How NHTSA 2000 'A preliminary assessment of the crash reducing effectiveness of passenger car daytime running lamps' fails to overcome the problems of method of the daytime running light studies

Introduction

Koornstra *et al* 1997 re-analysed the data of all of the studies of motorcar daytime running lights to date.

The main study that has been conducted since then is the US study: National Highway Traffic Safety Administration 2000 'A preliminary assessment of the crash reducing effectiveness of passenger car daytime running lamps'.

NHTSA 2000 analyses:
- 1995–1997 Fatal Analysis Reporting System 'national' data of (1) 'opposite direction' two-vehicle accidents, and (2) single-vehicle pedestrian accidents
- 1995–1996 'local' data of non-fatal two-vehicle accidents from four US States

using the 'odds-ratio' and 'simple odds' tests.

It is thought that some persons have stated that the authors of NHTSA 2000 made findings 'in favour' of motorcar daytime running lights.

In fact, as follows, the authors made mixed findings, which they did not attempt to reconcile or explain.

But fatally also—in common with the Transport Canada study, Arora *et al* 1994—, by virtue of the limitations of its data, and the lack of specificity of the 'odds-ratio' and 'simple odds' tests, NHTSA 2000 suffers from fundamental defects of method.

Findings

NHTSA 2000 makes mixed findings:

Statistically significant findings: On the one hand NHTSA 2000's analyses of:
- 1995–1997 Fatal Analysis Reporting System data of single-vehicle pedestrian accidents (*-28%)
- 1995–1996 data of non-fatal two-vehicle accidents from Florida, Maryland, Missouri, & Pennsylvania (*-7%)

yield a statistically significant reduction of accidents from daytime running lights by the 'simple odds' test.

But on the other hand, first, NHTSA 2000's analyses of the above data fail to yield a significant reduction of accidents from daytime running lights by the 'odds-ratio' test (-29%; -5%).

Second, its analysis of:
- 1995–1997 FARS data of 'opposite direction' two-vehicle accidents

fails to yield a significant reduction of accidents from daytime running lights by either the 'odds-ratio' (+8%) or 'simple odds' (-2%) test.

Non-statistically significant findings: As part already noted, in addition to the above findings NHTSA 2000's analyses yield a number of non-statistically significant findings of a reduction of accidents from daytime running lights by the 'odds-ratio' or 'simple odds' test.

Nevertheless by way of exception, first, to repeat, NHTSA 2000's analysis of :
- 1995–1997 FARS data of 'opposite direction' two-vehicle accidents (+8%)

yields an actual non-significant increase of accidents from daytime running lights by the 'odds-ratio' test .

Second, unlike the separate Florida, Maryland, & Pennsylvania data, its analysis of:
- 1995–1996 Missouri data of non-fatal two-vehicle accidents (+27%, +16%)

again yields a non-significant increase of accidents from daytime running lights by the 'odds-ratio' test.

Discussion of findings

NHTSA 2000 does not discuss its findings.

In particular it does not attempt to reconcile or explain the mixed findings that are described above.

Yet the obvious cause of mixed findings is that more than one factor, not just the study factor, is acting to influence the data.

One of the studies that NHTSA 2000 recites in its background review of the existing scientific literature is Andersson *et al* 1976's odds-ratio study of the effect of the 1972/73 Finnish winter daytime running lights law.

By contrast with NHTSA, Andersson *et al* did not find that multi-vehicle accidents or pedestrian accidents fell after the law. Instead only 'other' accidents—which they said comprised mainly animal accidents—fell.

Nevertheless again NHTSA does not mention the discrepancy between the two sets of findings, or attempt to reconcile or explain it.

Method

NHTSA 2000 analyses data of accidents between a motorcar and another motorcar or pedestrian that occured in its study areas during the given periods:

1) NHTSA determines from the make and model year of the motorcar whether or not the motorcar was fitted with 'hard-wired' (ie automatically illuminating) daytime running lights.
2) It classifies the accident according to its 'configuration' as a 'target', or 'study', accident if the presence or absence of daytime running lights may have been 'relevant' to its causation, or a 'comparison', or 'control', accident if they will have not.
3) It then applies the 'odds-ratio' and 'simple odds' tests to the resulting data in order to arrive at a 'controlled comparison' of the figure of accidents that are experienced by motorcars that are fitted, or not fitted, with daytime running lights.

In the simplest case, 'study' accidents comprise daytime multi-vehicle accidents (DMVA), and 'control' accidents daytime single-vehicle accidents (DSVA) and all nighttime accidents (NMVA + NSVA).

The measures of the 'simple odds' test is then the simple 'ratio':

$$\frac{\text{DMVA}}{\text{DSVA + NMVA + NSVA}} ,$$

or the measure of the 'odds-ratio' test is the complex 'ratio':

$$\frac{\text{DMVA} \times \text{NSVA}}{\text{DSVA} \times \text{NMVA}} .$$

Defects of method

It is surprisingly difficult to achieve a reliable method of measuring the effect of daytime running lights:

Diversity of background: One must compare:
- The figure of accidents of motor vehicles not using lights against a background of 0% of all vehicles using lights
- The figure of accidents of motor vehicles using lights against a background of 100% of all vehicles using lights.

Otherwise one measures only the provisional 'novelty' or 'distractive' effect of daytime running lights; not the intended enduring 'true' effect, which will persist even after all vehicles use them.

Specificity of test: One must devise a test that responds only to the 'predicted' effect of daytime running lights to reduce daytime multi-vehicle accidents; not also to the effect of any other factor.

Or if one is unable to do so, one must measure and allow for the influence upon the test of the other factor.

On scrutiny NHTSA 2000 fails to meet both criteria:

Common background: First, NHTSA 2000 compares the figure of accidents of motorcars that use, or do not use, daytime running lights against a common, not diverse, background.

The accidents of motorcars using, and not using, daytime running lights are recorded over the same period, in the same area.

Lack of specificity of test: Second, by virtue of their formulation, both the 'simple odds' and 'odds-ratio' test respond to the effect of other actors besides daytime running lights.

But NHTSA 2000 neither presents data, nor allows for, the influence of the factors.

The 'simple odds' test has a 'dual sensitivity' to differences in the volume of nighttime driving of the drivers of different makes and model years of motorcar.

The 'odds-ratio' test has a 'dual sensitivity' to differences in the volume of late nighttime driving of the drivers of different makes and model years of motorcar.

The sensitivity—as exemplified by Finnish and Swedish monthly odds-ratio values*—flows from the fact that late at night the traffic density, and so ratio of multi-vehicle accidents to single-vehicle accidents, falls.

NHTSA might attempt in the circumstances to 'profile' a sample of drivers, and allow for the influence of any differences in the volume of nighttime driving between them that the exercise reveals.

But it does not do so.

Conclusion

In conclusion, because of their mixed nature, the findings of NHTSA 2000 are not in favour of motorcar daytime running lights, but instead equivocal.

More fundamentally, because of the defects of method of NHTSA 2000, the findings are also totally unreliable, and so utterly worthless.

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* Eg in Finland in 1968 the odds-ratio value was 1.70 in December, but 4.09 in June (Andersson *et al* 1976).