Critique of the Methodology of IR2: Daytime Running Lights by The Motorcycle Action Group UK

Meta-analysis is essentially a synthesis or review of available literature about a specific topic where the data are combined to arrive at a summary estimate of the effect, its 95% confidence interval, and a test of homogeneity of the studies. Ideally a review of randomized trials is carried out to arrive at a single summary estimate, although other types of studies are used for meta-analysis such as aggregate studies or observational studies.

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According to Egger, Schneider and Davey Smith[1] (1998), Meta-analysis, by promising a precise and definite answer when the magnitude of the underlying risks are small or when the results from individual studies disagree, seems an attractive proposition both in aetiological studies and in observational effectiveness research.

Meta-analysis of randomised trials is based on the assumption that each trial provides an unbiased estimate of the effect of an experimental treatment, with the variability of the results between the studies being attributed to random variation. The overall effect calculated from a group of sensibly combined and representative randomised trials will provide an essentially unbiased estimate of the treatment effect, with an increase in the precision of this estimate.

However, Egger et al (1998:3) argue that “a fundamentally different situation arises in the case of observational studies. Such studies yield estimates of association which may deviate from true underlying relationships beyond the play of chance. This may be due to the effects of confounding factors, the influence of biases, or both”. In other words, they suggest that different methods of research produce differing results.

Pole and Lampard[2] (2002) point out that there are issues that are specific to the use of existing data and that this is due to the fact that the researcher is constrained by the historical nature and pre-determined range of existing sources. The range of data available is as much socially determined as the nature of the data available is and can reflect various dimensions of power and dominance within society.

With regards to reporting randomised and non randomised studies. If reviewing both randomized and non-randomized studies in the same meta-analysis, it is necessary to report the effect sizes separately for the RCTS and non-randomized studies. This is because the effect of a new treatment (or in the case of DRL, changes in legislation, population, technology etc) is likely to be larger in studies that employ a non-randomized design.

However in the Elvik et al study, only three of the studies appear to be randomized.
These are: study number 3 of those listed by Elvik et al, which is by Vaughan et al (1977); study number 5 Hurt et al (1981) and study number 15 Haworth et al (1997). The remaining thirteen appear to be non randomized therefore "the effect would be larger". Furthermore, two of these studies were carried out over twenty years ago (see below) in two countries with very different populations and climate conditions. The third document (number 15) was counted twice, because Elvik et al took two estimates of the effect of daytime running lights from this study. However, upon reading this paper, it is difficult to understand the rationale behind the inclusion of Haworth et al, considering that these authors state that “The headlights were on for most of the crashed

[1] Egger M, Schneider M and Davey Smith G (1998), British Medical Journal (BMJ) 316:140-44
[2] Pole C and Lampard R (2002:) Practical Social Investigation, Prentice Hall

and control motorcycles (both pre- and post-1992[3]). The odds ratios associated with pre-1992 motorcycles having headlights off were not statistically significant." In other words, there was no difference if using DRL or not - on accidents. In Australia, mandatory hardwiring was introduced for motorcycles in 1992 (see appendix one for a breakdown of the relevant data from the Haworth et al study).

In the sixteen studies listed, an indication of whether daytime running lights were used is of course a crucial element of the meta analysis in order to determine whether the studies had identified any effect or not. However under the item "DRL in use", eight of the studies indicate "Not stated" so there is no way of knowing the motorcycles actually used DRL or not in 50% of the studies analysed. In this respect it does not make sense as to why these studies were included in the first place.

Furthermore, it is essential to mention the cut-off dates in the analysis so that it becomes clear that studies that were published before and after the time mentioned were not missed but not included in the study as part of the design. Part of the reason for this is to have a clearly defined window of time to offer reasonable comparability amongst the studies.

However, the 16 studies on motorcycles span from 1970 to 2000 - 30 years of studies. Implicitly the designs of the study are unlikely to be the same, but there does not appear to be any mention of cut-off-dates. Possibly more important, the development of PTWs over 30 years has changed tremendously, so it would be impossible to relate to a study carried out in 1970 in the US and try to find some sort of commonality with a study carried out in Singapore 30 years later - irrespective of whatever analysis is used. Habits, legislation on road usage – (such as the mandatory introduction of hardwiring for motorcycle headlights in Australia in 1992), changes in technology etc all have modified or changed over a thirty year period, therefore as previously highlighted by Pole and Lampard, "The range of data available is as much socially determined as the nature of the data available is and can reflect various dimensions of power and dominance within society". Thus any outcome from the meta analysis would need to consider these issues. Elvik et al have not done so.

The sixteen studies are in English, nine of which were carried out in the United States, two in Australia, two in Malaysia, one in Singapore and one in Great Britain. One of the English papers was effectively carried out on two populations: Austria (in which there was a reduction in accidents using DRL by 16% and in Denmark, where there was an increase in accidents using DRL by 14%). As the Elvik et al report is intended to be a defining study for the whole of Europe, it is somewhat difficult to comprehend how only two European studies were included and to what degree the study of countries (14 of 16 studies) outside Europe are intended to contribute, in consideration of the complex issues of analysis as identified by Pole and Lampard and Egger et al. Further, it stands to reason that if faced with multiple reports published from the same study on similar topic, only one study should be used so that information from the same study population should contribute ONLY ONCE to the analysis.

Two are on the same topic from the same group in Malaysia; Two are from the same institute and appear to be separate analyses of the same study in the US (Muller and Zador, Am Journal of Public Health) - three others are the same topic from the same author whose analysis suggests that DRL do not reduce accidents (Muller). Whether different populations were used or not is difficult to ascertain, as there has been no summary of the individual reports other than very sketchy outlines on pages 45 to 54.

As the Elvik et al report was commissioned, it is important to highlight the fact that any report of this nature would ultimately be designed and written with a client in mind, in this case DG TREN

[3] This is when manufacturers commenced the hardwiring of motorcycle lights in Australia

of the European Commission. Furthermore, at least half of the sixteen reports on motorcycles identified by Elvik et al appear to be written with an agenda, which is that of resolving issues of road safety and the reduction of accidents. However, in these studies there appear to be clients for whom the reports were carried out, in other words these studies were not necessarily independent.

Consider that existing data (such as those used in meta analysis) have been socially constructed, and are thus in part a reflection of the person or people involved in their construction. In other words existing data are as much social construction as they are records or measures that the researcher wishes to know about. Thus the researcher needs to consider the purpose for which the existing data were originally intended:

- Were they generated for research purposes, or for some other purpose?
- If they were generated for research purposes, how close a match is there with the researcher's own agenda?
- If the data were not generated for research purposes, were they generated as an incidental by-product of some administrative process, or were they constructed as a source of information aimed at a specific audience? (Pole and Lampard 2002)

The danger of the outcome of the methodology used by Elvik et al, is that whichever way they are interpreted, these three questions are ultimately crucial and one could suggest that they are the driving force behind the analysis in the report and the subsequent results or rather, apart from being misleading and inconclusive, the report is biased.

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Appendix One

Haworth N et al Case-Control Study of Motorcycle Crashes Monash University Melbourne Australia, Sponsored by the Federal Office of Road Safety

Pages 105 to 107

Table 10.11 summarises the percentage of case and control motorcyclists who had headlights on. The percentages are generally very high and this is likely to be influenced by the number of relatively new motorcycles in the study. Hard-wiring of headlights was mandated for motorcycles produced from March 1992 to October 1996 and these motorcycles comprise a considerable proportion of the motorcycles in the study. To examine the "voluntary" use of headlights, Table 10.12 presents the data for motorcycles manufactured before 1992 only. Year of manufacture was only known for those controls where a follow-up interview was conducted.

Table 10.13 shows that none of the unadjusted or adjusted odds ratios associated with not having headlights on for motorcycles manufactured before 1992 were statistically significant.

Table 10.11. Percentages of case and control motorcycles with headlights on.

	Cases	Controls
Overall	90	89
Daytime (6 am - 6 pm)	86	88
Night-time (6 pm - 6 am)	97	92
BAC=.000	89	87
BAC>.000 *	100	75
Rider age		
under 25	93	92
25 to 34	94	89
35 and over	81	80
Licence		
unlicensed *	67	0
learner	90	95
probationary	96	98
full	90	85
Year of manufacture		
before 1992	85	79
1992 and later	97	97
Training		
yes	90	89
no	87	82
Work-related trip	90	84
Nonwork-related trip	90	88

* percentages based on small numbers and so may be unreliable

Table 10.12. Percentages of case and control motorcycles with headlights on - motorcycles manufactured before 1992 only.

	Cases (n=102)	Controls (n=227)
Overall	85	79
Daytime (6 am - 6 pm)	77	78
Night-time (6 pm - 6 am)	95	80
BAC=.000	81	79
BAC>.000 *	100	67
Rider age		
under 25	91	88
25 to 34	91	85
35 and over	67	68
Licence		
learner	90	95
probationary	91	94
full	84	76
Training		
yes	73	75
no	89	83
Work-related trip	88	78
Nonwork-related trip	83	80

* percentages based on small numbers and so may be unreliable

Table 10.13. Unadjusted and adjusted odds ratios and confidence intervals for having headlights off for motorcycles manufactured before 1992 only. Highlighted odds ratios are statistically significant.

Variable	Odds ratio	Confidence interval
Unadjusted	0.9	0.3 - 2.3
Adjusted for..		
Rider age	2.8	0.7 - 10.8
Presence of alcohol	0.9	0.2 - 4.1
Licence status	1.2	0.4 - 4.0
Age and alcohol	1.6	0.3 - 9.5
Work-related trip	0.8	0.3 - 2.2