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Research challenges and findings from a driver training pilot study in China

A/Prof Teresa Senserrick[1,2], Dr James Yu[3], Dr Soufiane Boufous[2], Prof Mark Stevenson[4], Prof Rebecca Ivers[1]

[1] The George Institute for Global Health, The University of Sydney, Australia
[2] Transport and Road Safety Research, The University of New South Wales, Australia
[3] Global Actions in Harmful Drinking, China
[4] Monash University Accident Research Centre, Australia

Email for correspondence: t.senserrick@unsw.edu.au

Abstract

The George Institute in Australia and China collaborated on a pilot study, funded by the FIA Foundation, to develop and evaluate a driver education and training program to reduce novice driver crashes in China. The program was established and implemented in Beijing during 2010-2011.

A randomised control trial was conducted with recently licensed drivers recruited through official driving schools. Block randomisation was used to randomise participants to the intervention (n=64) or control group (n=63), with the latter receiving roadside assistance memberships to similar monetary value as the intervention. The intervention included a DVD education program on novice-specific risks plus six hours of in-vehicle training focused on maintaining a safety gap around the vehicle. Participants completed baseline and follow-up questionnaires at approximately four months apart.

Recruitment proved challenging, however, once involved, all participants bar one continued through to follow-up. Relatively equal distribution by age, gender and other characteristics was achieved. Very low incidence of any risk taking was reported. Trained participants were significantly more likely to transition to driving-related employment positions and also, but not significantly, reported greater average driving exposure, driving risks and inflated perceptions of their ability than controls. There was no difference in crash involvement (9 participants or 14% in each group).

Findings may reflect cultural differences in research familiarity and reporting as much as actual outcomes of the intervention; notwithstanding limitations in participant numbers and self-reported methods applied. The potential for the program to lead to over-calibration and increased risk cannot be discounted. More effort is needed in future studies to build rapport with participants and to have local endorsements to support truthful responding without consequences. Representative research and more local data on novice crash and offence issues is also needed to increase our understanding of novice driver risks in China and how to best address them.

Key words: novice drivers, driver training, crashes, risky driving, China.

1. Introduction

In the two decades between 1985 and 2005 the number of private passenger vehicles in China increased ninefold (Hu et al, 2008), with Beijing experiencing a tenfold increase in the past decade (Liu et al, 2006). Accordingly, the number of licensed drivers (minimum age 18 years) has also increased rapidly, with a 2010 publication citing 60 million new drivers in China in the previous three years (Wang et al, 2010). The rapid pace of the transition to a

private car culture has been supported by rapid growth in road infrastructure, but systems infrastructure, including effective driver education, training and licensing programs for novice drivers, is yet to match this rapid pace (World Bank, 2008; World Health Organization, 2009).

Correspondingly, road traffic crashes and mortality have also rapidly increased. The Ministry of Public Security Annual Report cited a total approaching 68,000 deaths in 2009, although comparisons to death registration data collected by the Ministry of Health suggest this figure may be twice as high (Hu et al, 2011). Furthermore, the rate of increase in road traffic injuries between 1985 to 2005 exceeded that anticipated against an earlier estimated increase of 92% by 2020 (Hu et al, 2008; Kopits & Cropper, 2005). Without effective preventive measures, both the social and economic costs for China will be excessive, with road traffic fatalities accounting for more than one-third of potentially productive life years lost from injury deaths in China due to the over-involvement of youth and young adults (Wang et al, 2008).

Within this context, The George Institute for Global Health in Australia and China sought to collaborate to develop and evaluate a driver education and training program for novice drivers in China, with funding from the Fédération Internationale de l'Automobile (FIA) Foundation. The program was established and a pilot randomised control trial conducted in Beijing, with details of the program development phase and process evaluation previously reported (Senserrick et al, 2011). The long-term objective of this research was to develop a driver education and training program for novice drivers in China that would be effective in reducing their over-involvement in road traffic crashes. The present paper reports on the outcome evaluation, which aimed to determine the impact of the program on road safety outcomes, including self-reported risky driving and crash involvement.

2. Methods

2.1. Procedure and participants

Recruitment was conducted with attendees at driving schools at the time of passing their licence tests and required grand measures to authenticate the study, including professional posters and large billboards in the driving school area and professional “uniforms” and identity badges for researchers. The researchers explained the general objectives of the research and study aims and requirements. Inclusion criteria were: (a) having obtained a driver licence within the past four weeks; (b) access to a vehicle; and (c) intention to drive during the following months. This was to ensure that all participants were novices, with a somewhat similar baseline of driving experience, and also that they had the opportunity to drive during the study period in order to be able to gauge any differences between trained and non-trained participants on the outcome measures. If interested, applicants were invited to contact The George Institute China office to schedule a visit for an in-person interview.

At the office visit, informed written consent was first obtained, followed by a baseline survey, which could either be self-completed or by interview. After the baseline survey completion, a block randomisation technique (blocks of five) was used to randomly assign participants to the intervention or to a control group. The intervention included a DVD education program on novice-specific risks plus six hours of in-vehicle training focused on maintaining a safety gap around the vehicle. In lieu of the free driving lessons provided to intervention participants, control participants were provided with a six-month roadside assistance membership with the China Automobile Association to a similar monetary value. Comprehensive driving insurance was also purchased for the intervention participants for six months to cover their involvement in the study. No claims were made throughout the study.

In total, 127 participants were recruited during March to November 2010. Of these, 64 were randomised to the intervention and 63 to the control group. Participants were invited to complete a follow-up questionnaire at approximately three months following the intervention

or equivalent timeframe for controls, approximately four months from baseline. An interactive survey document was developed in order to allow participants to complete email without the requirement for printing and scanning. Alternatively, an interview could be conducted by phone. Car wash vouchers were offered to thank participants for their time. All but one control participant completed the follow-up survey, with this participant citing continued intention to complete the survey but inability to do so within the study timeframe.

All schedules for recruitment, follow-up contacts and all interview/survey responses were collated in the China office into Microsoft Office Excel 2007 spreadsheets and transmitted to the Australia office for further analyses. Ethical approval for the overall study protocol was sought and secured by both The University of Sydney Human Research Ethics Committee and the Peking University Institutional Review Board. This process proved to require several iterations and added considerably to the timeframe for the conduct of the study.

2.2. Measures

The baseline survey and follow-up survey were developed based on previously validated items and measures where possible, primarily based on a cohort of over 20,000 newly-licensed drivers in New South Wales; namely, The DRIVE Study; described in detail elsewhere (Ivers et al, 2006). Items specific to the licensing system in China and the specific education and training program under evaluation were developed and integrated. Chinese translations were reviewed and agreed by two of the China-based project researchers. Both surveys were first piloted for interpretability with other personnel in The George Institute China office working in differing research fields (e.g., cardiology).

The baseline survey comprised items regarding: multiple contact details; demographics; driving training experience, intended driving and vehicle once licensed; typical sleep hours; alcohol consumption based on the Alcohol Use Disorders Identification Test (AUDIT; Babor et al, 1992)]; Kessler-10 Psychological Distress Scale (Kessler et al, 2002); an item from the Beck Suicide Intent Scale (Patton et al, 1997); perceptions of driving risks (Ivers et al, 2006); and the impulsivity sub-scale of the Sensation Seeking Scale (Zuckerman et al, 1993). The follow-up survey additionally comprised items regarding: the China version of the Driver Behaviour Questionnaire (DBQ; Xie & Parker, 2002), which separates the violation subscale into “aggressive violations” and “ordinary violations”; and crash involvement and crash characteristics (Senserrick et al, 2007).

2.3. Statistical analyses

Variables related to driving experience, driver training, risk-taking behaviours as well as various socio-demographic characteristics were compared between intervention and control groups both at baseline and at follow up. For categorical variables, proportions were computed for each group and tests of significance (Chi-square test or Fisher's exact test) were carried out as appropriate with a p value provided for each comparison, with $\alpha = 0.05$ significance level. For continuous variables, means, standard deviations and 95% confidence intervals (CIs) were provided for each group, with non-overlapping CIs indicating significant differences. All statistical analyses were carried out using SAS, Versions 9.1.

3. Results and discussion

3.1. Baseline

There were no statistically significant differences between intervention and control participants on baseline demographics and characteristics, suggesting the randomisation process was successful. Males represented 58 (45.7%) of the sample. Age ranged from 20 to 51 years, with an average age of 30.5 years. The peak age group was 26-34 year olds,

with about one-fifth younger and one-fifth older. The majority of participants (80%) worked full-time, and had a bachelor or higher degree (91%), and almost two-thirds were married. Sensation scores were extremely low averaging at mean 5.2 from a possible score range of 0-20. Risk perception scores were strongly orientated towards safety averaging at mean 39.3 from a possible score range of 0-44. Alcohol use was too low to calculate AUDIT high risk levels. The majority reporting drinking once a month or less (66 or 52.0%) or never (47 or 37.0%).

These findings contrast sharply to newly-licensed drivers in high income countries who are more likely to be closer to the minimum licensing age, never married and either completing secondary school or progressing to employment or higher education (e.g., CHOP, 2007; Ivers et al, 2006). They also tend to report higher sensation seeking scores and risk propensity, including high levels of hazardous drinking, albeit they are also likely to be younger (e.g., CHOP, 2007; Ivers et al, 2006).

In terms of training and licensing experience, approximately three-quarters (94, 74.1%) had failed some aspect of the tests conducted by the driving school for licensure on previous attempts. When further queried on which test aspect, only 37 replies were provided: 5 failed the theory test, 17 the in-school field tests, and 15 the on-road practical test. Overall however, 121 or 95.3% of participants believed they still needed more training even though they had successfully completed all the driving school training hours (58 hours) and testing for licensure. Now licensed, most anticipated driving either 1-2 times per week (44 or 34.6%) or 3-4 times per week (45 or 35.4%).

This high level of test failures on first attempt is much higher than might be anticipated in high income countries. In the DRIVE Study, for example, approximately two-thirds of participants passed their practical driving required for licensure on the first attempt (66% of females and 64% of males) (Boufous et al, 2011). Similarly, a study of over 1,000 newly-licensed drivers in Queensland, Australia, reported that 68.5% passed their licence tests on the first attempt (Scott-Parker et al, 2011).

3.2. Follow-up

Average weekly hours of additional training and driving experiences at follow-up are summarised in Table 1. Both the control and intervention groups gained additional training experience with family or friends, on average about 7-8 hours. The intervention group reported an average of six hours training with a study instructor (as provided in the program), but also, on average, an additional hour with another instructor. Control participants sought on average almost 4 hours with a professional instructor. There were therefore significant differences in the types of professional experience gained, but overall the intervention group averaged 7.3 hours additional instruction compared to 3.7 hours for the control group. The intervention group reported more driving hours per week than the control group, but not to a statistically significant difference. Reports of driving in rural areas or after midnight were rare, and only marginally more between 10pm and midnight.

These figures are somewhat comparable to a representative study of newly-licensed students in the United States (CHOP, 2007). More than 60% of participants reported frequently driving to relax or as a way to spend time with their friends, while more than half reported regularly driving to school or a job. Three-quarters regularly drove for shopping or running errands. However, night driving, particularly after midnight is more common and is a known inflated crash risk factor for novices (Williams, 2003).

Table 1. Average hours of additional training and driving experiences at follow-up (N=126)

Average hours experience	Control M (SD)	95% CIs	Intervention M (SD)	95% CIs
Training with family/friend	7.0 (11.7)	4.0, 9.9	8.2 (13.8)	4.8, 11.6
Training with study instructor	0.1 (0.5)	0.0, 0.2	6.1 (2.1)	5.6, 6.6*
Training with other instructor	3.6 (6.2)	2.0, 5.1	1.2 (2.8)	0.5, 1.8*
Weekly driving	5.6 (6.6)	4.0, 7.3	7.5 (12.1)	4.5, 10.5
Weekly driving, rural	0.5 (1.7)	0.1, 1.0	0.4 (1.6)	0.0, 0.8
Weekly driving, 10pm-12am	0.7 (1.6)	0.3, 1.1	1.9 (10.7)	0.0, 4.6
Weekly driving, 12am-6am	0.0 (0.3)	0.0, 0.1	0.0 (0.3)	0.0, 0.1

* Significant difference indicated by non-overlapping confidence intervals for control and intervention groups

We asked participants to rate their driving ability relative to other novice drivers, as well as to the "average driver" with results presented in Table 2. There were no statistically significant differences between control and intervention participants. Responses were close to the scoring mid-point of 3, with perceptions compared to other novices suggesting slightly above average perceptions, but perceptions compared to the average driver suggesting below average perceptions.

Table 2. Assessment of driving ability at follow up (N=126)

Item	Group	Mean (SD)	95% CI
Driving ability compared to novice drivers	Control	2.66 (1.05)	2.39, 2.92
	Intervention	2.48 (0.90)	2.25, 2.70
Driving ability compared to average driver	Control	3.87 (0.87)	3.65, 4.09
	Intervention	3.65 (0.94)	3.42, 3.89

Note: Score range from "much better" = 1 to" much worse" = 5

This contrasts sharply to novice drivers in high income countries who often rate their driving ability as above average in all comparison (as do more experienced drivers; see Senserrick & Mitsopoulos-Reubens, 2012). For example, in the DRIVE Study (Ivers et al, 2006), 62% reported being "better" or "much better" than other novices and 36% "about the same". Compared to the average driver, 30% still rated their driving ability as "better" or "much better" and 56% as "about the same".

The main outcomes of interest at follow-up in terms of the likely impact of the driver education and training program were self-reported risky driving, in terms of the DBQ subscales, and crash involvement. Table 3 summarises the finding for the DBQ subscales and Table 4 the resulting crashes, with no statistically significant differences identified. For each DBQ subscale, the means were extremely low, with only the lapse scale reported by intervention participants scoring a mean over 1.0. It was not uncommon for participants to rate every item as "0" including the items regarding driving over the speed limit.

These scores are somewhat lower than those found in the original China DBQ study conducted with experienced commercial drivers aged 19-60 years (Xie & Parker, 2002). Scores were more likely to approach 1.0 or slightly exceed 1.0, and a breakdown by age group showed higher scores among the youngest groups, which decreased with age.

In terms of crashes, 18 participants or 14.3% were involved in a crash as a driver; 9 each in the control (14.5%) and intervention (14.1%) groups. None reported multiple crashes. There were no statistically significant differences in crash and non-crash involvement by control and intervention groups, although the numbers were likely too small to detect any differences. A similar proportion of novice drivers have been found to report crash involvement in the first

six months of licensure in high income countries such as 10% in a recent Australian study (Scott-Parker, 2012).

Table 3. Driving Behaviour Questionnaire subscales at follow up (N=126)

How often when driving	Group	N	Mean (SD)	95% CI
DBQ aggressive violations	Control	61	0.48 (0.77)	0.28, 0.68
	Intervention	62	0.48 (0.61)	0.32, 0.63
DBQ ordinary violations	Control	61	0.46 (0.48)	0.34, 0.58
	Intervention	63	0.59 (0.56)	0.45, 0.73
DBQ errors	Control	60	0.64 (0.70)	0.46, 0.82
	Intervention	63	0.73 (0.73)	0.54, 0.91
DBQ lapses	Control	61	0.77 (0.63)	0.61, 0.93
	Intervention	63	1.04 (0.76)	0.85, 1.23

Note: Score range from “Never” = 0 to ”Nearly all the time” = 5

Details of the crashes are summarised in Table 4. Crashes were somewhat divided between week days and weekend days, with most occurring during the day and either in the lowest speed zones, 30km/h or less, or on 60km/h roads, and in poor traffic conditions, such as heavy congestion. No participant reported a crash with music or mobile phone use (including hands-free) as contributing factors, although three involved other passengers. The majority of crashes involved other passenger vehicles (approaching three-quarters), three involved cyclists and one pedestrian/s, suggesting only one was a single vehicle crash. While it was common to have some damage to the vehicles, no-one was injured in any of the crashes.

Table 4. Crash characteristics at follow up (n=18)

Crash characteristic	Value	Total n (col. %)	Control n (col. %)	Intervention n (col. %)
Day of week	Week day	10 (55.6)	4 (44.4)	6 (66.7)
	Weekend day	8 (44.4)	5 (55.6)	3 (33.3)
Time of day	Day time	15 (83.3)	8 (88.9)	7 (77.8)
	Night time (dark)	3 (16.7)	1 (11.1)	2 (22.2)
Speed limit	30 km/h or less	8 (44.4)	1 (11.1)	7 (77.8)
	60 km/h	8 (44.4)	6 (66.7)	2 (22.2)
	70-90 km/h	2 (11.1)	2 (22.2)	0 (0.0)
Driving conditions	Weather was bad	3 (16.7)	3 (33.3)	0 (0.0)
	Traffic conditions were bad	13 (72.2)	6 (66.7)	7 (77.8)
	Other passengers in car	3 (16.7)	1 (11.1)	2 (22.2)
	Radio or other audio playing	0 (0.0)	0 (0.0)	0 (0.0)
	I was using a mobile phone	0 (0.0)	0 (0.0)	0 (0.0)
Others involved	Pedestrian/s	1 (5.6)	0 (0.0)	1 (11.1)
	Bicycle rider/s	3 (16.7)	3 (33.3)	0 (0.0)
	Motorcycle rider/s	0 (0.0)	0 (0.0)	0 (0.0)
	Drivers/passengers of other vehicle/s	13 (72.2)	6 (66.7)	7 (77.8)
Damage to vehicle	No damage	4 (22.2)	2 (22.2)	2 (22.2)
	Minor damage	13 (72.2)	6 (66.7)	7 (77.8)
	Major damage	1 (5.6)	1 (11.1)	0 (0.0)
Anyone injured	Noone was injured	18 (100.0)	9 (100.0)	9 (100.0)

3.3. Additional exploratory analyses

Given that overall lack of variation and therefore significant differences for the vast majority of analyses, the results were explored further via additional controlled and stratified analyses informed by these initial findings. These included:

- Controlling for time to follow-up: several intervention participants took longer to complete the training program and/or follow-up questionnaire than the majority, therefore their driving exposure over the study period would have been greater.
- Comparing results for those driving for work purposes versus not: given that a key significant difference was that intervention participants were more likely to drive for work purposes (as opposed to commuting), we explored whether this might have influenced the main outcome variables (DBQ, crashes).
- Comparing results for those that reported never drinking: this was included as a proxy for risk taking given this measure was one of few with some variation in response.
- Comparing results for those who reported "0" for all DBQ items to the remainder of the sample: this was included as a proxy for greater reflection and honesty in responding given that the "error" and "lapses" scales for example include involuntary mistakes that should be reported by novices.

In all cases, no significant differences were found.

4. Conclusions

The findings suggested a somewhat homogeneous sample or potentially cultural influences on responses provided towards high safety and low risk responses. A recent PhD thesis has explored cultural issues between drivers in China and Australia, albeit not focused on novice drivers per se (Fleiter, 2010). In this research, rapport was able to be established in small focus group of drivers. Cultural issues raised in China included the need to save "face" not only on a personal level but a country level when presenting to "foreign visitors". For example, there was clear community acceptance of speeding in China, as in Australia; however, unlike Australia, there was no embarrassment in reporting being caught speeding. When asked what they would tell a foreign visitor about the prevalence of speeding in China, responses indicated they would portray China as a safe country with no problem with speeding; that this was important to "represent the honour of the whole country". It is possible that the 'branding' of the present study as involving other countries – required not only due to Ethics requirements, but to promote the research as authentic – nonetheless may have contributed to the strong orientation towards safety. However, the original DBQ study conducted by Chinese researchers did also report quite low scores (Xie & Parker, 2002), suggesting this reporting may be prevalent regardless.

Given these potential cultural influences and scarcity of statistically significant differences found, it is unclear what the full impact of the program might have been in the current study. The main statistical difference at follow up was that those in the intervention group were more likely to progress to work requiring driving as a role of that employment (as opposed to commuting to and from work only). This was unexpected and it is not known whether the intervention participants leveraged their experience in the study to help achieve these positions. If assuming such work would require driving on a daily basis, this contrasts to the baseline expectations of how much driving would be undertaken. Only one control and two intervention participants anticipated driving four or more times per week.

It is possible this work role contributed to intervention participants reporting higher weekly average driving hours compared to controls, and slightly higher DBQ scores and perceptions of their driving ability. There is a long history of education and training programs for learner drivers being associated with over-estimation of driving ability or lack of self-calibration and thereby leading to *increased* rather than reduced crash risk once licensed due to the trained drivers taking on more demanding driving (Senserrick & Williams, 2012). This cannot be discounted in the current research, although analyses to control these factors also were not statistically significant, albeit based on very small numbers. Despite this, there were no differences in crash involvement. The vast majority occurred on lower speed roads with congestion resulting in vehicle damage but no injuries, which may simply reflect the main driving conditions in a city such as Beijing.

4.1 Limitations

Limitations of the study include inability within the project resources to deliver more than six hours of individualised driving lessons. While the optimal amount of professional lessons plus private supervised driving is unclear, the literature suggests a much greater number of hours is likely required (Senserrick & Williams, 2012). However, while more driving lessons could be speculated as necessary to reduce crash risk, the potential to lead to over-calibration in perceptions of driving ability and inadvertently increase crash risk cannot be discounted. Nonetheless, as China novices currently have a very low baseline level of experience, if any, of driving in typical Beijing traffic, it was anticipated that even six hours of lessons in such conditions, building on the driving school lessons and supplemented by the education program, would help alert new drivers to their uniquely high crash risk and to the higher order skills required for safer driving, and thereby promote safe driving practices.

In addition, participants were not able to be randomly selected and volunteered for an unfamiliar study, with an unfamiliar research approach. Therefore the generalisability to the wider novice driver population in China is unknown. Nonetheless, so little information is available on novice drivers in China and on the potential applicability of initiatives developed in high income countries that the results provide an important example to indicate feasibility issues and highlight lessons learned for future research initiatives.

4.2 Implications

The conflict between the need to present the international nature of the project to authenticate the study and meet ethics requirements, while potentially priming more safety-orientated responses, presents a conundrum for further research of this kind in China. It is likely that to increase truthfulness of responses when requiring wide-scale recruitment endorsement from a Government Minister might be needed and/or more explicit attempts to build rapport with individuals, to encourage honest reflection and responses and to assure there will be no consequences for responses deemed against maintaining ‘face’. A more substantial proportion of study budgets should be dedicated to high quality recruitment materials and initiatives in this regard. Conversely, the offer of free lessons or insurance and car wash vouchers for follow-up survey completion proved sufficient to ensure completion of the surveys with almost no attrition. Therefore, high monetary payments to participants were not required and helped lower that aspect of the budget.

Another lesson learned from this pilot study is that much more time and effort was needed to gain ethics approval for such research in China. The Australia ethics committee made requests that were unable to be readily accommodated in the China context (e.g., requiring full comprehensive insurance for intervention participants and recommendations to counselling services). The China ethics committee required changes to document formats or titles that seemed inconsequential to the study but resulted in considerable delays when needing to be ratified by the Australia ethics committee. In hindsight, more time could be dedicated to consulting with the ethics committees in each country prior to submitting the study protocol for approval. By pre-empting and discussing appropriate ways to address as many potential issues as possible beforehand, this could lead to more comprehensive initial ethics submissions that could reduce approval times in future.

Further research is necessary to gain a true understanding of the impact of the program, with qualitative research building rapport with participants most likely to have revealed more insights. Such research would also need to include random selection recruitment methods to ensure representativeness of the drivers. The current findings provide a snapshot of a particular volunteer novice driver group in China and cannot be generalised. As experiences with such studies builds and more data is made available on the driving offences and

crashes of novice versus experienced drivers in China, the education and training program could also be enhanced to focus more directly on known China-specific issues. Overall, this pilot study has been important in identifying several factors contributing to feasibility and interpretability of the evaluations findings and led to recommendations that can assist in wider scale studies in the future.

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