit at higher speeds, where fatality risk is already very high and cannot increase to a large extent[12,13,14]. For these reasons speed differences above 20 km/h were capped at the risk of travelling at 21 km/h over the mean speed in urban areas (a risk of 37 times of travelling at the mean speed), and at the risk of travelling at 41 km/h over the mean speed in rural areas (a risk of 76 times of travelling at the mean speed).

Speed survey results were combined with Kloeden et al.'s risk equations by speed limit. Risk by each unit of travelling speed was calculated by multiplying the risk associated with that speed by the number of vehicles

recorded travelling at that speed, and determining the proportion of risk by dividing by the sum of risks. For example in 110 km/h speed zones the risk of travelling at 120 km/h was 2.2 times that of the mean speed in that zone using Equation 2, based on 120 km/h being 10 km/h over the mean speed of 110 km/h (119 km/h is a risk of 2.0, 121 km/h is a risk of 2.4 etc.). This risk was multiplied by the count of vehicles recorded as travelling specifically (rounded to the nearest whole number) at 120 km/h (ie, 17,298 vehicles at 120 km/h) to reveal a risk of 38,117, which was divided by the sum of risks recorded (888,696) to determine that 4.3% of the risk of speeding in 110 km/h speed zones can be attributed to drivers travelling at 120 km/h. The risk calculated for each individual speed over the speed limit was then aggregated by the NSW speeding offence bands.

Estimate of casualty risk based on the Power model

A risk model based on the Power model was developed as a comparison to the risk model based on Kloeden et al.'s studies of risk. The Power model describes the relationship between the mean speed and crash rate. Whilst it is not directly applicable to the relationship between a specific level of speeding and crash risk, this analysis was conducted as a comparison to the risk model based on Kloeden et al.'s studies. The estimate of power used in the analysis in this paper was the power estimate for fatalities provided by Elvik of 4.5. The modified equation used for this analysis is provided in Equation 3 below:

Equation 3

$$\text{Relative Risk of } (D) = \left(\frac{ObservedSpeed(D)}{ObservedMeanSpeedofTraffic} \right)^{4.5}$$

Where D = difference in travelling speed relative to the mean speed

Reported speeds in crash data

Crashes reported to Police and recorded in the NSW Centre for Road Safety crashlink database from 2006-2008 are reported in this study. In NSW crashes are reported by severity, that is fatal, injury and non-injury crashes. This study reports on fatal and casualty (combined fatality and injury) severity. An analysis of the reported speeds of vehicles involved in casualty crashes by speed limit was conducted.

Results

Speed surveys descriptive analysis

The distribution of vehicle speeds is presented in Figure 3 and a descriptive analysis of the 2008 NSW annual speed surveys grouped by NSW speeding offence bands is presented in Table 2. This analysis looks specifically at the proportion of vehicles detected travelling over the speed limit, and indicates that around 75-80% of vehicles detected speeding were travelling at up to 10 km/h over the speed limit, whilst a very low proportion of vehicles were detected speeding at very high levels.

Figure 3: Distribution of vehicle speeds by speed limit, NSW 2008

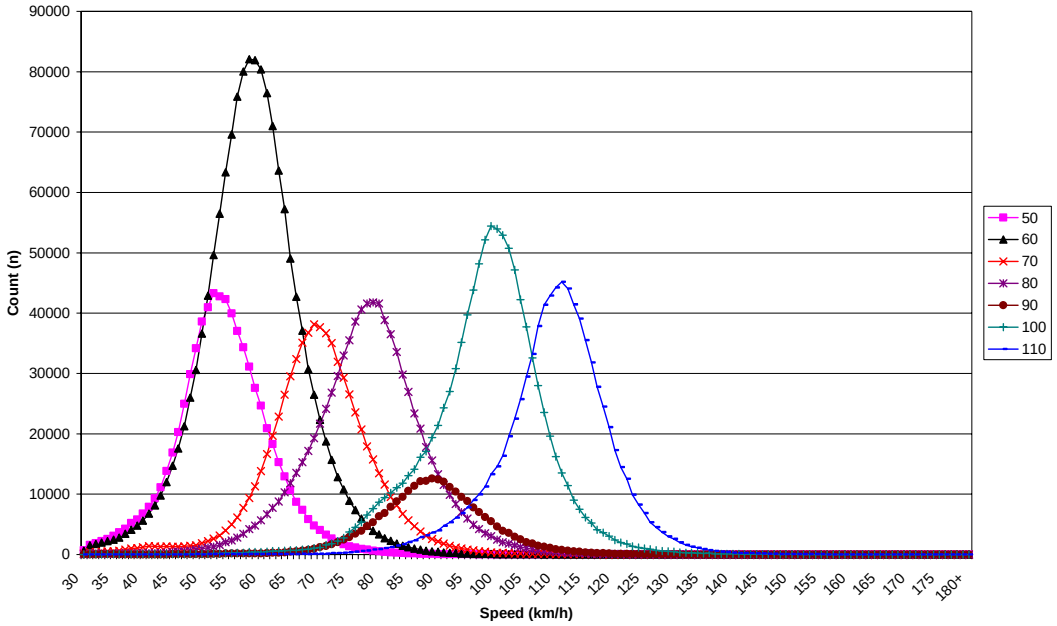

Table 2: Proportion of vehicles detected over the speed limit, by speeding offence band, NSW speed surveys 2008

Speed band (over speed limit)	Speed limit						
	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h
1-10 km/h	74.2%	81.6%	78.5%	77.4%	75.9%	81.6%	79.9%
11-20 km/h	22.2%	15.8%	18.1%	18.4%	19.7%	15.3%	17.3%
21-30 km/h	3.1%	2.2%	2.7%	3.3%	3.5%	2.4%	2.3%
31-45 km/h	0.5%	0.4%	0.5%	0.7%	0.8%	0.6%	0.4%
46 km/h +	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%

Risk model based on Kloeden et al.'s risk equations

The risk of speeding in each speed limit grouped by the NSW speeding offence bands is displayed in Table 3. To assist in the interpretation of Table 3, the results indicate that on roads with a 60 km/h speed limit, 38% of the crashes caused by speeding are due to drivers travelling between 1-10 km/h over the speed limit. This analysis shows that the population risk of speeding in all speed limit zones is highest for drivers speeding 11-20 km/h over the speed limit in 50-70 km/h speed limit zones and highest for drivers speeding up to 10 km/h in 80-110 km/h speed limit zones. The risk associated with low level speeding up to 10 km/h generally increases as speed limit increases. A much lower proportion of the speeding risk is attributable to drivers exceeding the speed limit by more than 45 km/h in all speed limit zones.

The risk of speeding was combined in proportion to the number of crashes in each speed limit to calculate a total risk by speed offence band for casualty fatal and crashes. This analysis shows that the largest proportion of fatal and casualty crash risk is from drivers exceeding the speed limit by up to and including 10 km/h.

Table 3: Population risk of speeding by speed limit and speeding offence bands in NSW based on Kloeden et al.'s estimate of risk and speed survey data

Speed band (over speed limit)	Speed limit							Total risk (casualty)	Total risk (fatal)
	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h		
1-10 km/h	30%	38%	33%	45%	43%	52%	54%	38%	43%
11-20 km/h	35%	41%	40%	26%	26%	23%	26%	35%	31%
21-30 km/h	27%	17%	22%	14%	13%	11%	10%	20%	17%
31-45 km/h	6%	3%	5%	12%	12%	10%	8%	6%	8%
46 km/h +	1%	0%	1%	4%	5%	3%	3%	1%	2%
Casualty crashes % (2008)	33%	34%	9%	8%	1%	11%	3%		
Fatal crashes % (2008)	19%	18%	9%	14%	2%	32%	6%		

Analysis of speeding risk using the Power function for fatalities

Similar to the analysis described above, speed survey results were combined with estimates of fatal crash risk based on the Power model. Risk by each unit of travelling speed was calculated by multiplying the risk associated with that speed by the number of vehicles recorded travelling at that speed, and determining the proportion of risk by dividing by the sum of risks.

The risk of speeding by speeding offence bands is displayed in Table 4. Due to the lower estimates of risk as speed increases in this model, the estimates of risk more closely reflect the speed survey distributions presented in Table 2. This analysis indicates that around two-thirds of the fatal crash risk is from drivers exceeding the speed limit by up to and including 10 km/h.

Table 4: Population risk of speeding by speed limit and speeding offence bands in NSW based on the Power model and speed survey data

Speed band (over speed limit)	Speed limit							Total risk (fatal)
	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h	
1-10 km/h	55%	68%	65%	65%	64%	73%	72%	67%
11-20 km/h	33%	24%	26%	25%	26%	20%	22%	25%
21-30 km/h	9%	6%	6%	7%	7%	5%	4%	6%
31-45 km/h	3%	2%	2%	3%	3%	2%	1%	2%
46 km/h +	1%	0%	1%	1%	1%	0%	0%	1%
Fatal crashes % (2008)	19%	18%	9%	14%	2%	32%	6%	

Analysis of reported speeds in Police reported casualty crash data 2006-2008

An analysis of reported speeds in the NSW Police reported crash data was also conducted. This analysis was conducted to describe the speeds that drivers were recorded as travelling when involved in a casualty crash, therefore in cases where speeds were not recorded (ie coded as 'unknown' or 'excessive') were excluded from the analysis. Even when accounting for these exclusions, over 90% of drivers were recorded as travelling at a speed at or below the speed limit, highlighting that recorded speeds are generally self-reported, which does not necessarily reflect the actual level of speeding in road crashes.

It was originally planned to report on recorded speeds from 2008 only as a direct comparison to the speed surveys also conducted in 2008, however due to the low number of data points for recorded speeds above the speed limit, data from 2006-2008 casualty crashes are included in this analysis and displayed in Table 5. The analysis indicates that in all speed limit zones the largest proportion of drivers were recorded as speeding by up to 10 km/h (equal largest in 80 km/h speed limits).

Table 5: Percentage of casualty crashes with stated speeds above the speed limit by speeding offence band, NSW 2006-2008

Stated speed band (over speed limit)	Speed limit						
	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h
1-10 km/h	62%	46%	57%	39%	64%	39%	53%
11-20 km/h	13%	32%	16%	39%	13%	28%	20%
21-30 km/h	13%	6%	17%	8%	4%	11%	12%
31-45 km/h	3%	11%	2%	7%	4%	13%	4%
46 km/h +	8%	5%	8%	7%	13%	8%	12%

Discussion

This study aimed to determine whether a focus on low level speeding is justified by examining the speeds at which drivers are recorded as travelling and combining these data with our knowledge of the relative risks of speeding. Speed survey results indicate that a large proportion of speeders were exceeding the speed limit by a small margin, and that less than 5% were speeding by more than 20 km/h in all speed limit zones, indicating that very few drivers exceed the speed limit by a large margin.

When these speed survey data were combined with the relative risks of speeding determined in the Kloeden et al.[2,3,4] studies it became apparent that the sheer number of low level speeders contribute to a large proportion of the risk associated with speeding. The results indicate that the largest fatal and casualty crash risks (43% and 38% respectively) can be attributed to drivers exceeding the speed limit by up to 10 km/h and that drivers exceeding the speed limit 11-20 km/h contribute the second highest level of fatal and casualty crash risk (31% and 35% respectively). These findings are consistent with Kloeden et al.'s finding that nearly 60% of the crash risk could be eliminated by eliminating speeding up to 15 km/h over the speed limit in urban environments. The results also indicate that only a small proportion of the fatal and casualty crash risk can be attributed to drivers travelling at 31 km/h or more over the speed limit.

Interestingly the crash risks of speeding by lower levels increase as the speed limit increases, which appears to indicate that the risks are probably more closely aligned to the speed that the driver is travelling and the limitations of human tolerance to physical force, rather than specifically speeding. This finding is consistent with our knowledge of the relationship between vehicle impact speed and fatality crash risks, which reach a very high risk of fatality, over 80%, for frontal impacts at 90 km/h and side impacts at 60 km/h[12,14].

Another result of particular interest is that in 80-110 km/h speed limit zones, a larger proportion of crash risk compared to at lower speed limits (8-12%) was attributable to drivers exceeding the speed limit by 31-45 km/h. This indicates that whilst a larger proportion of the crash risk was indicated for lower levels of speeding, the crash risks from drivers speeding by a larger margin remains a significant road safety issue. Clearly if a larger proportion of drivers were to speed by a higher level it would be of significant concern, and we cannot ignore strategies that continue to address high level speeding.

The analysis of relative risks based on the Power model was conducted to verify the analysis based on the Kloeden et al. studies, as was the analysis of stated speed in the NSW crash data. These analyses indicated that the distribution of risk appears to follow a similar pattern, with the largest level of risk due to low level

speeding. The analysis of stated speeds did, however, indicate that 5-13% of speeding drivers were exceeding the speed limit by 46 km/h or more, which is consistently higher than the population risk of speeding models presented here.

The above results must be considered with respect to the methodological limitations of the study. Firstly various assumptions were made in determining risk based on Kloeden et al.'s studies of the relative risk of speeding. Kloeden et al.'s[2,4] analysis of travelling speed in the urban environment was conducted in 60 km/h speed limit zones, which was applied to roads with a speed limit of 50-70 km/h in this study. It is not known if the application of this risk model to speed zones of 50 and 70 km/h is appropriate, however this was done with the understanding that areas with these speed limits have a similar urban environment with similar travel, and therefore risks of travelling above the speed limit may be similar.

A second limitation of this analysis was that the risk of involvement in a casualty crash was capped for high speeds based on Kloeden et al.'s[2,3,4] reports of the accuracy of their analysis. If the risk was not capped, in the 50-70 km/h risk analysis the risks would increase to an extremely high level at higher speeds, which was considered unrealistic (eg 71,289 times the risk for travelling at 45 km/h over mean speed). Whilst capping the risk appears to be consistent with our understanding of fatality risks by vehicle collision speed,[12,14] the level at which it was capped may not necessarily be appropriate.

Kloeden et al.'s study in rural speed provided a model with a good fit to a higher speed above the mean speed, and should therefore be considered as more robust in providing an accurate distribution of the population risk of speeding at higher levels. This analysis revealed a larger population risk for speeding by 31-45 km/h and 46+ km/h over the speed limit in areas with 80-110 km/h speed limits, which indicates that capping the risk may have underestimated the risk of high level speeding in 50-70 km/h speed limits.

Thirdly, the casualty and fatal crash involvement risks were collated based on the risk estimates from Kloeden et al.'s studies, which may not necessarily apply to both fatal and casualty crash risks. It is worth noting that in Kloeden et al.'s[2,4] urban study the crashes involved injured road users, but very few fatalities, whereas in Kloeden et al.'s rural study nearly 30% of crashes involved a fatality. Whilst these studies indicate a differing level of risk by increase in travel speed, as may be expected in different speed limits, they do indicate a similar pattern of increasing risk, which when combined with speed surveys in this study indicate a similar distribution of risk.

To maximise the validity of the results, the contributions of low and high level speeding were analysed by using both the Kloeden et al. and Power models, and by conducting an analysis of stated speeds. The limitations of these additional analyses have already been discussed, however it should be noted that employing either model of risk yielded broadly similar findings in the present study.

Notwithstanding the limitations of this study, it can be concluded that low level speeding contributes a large proportion of the overall risk of speeding. Clearly it is appropriate to intensify efforts at reducing speeding at all levels, including low levels as part of a comprehensive speed management framework.

With regards to public perception of speeding and the actual speeding behaviour of drivers, the results in this paper highlight the challenge of reducing the involvement of speeding in road related death and injury. The highest population risk corresponds with the speeds that drivers are recorded as travelling regularly, and feel most comfortable doing so. Walker et al. found that speeding up to 10 km/h in a 100 km/h speed zone was the most acceptable speeding behaviour (ie 40% rated as acceptable) which highlights the difficulties associated with modifying public perceptions and low level speeding, especially in high speed environments.

In terms of policy considerations, there are a number of implications for road safety practitioners in terms of enforcement, public education and other speed management tools to reduce low level speeding.

With regards to enforcement the results indicate there is a need to direct enforcement efforts at all levels of speeding, regardless of the level of speeding. The results do, however, indicate that enforcement efforts at

reducing low level speeding would have a larger impact on high speed roads. In urban speed limits of 50-70 km/h the highest level of risk is in the 11-20 km/h speeding band, indicating that speeding at the lowest level (ie up to 10 km/h), whilst still a large risk, is not as significant a concern as in higher speed limit zones.

The results provide strong support for low level speed enforcement and low enforcement tolerances. While there is a requirement for some allowance to ensure the accuracy of speed measurement, given public acceptance of low enforcement tolerances, there are clear road safety benefits in enforcing speeding at a level that is as low as technically possible. The results of this study also provide support for the reduction in enforcement tolerances in Victoria in 2002[15], and reduction recently announced in Tasmania[16].

Research demonstrates that a driver's level of speeding is directly influenced by the perceived likelihood that they will be caught at that level. This paper highlights that there is a high population risk of speeding at low levels due to the high prevalence of this behaviour, and that it is more social acceptable than high level speeding. Given that enforcement is a key motivator of a driver's speeding behaviour and a key determinant of the acceptance of low level speed enforcement, it is apparent that increasing the frequency of speed enforcement activities at low levels, and therefore increasing the likelihood of drivers being caught at these levels, would have a direct impact in reducing low level speeding, reducing the social acceptability of this behaviour, and reducing road trauma.

With regards to public education this paper highlights the importance of communicating the risk of low level speeding to all road users. In delivering road safety campaigns aimed at reducing speeding it is important to not depict excessive or extreme levels of speeding, but rather reflect the larger proportion of drivers who exceed the speed limit by less than 20 km/h over the speed limit. It is unlikely that public perceptions about lower level speeding will change until drivers believe that driving at 10 km/h over the speed limit is dangerous, socially unacceptable, increases their risk in a crash and is reflected in public awareness campaigns. Changing public perception of the unacceptability of low level speeding is clearly one of the largest challenges in road safety.

Many drivers report that at times they speed inadvertently and it is likely that a proportion of the risk of low level speeding is due to inadvertent speeding. Intelligent Speed Adaptation (ISA) which uses speed limit information and GPS systems to alert the driver of speeding or reduce engine power when a driver is detected speeding could play a significant role in reducing unintentional and low level speeding. Advisory ISA which uses GPS and lets drivers know when they are speeding could play an important role in the prevention of inadvertent speeding and reducing the risk associated with this behaviour, especially amongst drivers who are genuinely trying to stay below the speed limit. The estimated road safety benefits of advisory ISA have been reported as a 2-10% reduction in all crashes, with much larger safety gains from the elimination of intentional and unintentional speeding for directly speed limiting ISA[17]. Given these results, the increase in use of advisory ISA may also assist in reducing unintentional speeding at low levels, and consequently reduce both the risk associated with inadvertent low level speeding and the perception that inadvertent speeding is a significant issue.

Conclusion

This paper demonstrates that speeding up to 10 km/h over the speed limit contributes to around 43-67% of speed-related fatal crashes and that speeding up to 20 km/h contributes to around 74-92% of speed-related fatal crashes. Whilst the present findings must be considered in light of the limitations of the current study, different models of risk were applied to speeding behaviour in order to increase the validity of the results. These results have clear implications with regards to speed enforcement, public education and the development of strategies to reduce speeding.

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