

Using a driving simulator to evaluate a road safety education programme for young drivers

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Introduction

- Road traffic crashes are the leading cause of death for young people between the ages of 15 and 19 years and the second leading cause of death for 20 – 24 year-olds worldwide (Toroyan & Peden, 2007).
- In the UK, young drivers, especially males, have relatively more road traffic crashes than older drivers (Clark et al, 2002).
- In 2007, drivers aged 17 - 25 years old accounted for 48% of single vehicle car crashes and 82% of these were male drivers (Department for Transport, 2007).
- Various measures have been recommended to reduce the risks to young drivers and improve their safety. These include communication campaigns, stricter law enforcement, economic incentives, and education courses based on personal experiences (Berg, 2006).

Driving simulation

- Driving simulation frequently used in experimental and applied research to assess the effects of a wide range of factors that can affect driving
- Also used for driver training
- Driving simulators considered to be a valid and relatively safe means of measuring driving performance under experimental conditions (Kaptein et al., 1996; Reed and Green, 1999; Godley et al, 2002; Dorn, 2005; Fagbemi & Pfeffer, 2008).
- Driving simulators have been less frequently used for evaluation of interventions.

Aims

To investigate the usefulness of a driving simulator in evaluating the effects of a road safety education intervention on the driving behaviour of young drivers.

Participants

48 young drivers (24 men and 24 women,
mean age 19 years 9 months)

Within each gender group, participants were randomly assigned to either the experimental (road safety communication) or the control condition.

Materials

A fixed-base driving simulator (STISIM Model 100) housed in a full-sized Fiat Cinquecento; including a steering wheel, accelerator, brake and rear view mirror.

Urban and rural simulated road scenes were projected onto a large screen with a 60° horizontal field of view.

Two DVDs:

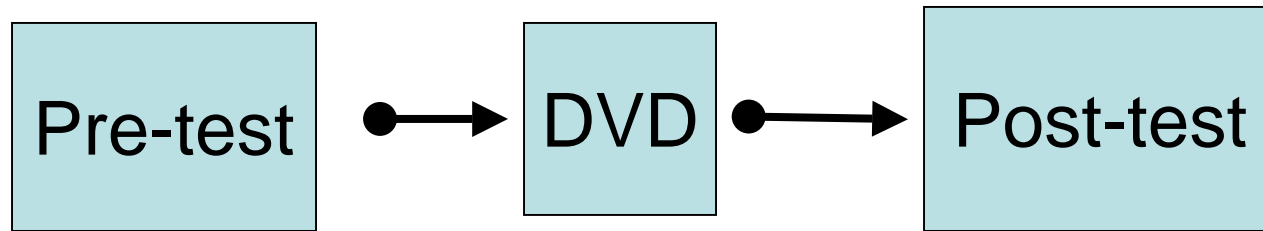
The experimental (road safety) DVD included personal accounts of road traffic victims and their families as well as emotional appeals to young drivers to reduce their speed and drive carefully.

The control DVD included footage from a popular animation about cars. Both lasted about 12 minutes.

Design

First session – Familiarisation drive

Second session



Third session - subjective assessment of simulator session

Procedure

- Participants were requested to sit in the car and drive the simulated route as they normally would, observing the UK highway code.
- Follow-up questionnaires concerned self-reported driving behaviours and subjective experiences of the driving simulator.

Results

Analysis of Variance was used for statistical comparisons.

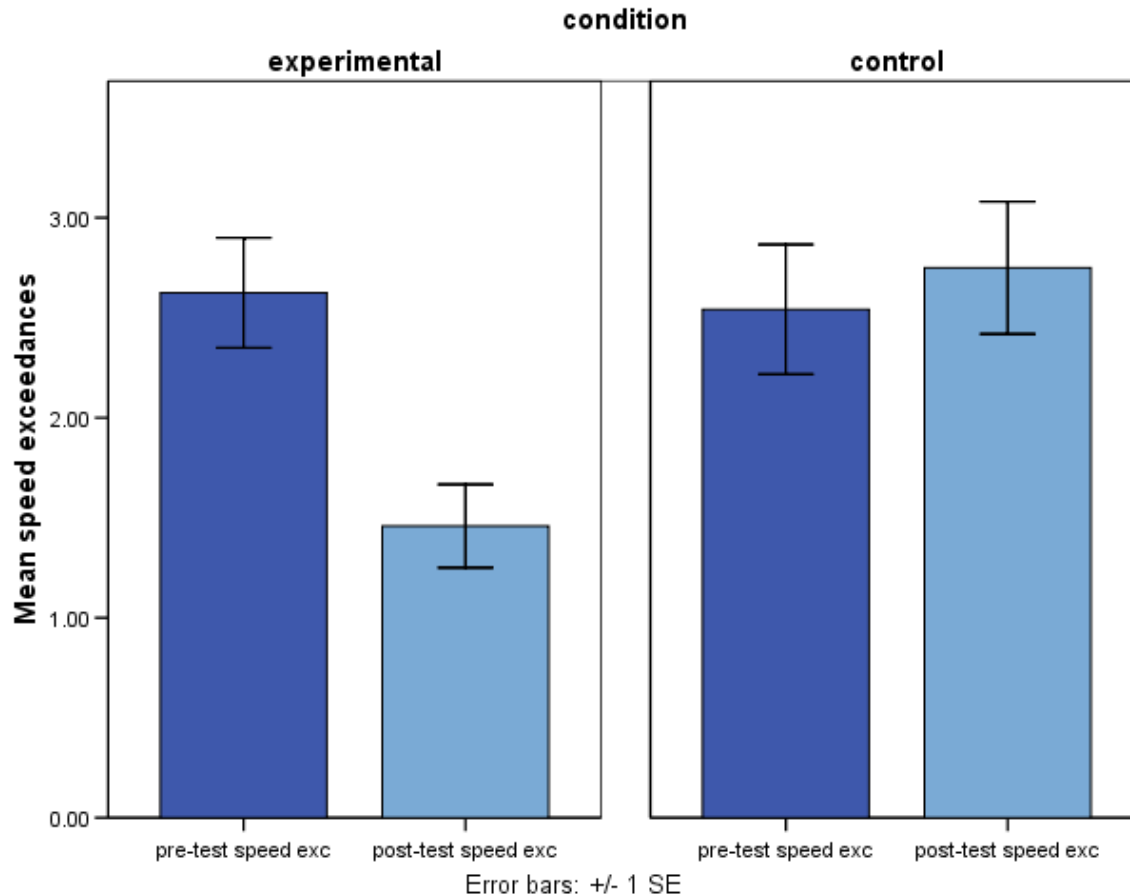
Between subject factors were

condition with 2 levels (experimental and control)

gender with 2 levels (male and female)

The Within subject factor was **pre-test/post-test** with 2 levels (driving before and after viewing DVD)

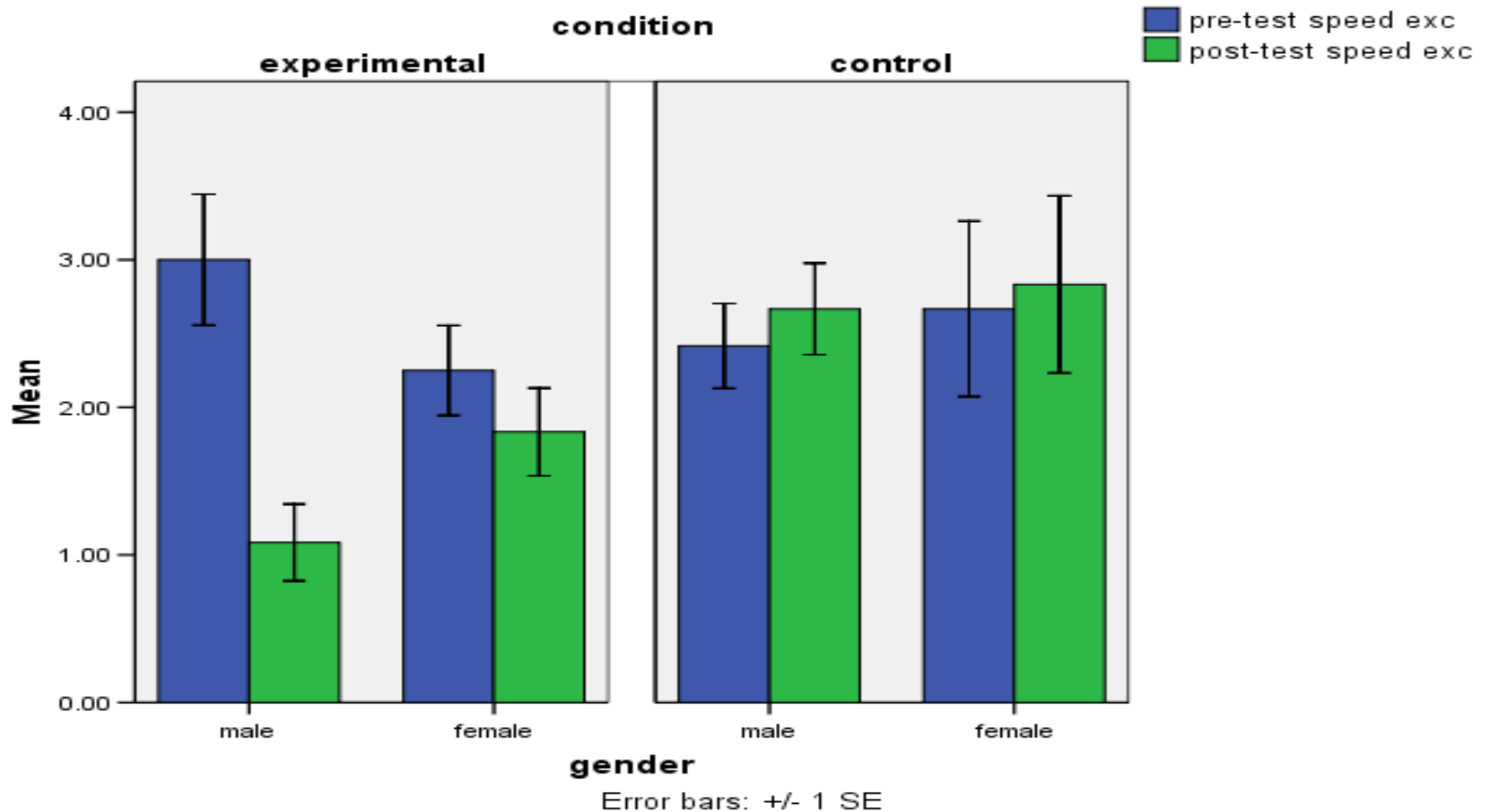
Speeding: condition effects



Speed exceedances decreased after viewing the road safety DVD but not after viewing the control DVD

Effect of condition $F_{1, 44} = 4.29, p < 0.05$;
Condition x Pre-test/Post-test interaction $F_{1, 44} = 5.75, p < 0.05$

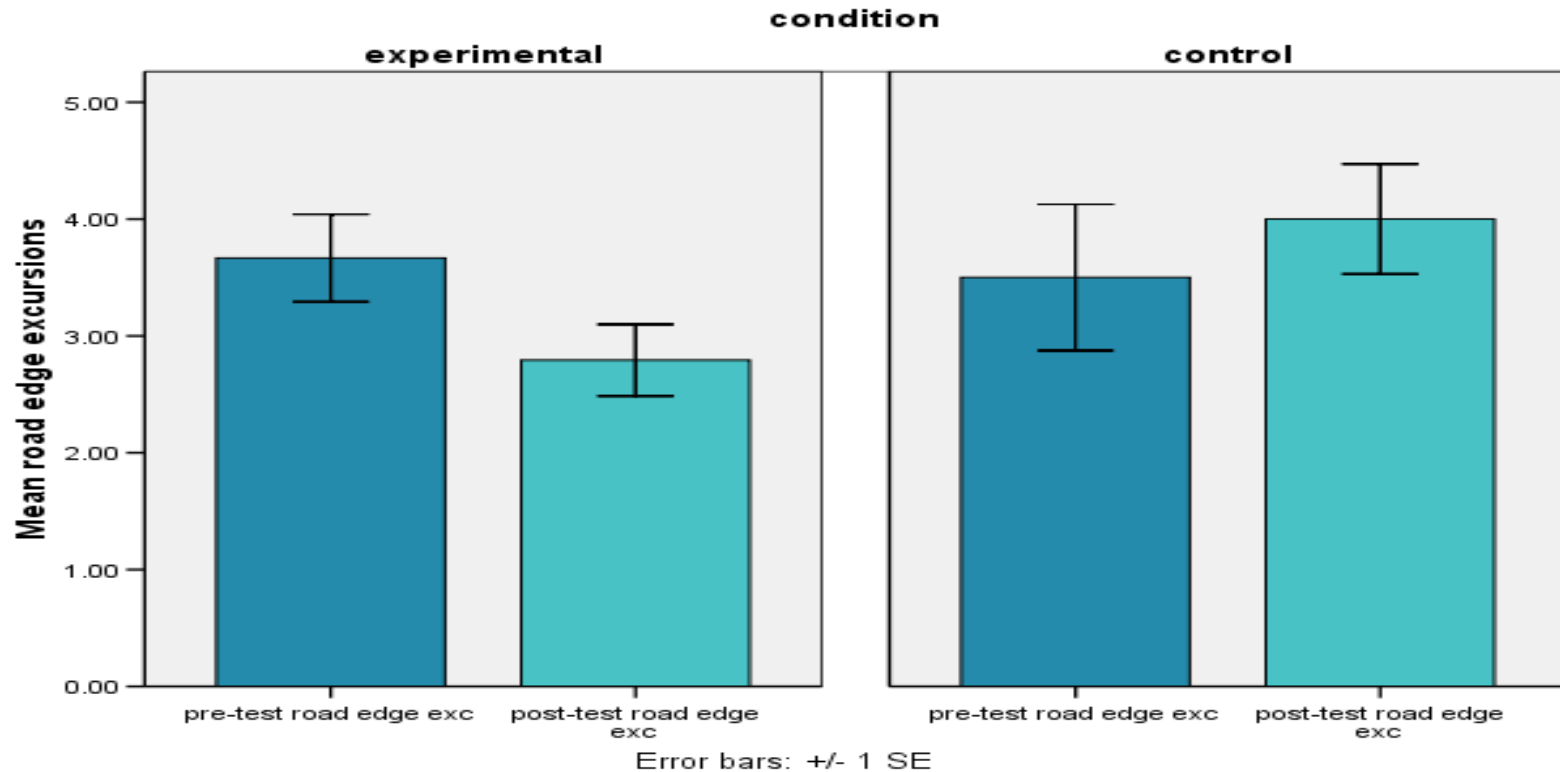
Speeding : comparison by gender



Speed exceedances decreased for male drivers after viewing the road safety DVD $p < 0.05$.

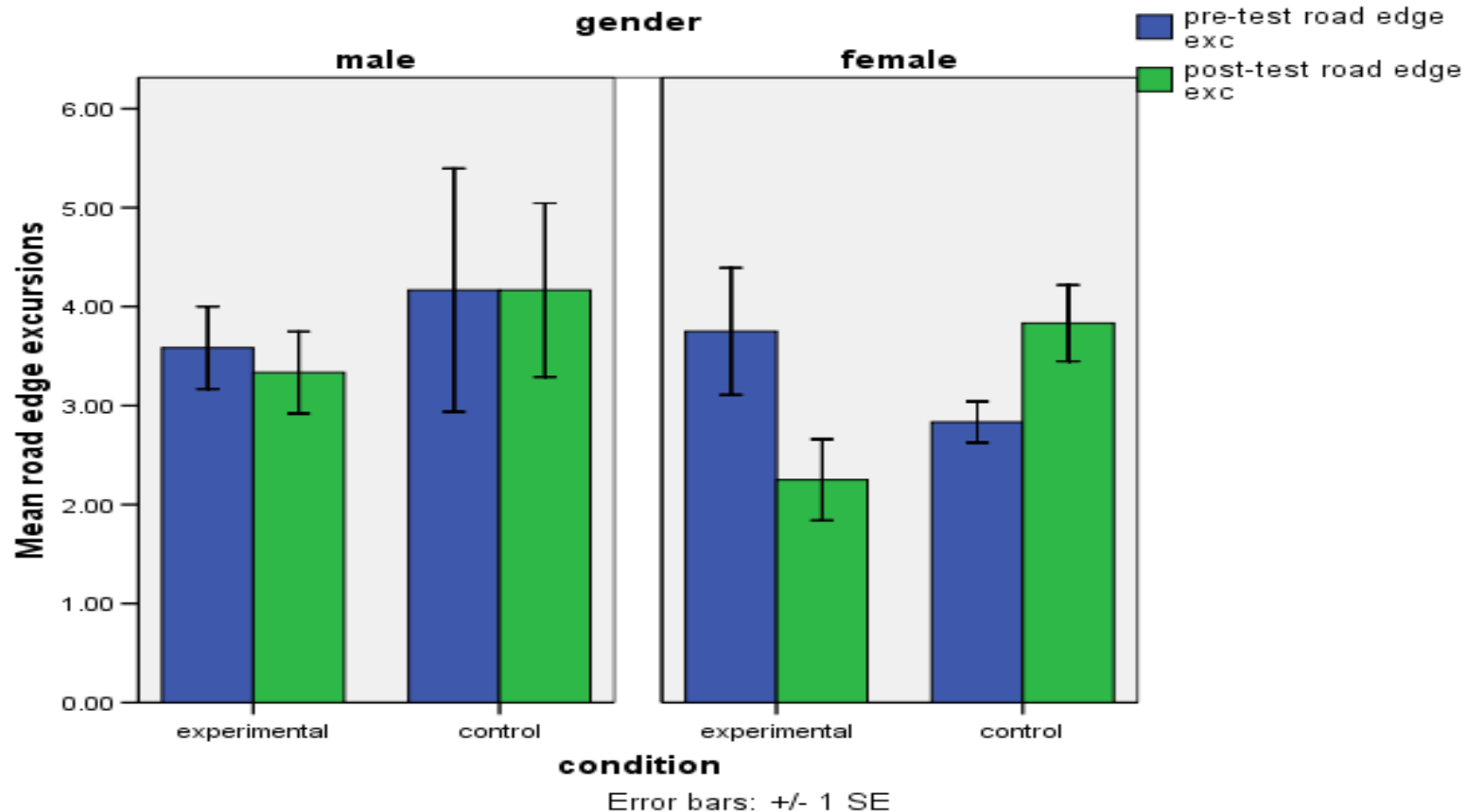
All other comparisons were non-significant.

Vehicle control (road edge excursions): condition effects



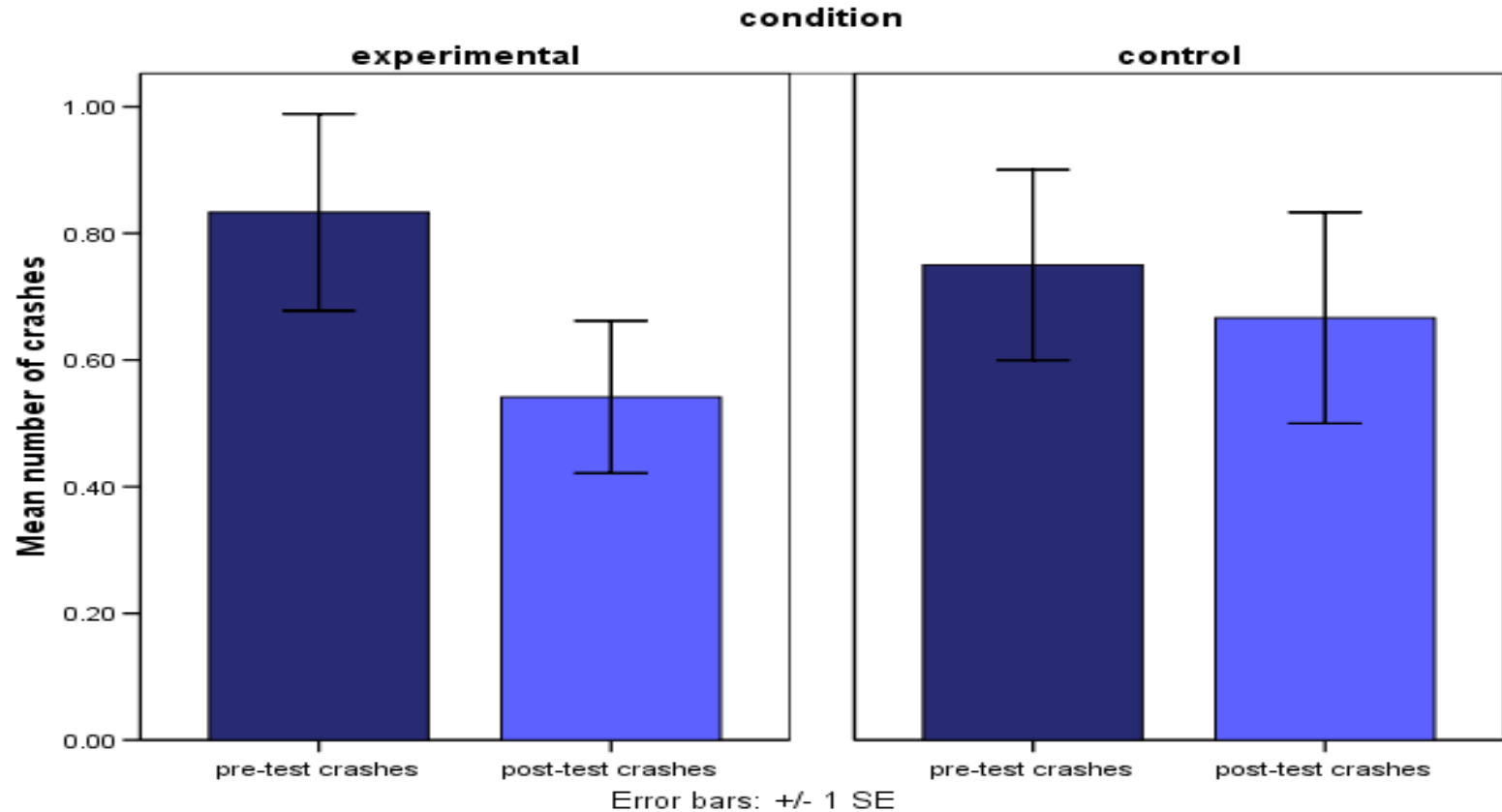
Main effect of condition on road edge excursions non-significant.
Condition x Pre-test/post-test interaction $F_{1,44} = 4.14, p < 0.05$

Vehicle control (road edge excursions): comparison by gender



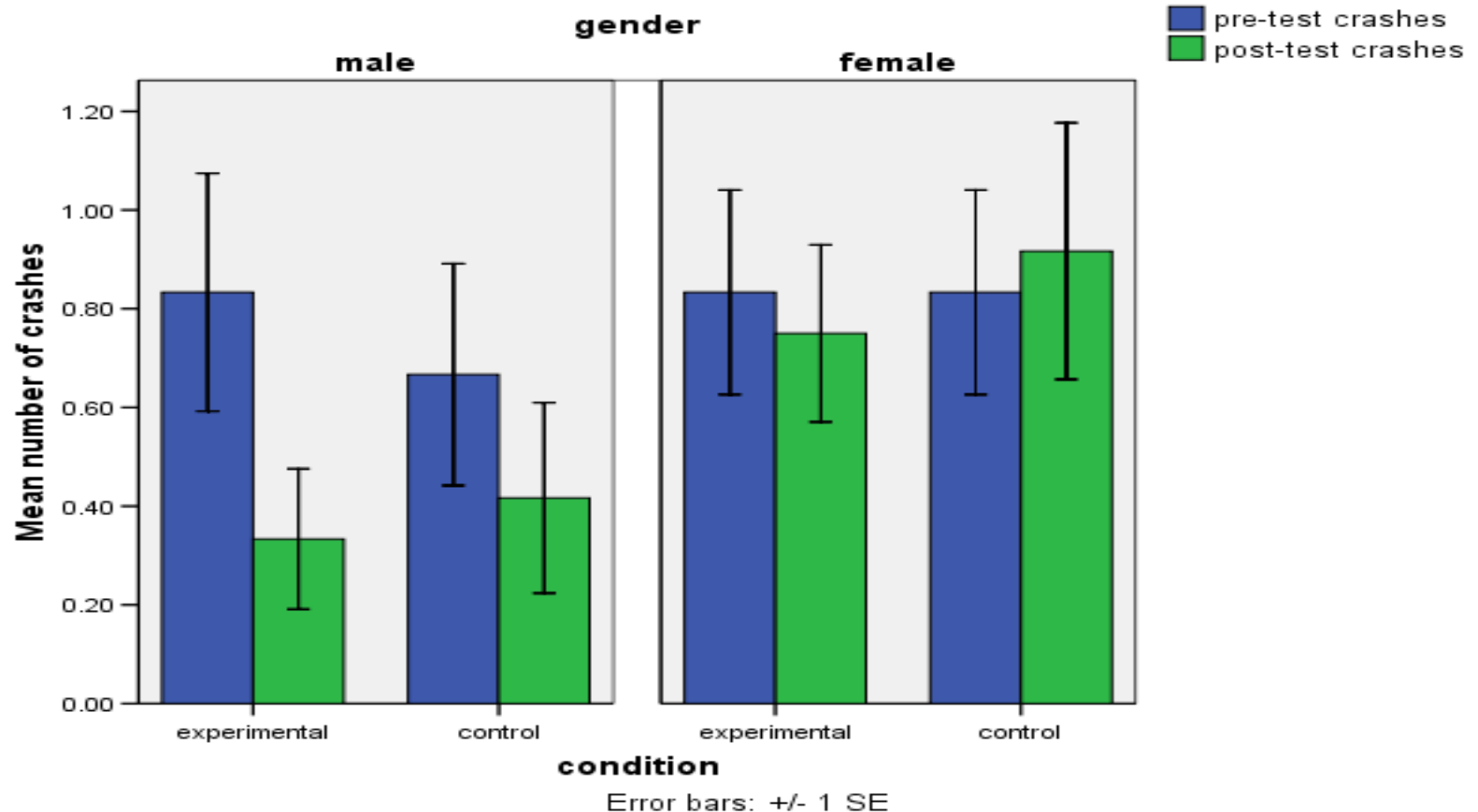
Vehicle control improved (as measured by a decrease in road edge excursions) for female drivers after viewing the road safety DVD ($p = 0.002$). Also, vehicle control worsened (REEs increased) after viewing the control DVD.

Crashes: condition effects



Main effect of condition on total number of crashes non-significant.
Also no statistically significant interaction effects.

Crashes: comparison by gender



The number of crashes for male drivers reduced in both conditions.
No statistically significant interaction between gender and condition.

Subjective reactions to the experimental procedure

- The majority of participants reported that the road safety DVD had affected their driving on real roads as well as in the simulator.
- When asked whether they thought the DVD had affected their driving, 79.2% of those who viewed the DVD responded that it had affected their driving in a positive way and 20.8% responded that it had not.
- In contrast, only 4.2% of the control group thought the control DVD had affected their driving
- This difference was statistically significant $X^2 (1) = 24.77$, $p < 0.001$.

Subjective reactions continued

- The majority (62.5%) who viewed the road safety DVD also thought it had affected their driving on the driving simulator.
- 20% of participants thought that they had taken more notice of speed limits after viewing the road safety DVD, 16.66% thought they were more observant and aware, 16.66% thought that they drove more cautiously.
- In the control condition, only 4.17% thought the DVD had affected their simulated driving and 95.83% thought it had not.

Limitations

- Some participants (20%) thought that the driving simulator was too artificial
- Future studies should include longer time lapses between the pre-test and post-test
- Driving simulation not suitable for all participants

Comparisons with questionnaire measures

- Questionnaire data obtained from 125 young drivers (aged 17-19 years)
- 57 drivers in the road safety communication group and 68 in the control group completed questionnaires
- Questions included driving mistakes and offences as well as attitudes to driving.
- Pre-test/post-test design.

Comparison results

Results were comparable to the driving simulation results:

- The frequency with which drivers reported going over the speed limit decreased following road safety education ($p = 0.002$) but no statistically significant difference was observed for the control group.
- The number of collisions decreased slightly for the road safety communication sample and for the control group. This slight decrease was statistically non-significant for both groups of drivers.

Conclusions

- Participants in our driving simulator studies have reported driving in the simulator to be enjoyable, realistic and occasionally as stressful as driving on a real road.
- For some measures, results were comparable to those obtained by questionnaire.
- Driving simulation provides a safe, quick and efficient means of obtaining objective data on the effects of road safety education for young drivers.
- It is recommended to injury prevention practitioners as a useful tool for evaluation purposes, particularly for young drivers.

References

- Berg, H-Y. (2006). Reducing crashes and injuries among young drivers: what kind of prevention should we be focusing on? *Injury Prevention*, 12, i15-i18.
- Clarke, D., Ward, P. and Truman, W. (2002). In depth accident causation study of young drivers. Department for Transport, London, UK. <http://www.dft.gov.uk>
- Department for Transport (2007). Road Casualties great Britain: 2007. Transport Statistics, Department for Transport, London, UK. <http://www.dft.gov.uk>
- Dorn, L. (2005).
- Fagbemi, O.S. and Pfeffer, K. (2008). The relationship between chronic sleep deficits and distractions in young adult drivers. *Advances in Transportation Studies, Special Issue*, 57-63.
- Godley, S.T., Triggs, T.J. and Fildes, B.N. (2002). Driving simulator validation for speed research. *Accident Analysis & Prevention*, 34, 589-600.
- Kaptein, N.A., Theeuwes, J. and Van der Horst, R. (1996). Driving simulator validity: some considerations. *Journal of the Transportation Research Board*, 1550, 30-36.
- Reed, M.P. and Green, P.A. (1999). Comparison of driving performance on-road and in a low-cost simulator using a concurrent telephone dialling task. *Ergonomics*, 42, 1015-1037.
- Toroyan, T. & Peden, M. (2007). *Youth and Road Safety*. Geneva: World Health Organization.