THE ICEBERG PRINCIPLE: THE KNOCK-ON EFFECTS OF ADDRESSING THE SAFETY OF "SPECIAL NEEDS" ROAD USERS

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ABSTRACT

In recent years there has been an increased focus on "special needs" road users who make up a relatively small proportion of the road toll. They include older road users, school children, international visitors and the disabled. A major policy issue is that the costs of addressing the needs of these groups seem disproportionately high. However, the problems experienced by special needs road users can be viewed as "the tip of the iceberg", with less obvious but similar problems being experienced by large numbers of other road users. This paper reports preliminary estimates based on older driver problems at intersections which indicate that there may be substantial knock-on benefits to a range of younger road users when countermeasures are introduced to address a relatively small problem. The knock-on effects of focusing on locations with school age pedestrian crashes are also examined. The implications for road safety planning and strategy are discussed.

INTRODUCTION

In the past two decades, economic rationalism has been a dominant influence on the programs and strategies of Australian Federal and State government agencies. This reflects a technocratic approach to administration, a concern with accountability for the prudent expenditure of public funds, and a focus on the achievement of outcomes. Road safety agencies in Australia are generally part of (or associated with) road authorities, whose orientation, structures and processes are strongly influenced by the engineering background of their leaders and line managers, and consequently have exhibited an affinity with the philosophy and approaches of economic rationalism.

This influence is seen most clearly in the use of benefit:cost analyses to develop strategies, business plans and action plans, in much the same way that they are used to evaluate road projects. For example, Queensland Transport's business planning process involves the ranking of activities according to several criteria, and each activity's benefit:cost ratio (BCR) is a major component of the score which is used for ranking (1).

For road safety itself economic rationalism has had a mixed impact. Many road safety practitioners welcome a focus on the achievement of quantifiable outcomes in excess of program costs, because of their concerns about levels of funding for popular but ineffective activities. However there is also concern that too much emphasis on economic rationalism can lead to:

- loss of funding for programs with potential but unproven benefits (particularly long term benefits);
- dropping of programs which, while having low BCRs when viewed in isolation, provide support for other programs, thus enhancing their effectiveness; this is exacerbated when program responsibilities are shared between agencies which separately rate the BCR of their parts of the programs;
- a conservative approach, based on existing knowledge of best practice;
- less research and evaluation work, which has indirect benefits spread over a range of programs and years of activity, and is not amenable to BCR calculation for particular projects;
- an emphasis on low cost activities with little reach but high BCRs, at the expense of high cost activities with moderate benefits but greater reach; and
- the downgrading of the importance of social justice and community obligation in the business planning process.

In practice, there has continued to be a strong commitment to road safety undertakings which cannot demonstrate quantifiable benefits in excess of costs. This is particularly true in the political arena, where community concerns about particular road safety issues cannot readily be dismissed with the argument that the crash savings are not worth the expenditure.

In response to these concerns, economic rationalism has been tempered with the addition of other, non-orthogonal principles. In Queensland Transport's case the additional principles include environmental sustainability and social justice, together with political indicators such as "government priority" and "community priority". Among the approaches taken to the operationalisation of the use of these principles in road safety planning and strategy has been the definition of what may be termed "special needs" road users.

"Special needs" road users are those who merit programs or strategies for reasons other than the value of crash savings in relation to costs. For example, travel to school is very safe, but community concerns require a level of expenditure on the safety of school children which cannot be justified using BCRs (2). Similarly, providing infrastructure to enable safer use of footpaths by wheelchairs meets equity and access objectives without achieving major savings in crashes of wheelchair users.

However, although we can segment road users readily, their crash problems and the measures to address them are not necessarily so discrete. Road safety problems faced by special needs road users may be shared by other road users, and the measures used to address them will therefore have knock-on effects for other road users, consequently raising the crash reduction benefits without increasing costs. In this sense special needs road user groups constitute "the tip of the iceberg", with their modest crash reduction potentials being associated with a larger, hidden crash reduction potential.

RATIONALE, METHOD AND RESULTS

The objective of the research outlined in this paper was to describe and quantify one or more examples where addressing the road safety problems of special needs road user groups could have wider potential benefits.

Older drivers at intersections

The most detailed example utilises data collected as background information for an ACR SPIRT grant awarded to the Queensland University of Technology School of Optometry, with Queensland Transport as the industry partner. The grant research includes use of Queensland Transport's Mt Cotton Driver Training Track, which is representative of rural driving conditions. The interactions between age-related visual change, time of day and road environment features are being investigated.

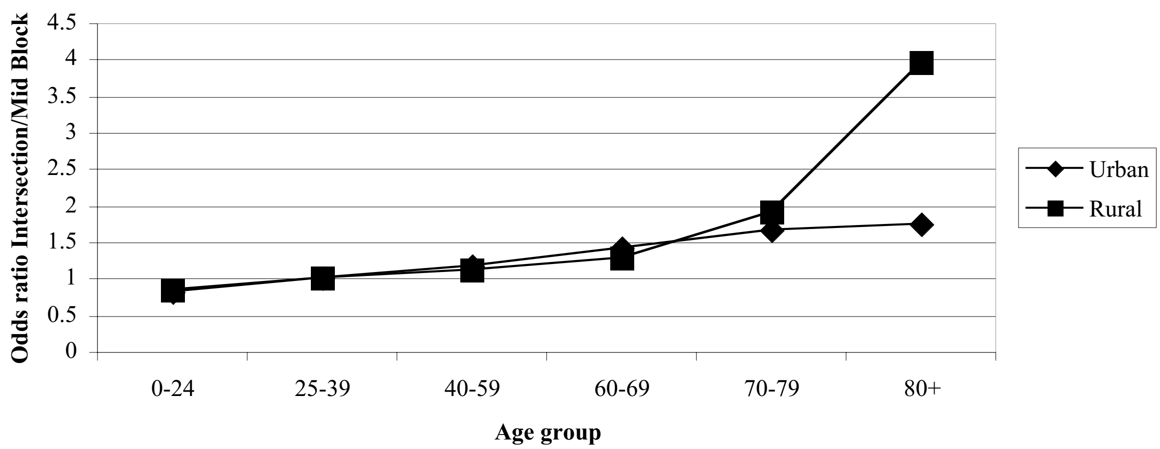
Crash data for the five year period 1995-99 were collected for all drivers killed, hospitalised or receiving medical treatment as a result of a crash between motor vehicles. The data were disaggregated by age group, location (urban/rural), time of day (day/night) and road environment (intersection/mid-block). Police opinion as to the degree of fault of each driver was also collected, but is not reported here.

Odds ratios were calculated for each age group, for the odds that drivers in that each group would be involved in intersection vs mid-block crashes, for urban and rural crashes overall, and for day and night crashes within urban and rural areas. The odds ratios were standardised against the odds ratios for the 25-39 year old age group, on the *a priori* assumption that this age group had the lowest overall crash rates.

Figure 1 (over page) presents the results for urban and rural areas overall, indicating that:

- the odds of involvement in intersection rather than mid-block crashes rise with age;
- crash-involved drivers aged 80 and over who crashed in urban areas were almost twice as likely as drivers aged 25-39 to have their crashes at intersections; and
- crash-involved drivers aged 80 and over who crashed in rural areas were four times as likely as drivers aged 25-39 to have their crashes at intersections.

Figure 1: Odds that crash is at intersection by age, urban vs rural, Queensland 1995-99



Figures 2 (below) presents urban data only, broken down by time of day. Apart from the final urban night time point, there is an increase in the odds of intersection crashes with age, which is more pronounced for night time crashes.

Figure 2: Odds that crash is at intersection by age, urban, day vs night, Qld 1995-9

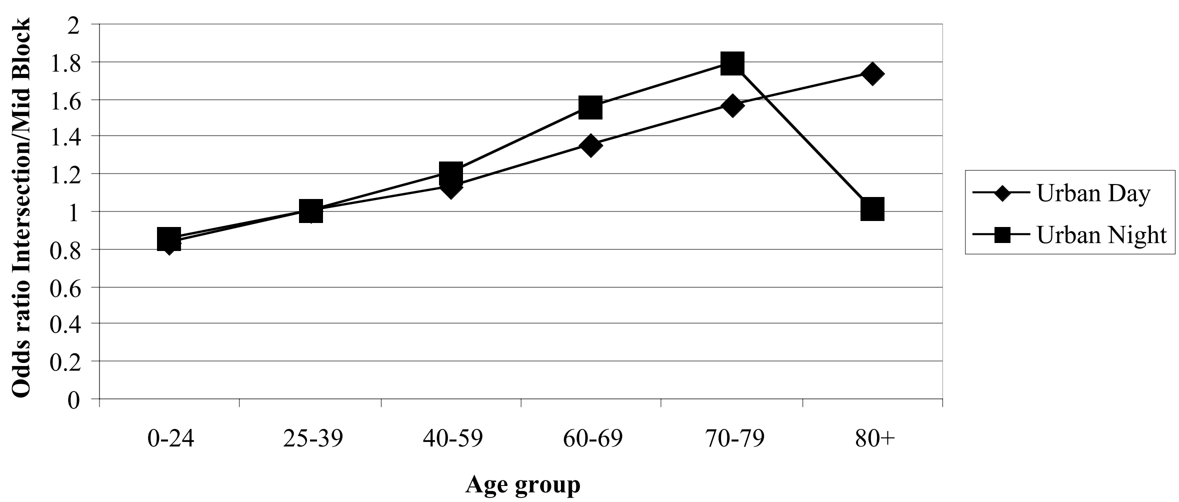
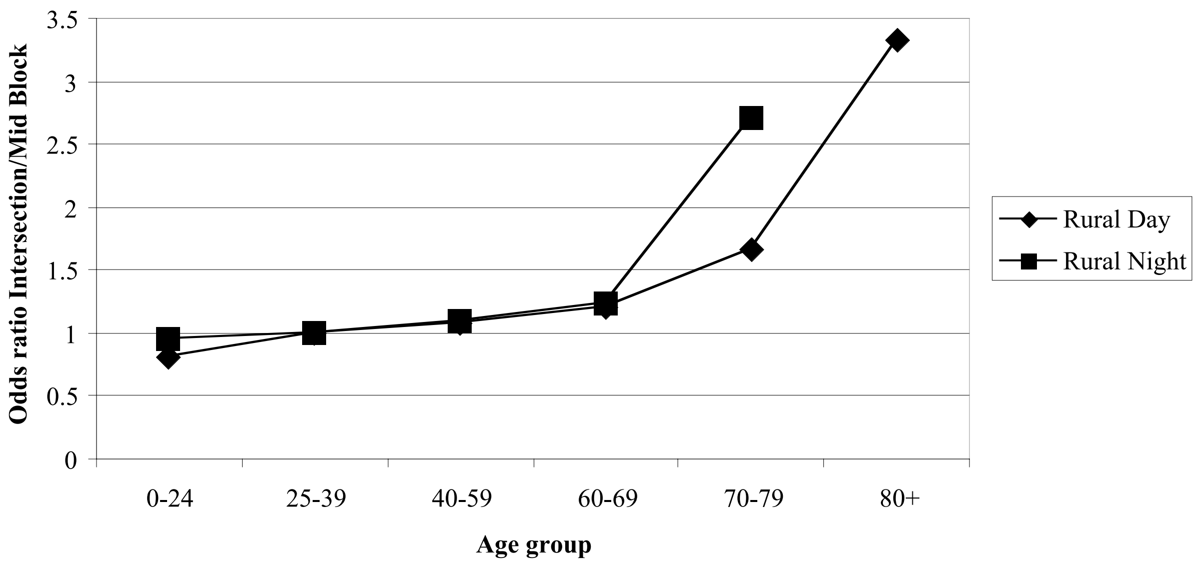


Figure 3 (over page) presents rural data only, broken down by time of day. The missing data point for drivers aged 80 and over involved in night time crashes was omitted because of small numbers. For the rest of the data, as for the urban series, there is an increase in the odds of intersection crashes with age, which is more pronounced for night time crashes.

Figure 3: Odds that crash is at intersection by age, rural, day vs night, Qld 1995-9



These data indicate that older drivers are prone to crash involvement at intersections, especially in rural areas and at night. However, these graphs conceal the fact that numbers are relatively small as age increases, and in particular when considering rural and night time crashes. The most extreme example is for the missing data point in Figure 3, for drivers aged 80 and above who were involved in intersection crashes in rural areas at night. There were only three such drivers over the five years investigated.

For such small groups of crash victims it would be difficult to justify widespread changes to intersection treatments and signage because of the cost, even if they are regarded as special needs road users.

However, Figures 1-3 show that increasing involvement in intersection crashes occurs across the age range, not just among the oldest drivers. This is suggestive of age-related changes to physical and/or cognitive abilities, which is borne out by research which shows a similar progression in deterioration in visual performance with age (3).

The implication is that measures which reduce the crash involvement of the oldest drivers will also reduce the crash involvement of other driver age groups, and the greater numbers of crashes in these age groups mean that the crash savings may be much greater for these groups than for the older, highest risk but least numerous drivers.

For example, if odds ratios for all drivers aged 40 and above were reduced to those of 25-39 year olds within each location/time of day combination, it can be shown that about 200-250 driver casualties per year would be prevented. This would account for 25% of casualties of drivers aged 40 and above in intersection crashes, and 9% of casualties of all drivers in intersection crashes.

It is difficult to know if an effect of this magnitude could occur in practice. On the one hand, the odds ratios would be unlikely to completely lose their tendency to increase with age. On the other hand, the odds ratios are standardised against the odds that 25-39 year old drivers will be involved in crashes at intersections rather than mid-blocks, and this base ratio may well decline in response to interventions aimed at older drivers, leading to crash savings across the age range.

School age pedestrians

Another special needs road user group is school age pedestrians. There is considerable community and political concern about pedestrian safety around schools, so much so that more funds are expended on School Crossing Supervisors than on any other school travel safety program, in spite of evidence that few pedestrian crashes occur outside schools on trips to and from school.

Crash data were used to generate two lists of the highest crash locations for pedestrians aged 5-16 years for the five year period 1995-1999. One listed the 50 intersections with the highest number of injury crashes involving 5-16 year old pedestrians, and the other listed the top 50 mid-blocks according to the same criterion.

There were 73 5-16 year old pedestrians injured in crashes at the top 50 intersections, accounting for 15.7% of all 5-16 year old pedestrians injured at intersections. There were 120 5-16 year old pedestrians injured at the top 50 mid-blocks, accounting for 15.2% of all 5-16 year old pedestrians injured at mid-blocks.

In practice, the measures which could be taken to improve pedestrian safety at these locations would improve safety for pedestrians of all ages, even though there are differences in causal factors (or rather, the relative contributions of different causal factors).

This means that addressing the 73 crashes of 5-16 year old pedestrians at the top 50 intersections would also lead to the addressing of a further 44 crashes of pedestrians of other age groups at these locations (60% more), accounting for 3.1% of all intersection crashes of pedestrians in these age groups.

Similarly, addressing the 102 crashes of 5-16 year old pedestrians at the top 50 mid-blocks would also lead to the addressing of a further 116 crashes of pedestrians of other age groups at these locations (114% more), accounting for 5.3% of all mid-block crashes of pedestrians in these age groups.

DISCUSSION AND CONCLUSIONS

Both these examples illustrates the point that measures taken to address a small number of crashes among special needs road users could address so many other crashes as to constitute a significant proportion of all crashes of that type.

For older drivers at intersections, their small numbers in general, and in particular at night and in rural areas, would make them an unattractive proposition for the investment of crash reduction funding. However, it was shown that a much larger number of crashes involving younger drivers could potentially be addressed by the measures developed for the older driver group. For school age pedestrians, it was shown that a focus on intersection and mid-block blackspots would address a large number of crashes of adult pedestrians as well.

In this way, a special needs road user group can act as the tip of the iceberg, drawing attention and funding to problems which might not have been attended to otherwise, and which have benefits beyond the special needs group. There are two caveats:

- enhancement of BCRs can only be justified where there is good reason for believing that knock-on effects will occur; this applies in the two examples used here, but may not always hold; and
- unless there is research evidence to assist, estimation of the knock-on effect will, of necessity, be crude.

For road safety agencies that base their programs on BCRs, taking account of the iceberg principle leads to less discomfort with programs that have been adopted primarily for political or community purposes. For politicians and the community at large it emphasises a continuity between the road safety needs of the community and those of special needs road users. The use of the iceberg principle is also consistent with Vision Zero (4). Tailoring the traffic environment for special needs road users should contribute to much greater levels of safety for all road users.

ACKNOWLEDGMENTS

Tim Lebsanft of Queensland Transport for provision of the crash data (tables and lists).

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