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Evaluating a novice driver and pre-driver road safety intervention

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Abstract

Intervention or evaluation studies represent a small proportion of traffic psychology research. The current study evaluated the effectiveness of a road safety intervention by measuring attitudes towards unsafe driving behaviors and risk perception. A sample of high school students (n = 133) participated in a road safety intervention program focusing on attitudes and risk perceptions of young people as novice drivers, pre-drivers, and passengers. This sample was compared with a matched sample of students who did not take the program (n = 172) on their attitudes and perceived risk towards unsafe driving, both prior to the program (T1), immediately after the program (T2), and at 6-week follow-up (T3). While no changes in attitudes towards unsafe driving were found for the control group, the intervention group reported riskier attitudes towards unsafe driving behaviors from T1 to T2 and T3. No differences were found from T1 to T3 in perceived risk towards unsafe driving for either the intervention or control groups. Implications of the study include encouraging a higher rate of road safety program evaluations, leading to better understanding of the effectiveness of road safety intervention programs and how they may be designed and delivered to ensure lower engagement in unsafe driving behaviors by young drivers.

Keywords: Young drivers; Driver training; Risk perceptions; Risk attitudes; Gender effects; Longitudinal study

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1. Introduction

Young driver overrepresentation in motor vehicle crash (MVC) rates (Blows et al., 2005; Peek-Asa et al., 2011; Zhang et al., 1998) is a public health priority (Cortes-Simonet et al., 2010; Ivers et al., 2009; Peden et al., 2004; Peek-Asa et al., 2011). In Australia, 17-to-24-year-olds comprise 13-15% of the driving population but 25% of all road deaths (BITRE, 2011). One percent of deaths to individuals over the age of 25 are transport-related, compared with 31% for those under the age of 25 (ABS, 2008). Males are more likely than females to be involved in fatal MVCs (Monárrez-Espino et al., 2006; Oltedal and Rundmo, 2006; Vassallo et al., 2007).

Underpinning young drivers' overrepresentation in MVCs is their tendency to engage in more unsafe driving behaviors than older drivers do (Bina et al., 2006; Blows et al., 2005; Catchpole, 2005; Chen et al., 2008; Fergusson et al., 2003; Ivers et al., 2009; Jelalian et al., 2000; Jonah, 1986; Laapotti et al., 2001; Simon and Corbett, 1996; Stevenson and Palamara, 2001; Stevenson et al., 2001; Ulleberg and Rundmo, 2002; West and Hall, 1997; Williams et al., 2007). Young drivers' exposure-controlled crash-risk is higher than that of older drivers (Deery, 1999; Jonah, 1986), while inexperienced 20-year-old drivers' crash-risk is higher than that of equally inexperienced 30-year-old drivers (Maycock et al., 1991). Compared with those involving older drivers, young drivers' MVCs are more likely to be characterized by unsafe driving behaviors (Clarke et al., 2005; Guria, 1999; Rhodes et al., 2005; Zhang et al., 1998). Gender is a consistent predictor of unsafe driving behaviors (Harré et al., 2000; Turner and McClure, 2003), with males participating more than females (Bina et al., 2006; Catchpole and Styles, 2005; Fergusson et al., 2003; Harré et al., 1996; Ivers et al., 2009; McEvoy et al., 2006; Oltedal and Rundmo, 2006; Vassallo et al., 2007).

1.1. Road safety interventions and evaluations

Approaches to reducing MVC rates have included stricter traffic regulation, increased education, and improving vehicle and road safety (Lund and Rundmo, 2009). Despite evidence of some success (Elder et al., 2004), death, injury and crash rates remain higher for younger drivers than for all other age groups (Mayhew et al., 2003; Shope, 2006). Intervention programs designed to modify driver behavior often fail to acknowledge the antecedents of specific unsafe driving behaviors (Schwebel et al., 2006; Sheehan et al., 2004). Despite this, Lund and Rundmo (2009) indicated that appropriately executed psychological road safety interventions could reduce MVCs. However, developing interventions to reduce young drivers' over-representation in MVCs has proven exceedingly complex (Sheehan et al., 2004), with driver education and training requiring continual research and evaluation (Mayhew and Simpson, 1995).

Despite having high face validity, Begg and Langley (2009) reported a lack of scientific evidence that driver training reduces novice drivers' crash involvement. This view has received considerable empirical support from evaluation studies (Christie, 2001; Glad, 1988; Howarth et al., 2000; Jones, 1993; Lund et al., 1986; Mayhew et al., 1998; Strang et al., 1982; Williams and Ferguson, 2004; Wynne-Jones and Hurst, 1984), literature reviews (Brown et al., 1987; Lonero, 2008; Lonero and Mayhew, 2010; Mayhew and Simpson, 2002; Mayhew et al., 1998; McKenna, 2012; OECD, 1990; Williams, 2006; Woolley, 2000) and meta-analyses (Elvik and Vaa, 2004; Roberts and Kwan, 2001; Ker et al., 2005; Mayhew and Simpson, 1996; Vernick et al., 1999). There is even evidence that driver education within graduated driver licensing schemes either has no effect (Mayhew et al., 1998), or may increase crash rates (Boase and Tasca, 1998; Ferguson, 2003; Mayhew and Simpson, 1996; Mayhew et al., 2003). While much less research has investigated the effect of novice driver training on presumed crash antecedents, such as knowledge, attitudes and perceptions, studies have also

indicated deficiencies in intended outcomes following such programs (Carcary et al., 2001; Poulter and McKenna, 2010; Zeedyk et al., 2001). The current study aims to increase knowledge in this aspect of the field by comparing naturally occurring groups in a quasi-experimental design (Lonero and Mayhew, 2010).

Evaluations are vital in enhancing the benefits of interventions by investigating their impacts on traffic safety, identifying areas requiring focus, and encouraging resources to convert research into practice (Iversen et al., 2005). However, the continuing gap between road safety research and practical interventions impedes progress in preventing traffic-related injuries (Sleet and Baldwin, 2010). Reviewing nearly 1500 traffic psychology publications for the years 1998-2008, Glendon (2011) found that less than 2% could be classified as either intervention or evaluation studies.

Generic program evaluation strategies (Hamblin, 1974; Owen, 2007; Posavac and Carey, 1997; Stufflebeam, 2001; Stufflebeam and Shinkfield, 1985) can be augmented by specific guidance on evaluating driver training (Clinton and Lonero, 2006a, b; Lonero and Clinton, 2006; OECD, 1986; Queensland Government, 2009). However, establishing the effectiveness of campaigns using crash data has been considered flawed due to the low frequency and random variability of crash numbers (Hutchinson and Wundersitz, 2011), as well as research design problems (Tay, 2001). Limited evaluation research has determined that, whilst offering the promise of reduced deaths and serious injuries from young drivers' MVCs, the efficacy of road safety campaigns has generally been low (Atkin, 2001; Delaney et al., 2004; Delhomme et al., 1999; Lund and Aaro, 2004; Mendelsohn, 1973; Phillips et al., 2011; Senserrick, 2007; Strecher et al., 2006; Vaa et al., 2004), including traditional and school-based driver education programs (Hirsch, 2003; Mayhew, 2007; Senserrick et al., 2009; Vernick et al., 1999).

To respond to this evaluation problem, strategies could aim to determine the effectiveness of campaigns by measuring important predictors of safe and unsafe driving behaviors, in the

expectation that these potentially translate into corresponding driving behaviors (Ulleberg and Rundmo, 2003). Two such predictors are attitudes and perceived risk, which have been shown to reliably predict unsafe driving behavior and crash involvement (Hatfield and Fernandes, 2009; Iversen et al., 2005; Kraus, 1995; Weinstein et al., 1998). Rowe et al. (2013) found that pre-driver attitudes became riskier as driver training and experience increased, opening the possibility that interventions seeking to influence pre-driver attitudes are worth investigating. Mann and Sullman (2008) is a rare example of an evaluation of a pre-driver training program. The current study adds to the literature by exploring the extent to which novice driver and pre-driver attitudes might be influenced by a training intervention.

1.2. Attitudes towards unsafe driving

An evaluation of an advanced driver coaching system revealed that although driving experience is necessary to acquire relevant skills, this does not guarantee enhanced driving competency (Stanton et al., 2007). These authors suggested that advanced driving courses have not been effective as they lack insight training such as attitudinal and motivational factors. Harré (2000) observed that young drivers' increased participation in unsafe driving behaviors suggested that their over-representation in crashes and injuries is not solely related to their driving inexperience, but that judgements they make whilst driving may be problematic. This supports assertions that, while it is significant, inexperience alone does not lead to increased crash risk among young drivers (Catchpole, 2005; Jonah, 1986). It seems that inexperience may be fundamentally linked to, or exacerbates, young drivers' flawed judgements (Clarke et al., 2006; Cooper et al., 1995; Ulmer et al., 1997).

Evaluating relevant factors is integral to an individual's decision-making (Ajzen and Fishbein, 1977). Attitudes towards traffic safety have been negatively correlated with unsafe driving behavior, including aggressive driving, speeding, and self-reported crash involvement

(Lawton et al., 1997; Parker et al., 1998; Ulleberg and Rundmo, 2003). Attitudes also longitudinally predict unsafe driving (Iversen, 2004), whilst explaining additional variance in unsafe driving behavior when controlling for age, experience, risk perception, personality, and motivation (Jovanovic et al., 2011; Ulleberg and Rundmo, 2003). Young males report more risky attitudes toward driving than females do (Farrow and Brissing, 1990; Harré et al., 2000; Ulleberg, 2004; Yagil, 1998).

To evaluate road safety programs, Ulleberg and Rundmo (2002) recommended that attitude scales be administered before and after programs designed for adolescents to determine whether their attitudes had changed. These researchers argued that campaigns aimed at influencing safety attitudes in general had been unsuccessful as they did not focus on the specific attitudes likely to influence risk-taking behavior. Research has demonstrated that general attitudes are poor predictors of specific behaviors (Ajzen and Fishbein, 1991), such as unsafe driving (Iversen, 2004; Iversen et al., 2005). More specific attitudes towards risk-taking behavior in driving can predict unsafe driving behavior, such as attitudes towards rule violations, joyriding, and speeding (Iversen, 2004; Ulleberg and Rundmo, 2002; West and Hall, 1997). Research suggests that differences in attitudes towards traffic safety and self-reported driving behavior are only found when interventions target specific attitudes rather than general behavior modification (Iversen et al., 2005). This indicates that psychological interventions may be optimized when separated from skill and safety orientation programs (Lajunen and Summala, 1995).

1.3. Perceived risk

Deery (1999) suggested that driver training programs lacked success due to the limited attention given to psychological aspects, such as perceived risk, that are important in crash etiology. Researchers have argued that psychological processes associated with risk

judgments require further investigation (Price, 2001), especially in relation to whether young drivers perceive less risk than older drivers do, or are more confident in their abilities to deal with hazards (Beyth-Marom et al., 1993; Hatfield and Fernandes, 2009; Williamson, 2003).

Research has demonstrated that perceived risk, including the subjective probability of MVC involvement and the anticipated severity of consequences associated with unsafe driving behaviors (Brown and Groeger, 1988; Lund and Rundmo, 2009; Sjoberg et al., 2004), are related to self-reported engagement in unsafe driving (Hatfield and Fernandes, 2009; Jonah, 1986; Rundmo, 1995; Weinstein et al., 1998). Young novice drivers' risk perceptions correlating negatively with unsafe driving behavior (Ivers et al., 2009; Ulleberg and Rundmo, 2003) has led researchers to argue that, if perceived risk affects behavior, then influencing risk perception may result in behavior change (Rundmo, 1999; Sjoberg et al., 2004).

Ivers et al. (2009) found that, compared with young females, young males reported less perceived risk about driving unsafely. Compared with their male counterparts, grade 9-11 girls were found to perceive risky situations as having a greater effect on safety (Ginsburg et al., 2008). Compared with men, women perceived the risk of traffic hazards as greater while also having a lower estimate of their ability to deal with the risks (Farrand and McKenna, 2001). Farrow and Brissing (1990) found that males perceived themselves as having greater driving skill than females did in risky situations, which leads to males perceiving themselves at lower risk of being injured in a MVC compared with females (Ulleberg, 2004).

1.4. Current study

The current study reports an evaluation of a 1-day safety education course targeting 16-17-year-old school students, focusing on their attitudes and risk perceptions as drivers, pre-drivers, and passengers. While it included evaluations completed by participating students, a

more comprehensive evaluation of the impact of the program on participants' road safety attitudes, risk perception, awareness and knowledge is essential. The program did not set out to directly influence behavior, as it targeted young people before they obtained their driver's license or while they were still under supervision (Learner's license). The study sought to evaluate the intervention program using valid and reliable self-report measures with a comparison control sample. From the reviewed literature and the program aims, it was hypothesised that:

1. Regardless of Group, compared with males, females will report: a) less risky attitudes towards unsafe driving, and b) higher perceived risk of unsafe driving.
2. There will be a Time × Group interaction. Specifically, no differences in attitudes or perceived risk towards unsafe driving for either males or females will be found in the control group from prior to the program (T1) to 6-week follow-up (T3). However, program participants (intervention group) will report: a) less risky attitudes toward unsafe driving, and b) higher perceived risk, both i) immediately after the program (T2), and ii) at 6-week follow-up (T3) compared with T1.

2. Method

2.1. Participants

Participants were Year 11 students (age range 16-17 years) from two private schools in Queensland, Australia. In Queensland, a Learner License can be obtained from age 16 years, and must then be held for a 1-year minimum period, requiring all on-road driving to be appropriately supervised, before the driving test can be taken. Of the participants 37% reported having no driver's license and 60% held a Learner License. Most of the other 3% held a Provisional License, which allows unaccompanied driving but requires display of

probationary license plates, and has restrictions that include mobile (cell) phone use, peer passengers, driving higher-performance vehicles, and a zero-alcohol limit.

Independently of the evaluation study, the training organization had gained permission from the Principal to invite all School A's Year 11 students to participate in the training program. Intervention group participants (n = 133; 58 females) were those students from School A whose parents had agreed to their participation in the pre-driver training and also in the evaluation study, and who themselves also agreed to participate in both the training and evaluation. While declining to participate in the training, the School B Principal agreed that the research team could approach their Year 11 students to act as a control group for the evaluation study. The control group (n = 172; 70 females) comprised 49 students from School A whose parents had not agreed to their participation, or who themselves had elected not to participate in the training, but who agreed to participate in the evaluation study, together with 123 students from School B whose parents and themselves agreed to participate in the evaluation study only.

While random assignment to intervention and control groups was not possible because of the conditions under which the research team was invited to undertake the evaluation, the groups had equivalent gender proportions, χ^2 (1) = 0.74, p = .39. There were no age differences between the groups for either females (intervention n = 60: M = 16.28, SD = 0.47; control n = 69: M = 16.37, SD = 0.59, t(137) = 0.98, p = .33) or for males (intervention n = 73: M = 16.32, SD = 0.43; control n = 103: M = 16.49, SD = 0.49, t(93) = 1.82, p = .07). Respective proportions of the intervention and control groups holding either a Learner License or having no driver's license did not differ, χ^2 (3) = 3.87, p = .28. T1 to T3 retention rates were 88% (intervention) and 95% (control).

2.2. Materials

At the time of the study, the training in which the intervention group participated was a nationally-delivered program claiming over a quarter of a million participants since its inception some ten years before. The course comprised six 30-minute sessions with up to 30 students per group. Content involved interacting with a seriously injured crash survivor, practical demonstrations of the importance of vehicle and road conditions on reaction time and stopping distance, and interactive workshops on the impacts on driving of alcohol, drugs, and fatigue. It included group discussions about the importance of vehicle safety and regular maintenance. Talks targeted attitudes, awareness, and preparation for the unexpected by eliminating risk, minimising distractions, and anticipating hazards. A local police presentation covered possible consequences of a driver's choices, including fatalities, crashes, fines, and penalties. Possible session order effects were elimination by the six student groups randomly rotating through the six program components. The intervention was not based on any theoretical literature but on the intuitions of staff of the organization that designed and delivered the training. The research team was completely independent of the training program, having no involvement in its design or delivery, but were invited by the organization to undertake the evaluation described in this paper.

A questionnaire included attitudes towards unsafe driving and perceived risk scales as well as demographic information. A cover sheet requested name and date to match participants between time periods.

2.2.1. Attitudes towards unsafe driving

Forty-two items came from a scale validated in an adolescent Norwegian sample by Ulleberg and Rundmo (2002), whose original item set reduced to eleven factors, with Cronbach's alphas between .63 and .86. The Fatalism factor items were not used in the

current study due to weak scalability. One item came from West and Hall (1997). Items were measured on a 5-point scale from 1 *strongly disagree* to 5 *strongly agree*. Some items were modified to ensure their relevance for Australian participants (e.g., on local speed limits). Some items were reverse-scored but once re-coded higher scores indicated riskier attitudes toward unsafe driving. Scales were derived by summing individual item scores, giving a range of possible scores of between 43 and 215.

2.2.2. Perceived risk

Perceived risk was measured using an 8-item scale based on items created by Ivers et al. (2009). Participants were asked, "When you are driving, how safe do you think the following are?" Sample items included, "Driving at 110km/h in a 100km/h zone", and "Driving while talking on a mobile phone". Items were measured on a 4-point scale, indicating, *always safe*, *mostly safe*, *sometimes safe*, and *rarely safe*. The perceived risk scale was the sum of the item scores. Ranging from 8 to 32, higher scores indicated higher perceptions of risk. Not reported by Ivers et al. (2009), alphas for the current samples ranged from .84 to .86.

2.3. Procedure

Prior to its commencement, the study was approved by the authors' University Human Research Ethics Committee and the required ethical guidelines were adhered to throughout. Schools were contacted requesting their involvement with the study. School A provided intervention participants. School B, which did not offer the program to their students, volunteered to provide the control sample, along with School A's Year 11 students who did not participate in the program. As students could not be randomly assigned to the intervention and control groups, the study could be considered to be a quasi-experimental design. Written permission and informed consent was acquired from each school, as well as

from each participating student's parent or guardian, and from participating students. Data were collected prior to program participation (T1), immediately following the program (T2), and approximately six weeks after participation (T3) for the intervention group, and on two occasions (T1, T3) for the control group. The survey took approximately 20 minutes to complete on each occasion. Data were de-identified and the questionnaire cover sheets destroyed prior to data analysis.

3. Results

3.1. Overall attitudes towards unsafe driving

SPSS v19.0 was used for all analyses. From inspection of the distributions of the 49 items measuring attitudes to unsafe driving for both control and intervention groups (T1) (N = 305), 3 items were discarded due to extremes in non-normality or floor/ceiling effects. Following an exploratory factor analysis a further 16 items with low communalities were omitted from further analyses. The remaining 30 items formed ten factors, corresponding with those from Ulleberg and Rundmo (2002), and are listed with their factor loadings in Table 1. Cronbach's alphas for the overall attitudes to unsafe driving scale were .90 (T1), .89 (T2) and .91 (T3), with alphas for each of the subscales ranging from .66 to .91 across all data collections. To check that attitudes of the students from the two schools from which the intervention and control samples were drawn were comparable, an independent samples t-test revealed no difference between overall mean attitudes to unsafe driving of the students from schools A and B at T1, $t(295) = -1.05$, $p = .29$, confirming that attitudes of students at each of the two schools did not differ at baseline.

[Table 1 near here]

To test H1a (that compared with males, females would report less risky overall attitudes towards unsafe driving), a 2 (Time: T1, T3) × 2 (Gender: male, female) mixed factorial ANOVA was performed on the combined intervention and control groups' data. Analyses revealed a significant main effect for gender, $F(1, 214) = 14.26$, $p < .001$, $\eta^2 = .06$, indicating that males ($M = 100.29$, $SE = 0.89$) had riskier attitudes towards unsafe driving than females did ($M = 94.92$, $SE = 1.11$). The main effect for Time was not significant, $F(1, 214) = 3.41$, $p = .06$, indicating no change in attitudes towards unsafe driving from T1 ($M = 96.81$, $SE = 0.78$) to T3 ($M = 98.4$, $SE = 0.88$), regardless of group or gender. The non-significant Time × Gender interaction, $F(1, 214) = 3.84$, $p = .06$, indicated that neither gender sub-sample changed their attitude towards unsafe driving over time. These effects are shown in Fig. 1. A simple effects analysis revealed that the tendency for females to report a riskier attitude towards unsafe driving from T1 to T3 was not significant.

[Fig. 1 near here]

To test H2aii (that the intervention group would report less risky overall attitudes toward unsafe driving at 6-week follow-up (T3) compared with T1), a 2 (Time: T1, T3) × 2 (Group: intervention, control) mixed factorial ANOVA was performed on the control and intervention groups' data. Analyses revealed non-significant main effects for Time, $F(1, 214) = 2.14$, $p = .15$, and Group, $F(1, 214) = 2.75$, $p = .10$, indicating that no change in attitudes towards unsafe driving occurred between T1 ($M = 97.60$, $SE = 0.79$) and T3 ($M = 98.82$, $SE = 0.86$), as well as no significant overall difference between the intervention ($M = 99.39$, $SE = 1.01$) and control groups ($M = 97.03$, $SE = 1.00$). However, a significant Time × Group interaction, $F(1, 214) = 3.75$, $p = .05$, $\eta^2 = .02$, indicated that the groups differed in the way in which they changed over time. Independent samples *t*-tests revealed that the difference in the control group's overall attitudes towards unsafe driving between T1 ($M = 97.23$, $SE = 1.11$) and T3 ($M = 96.83$, $SE = 1.24$) was not significant, $t(298) = 0.58$, $p = .56$, but that the difference in the intervention group was significant, $t(214) = 2.32$, $p = .02$, with riskier attitudes towards

unsafe driving reported at T3 (M = 101.07, SE = 1.17) than at T1 (M = 98.10, SE = 1.13). These effects are shown in Fig. 2.

[Fig. 2 near here]

To test H2a (that the intervention group would report less risky overall attitudes toward unsafe driving, both i) immediately after the program (T2), and ii) at 6-week follow-up (T3) compared with T1), a 3 (Time: T1, T2, T3) × 2 (Gender: male, female) mixed factorial ANOVA was performed on the intervention group data. Analyses revealed a significant main effect for Gender, $F(1, 99) = 5.57$, $p = .02$, $\eta^2 = .05$, indicating that males (M = 103.22, SE = 1.24) had riskier attitudes towards unsafe driving than females did (M = 98.64, SE = 1.49). The main effect for Time was also significant, $F(2, 181) = 16.71$, $p < .001$, $\eta^2 = .14$. Pairwise comparisons, using a Bonferroni correction for family-wise error, revealed significant mean differences between all groups, with riskier attitudes at T2 than at T1 ($p < .001$) and T3 ($p < .01$), and also riskier attitudes at T3 than at T1 ($p = .02$). The non-significant Time × Gender interaction, $F(2, 181) = 1.06$, $p = .35$, indicated that males' and females' respective changes in attitudes towards unsafe driving were uniform over time (see Fig. 3).

[Fig. 3 near here]

3.2. Specific attitudes towards unsafe driving

To test H2a (that the intervention group would report less risky specific attitudes toward unsafe driving, both i) immediately after the program (T2), and ii) at 6-week follow-up (T3) compared with T1), for each of the ten subscales, 3 (Time: T1, T2, T3) × 2 (Gender: male, female) mixed factorial ANOVAs were performed on the intervention group data. Significant and non-significant effects from these analyses are shown in Table 2. Significant main effects for Time were found for: attitudes towards riding with an unsafe driver, speeding, showing off driving skill to others, traffic flow, and daring to speak up to an unsafe driver. For attitudes

towards riding with an unsafe driver, and daring to speak up to an unsafe driver, pairwise comparisons revealed attitudes at T2 to be significantly riskier than at T1 ($p < .001$ and $p = .03$, respectively) and at T3 ($p < .001$ and $p = .02$, respectively) with no significant differences between T1 and T3. For attitudes towards speeding and traffic flow, pairwise comparisons revealed attitudes at T2 to be significantly riskier than at T1 ($p < .001$, both cases) and attitudes at T3 to be significantly riskier than at T1 ($p < .001$, $p < .01$, respectively) with no significant differences between T2 and T3. Examination of a significant Time × Gender interaction for attitudes towards speeding revealed that the time differences only held for females ($p < .001$, both cases). For attitudes towards showing off driving skill to others, pairwise comparisons revealed attitudes at both T1 and T3 to be significantly riskier than at T2 ($p = .02$, $p = .001$, respectively) with no significant difference between T1 and T3. Examination of the significant Time × Gender interaction revealed that these differences only held for males ($p < .001$, both cases).

Of the ten subscales tested, significant main effects for Gender were found for attitudes towards: riding with an unsafe driver, concern about hurting others, joyriding, daring to speak to an unsafe driver, and risk of accidents. For these subscales, except for concern about hurting others, males reported riskier attitudes towards the specific aspects of unsafe driving than females did. Female responses were higher than were those of males to the concern about hurting others subscale, indicating less risky attitudes towards avoiding harm to others while driving. These findings are consistent with results shown in Figs. 1-3.

[Table 2 near here]

3.3. Perceived risk

To test H1b (that compared with males, females would report higher perceived risk of unsafe driving), a 2 (Time: T1, T3) × 2 (Gender: male, female) mixed factorial ANOVA

was performed on the combined intervention and control groups' data. Analyses revealed a significant main effect for Gender, $F(1, 224) = 20.79$, $p < .001$, $\eta^2 = .09$, indicating that females ($M = 12.84$, $SE = 0.30$) reported higher perceived risk than males did ($M = 11.03$, $SE = 0.25$). The main effect for Time was not significant, $F(1, 224) = 0.08$, $p = .78$, indicating no change in perceived risk from T1 ($M = 11.89$, $SE = 0.25$) to T3 ($M = 11.98$, $SE = 0.24$), regardless of group or gender. The non-significant Time × Gender interaction, $F(1, 224) = 0.05$, $p = .82$, indicated that neither gender changed their perception of risk associated with unsafe driving over time (see Fig. 4).

[Fig. 4 near here]

To test H2b (that the intervention group would report higher perceived risk, both i) immediately after the program (T2), and ii) at 6-week follow-up (T3) compared with T1), a 2 (Time: T1, T3) × 2 (Group: intervention, control) mixed factorial ANOVA was performed on the control and intervention group data. Analyses revealed non-significant main effects for Time, $F(1, 221) = 0.45$, $p = .50$, and Group, $F(1, 221) = 2.10$, $p = .15$, indicating no change in perceived risk between T1 ($M = 11.55$, $SE = 0.23$) and T3 ($M = 11.72$, $SE = 0.23$), and no significant overall difference between the intervention ($M = 11.36$, $SE = 0.27$) and control groups ($M = 11.91$, $SE = 0.27$). The non-significant Time × Group interaction, $F(1, 221) = 0.10$, $p = .75$, indicated that the groups did not differ in the way they changed over time (see Fig. 5).

[Fig. 5 near here]

To further test H1b (that compared with males, females would report higher perceived risk of unsafe driving), a 3 (Time: T1, T2, T3) × 2 (Gender: male, female) mixed factorial ANOVA was performed on the intervention group data. Analyses revealed a significant main effect for Gender, $F(1, 104) = 15.00$, $p < .001$, $\eta^2 = .13$, with females ($M = 11.98$, $SE = 0.35$) reporting higher perceived risk than males did ($M = 10.18$, $SE = 0.31$). The main effect for Time was also significant, $F(2, 208) = 4.62$, $p = .01$, $\eta^2 = .13$. Pairwise comparisons, using a

Bonferroni correction for family-wise error, revealed T3 to be significantly higher than T2 (p = .01), with no differences either between T1 and T2 (p = .17) or between T1 and T3 (p = .95). The non-significant Time × Gender interaction, $F(2, 208) = 2.00$, p = .14, indicated that both genders changed similarly in their perception of risk associated with unsafe driving over time (see Fig. 6).

[Fig. 6 near here]

4. Discussion

4.1. Attitudes towards unsafe driving

The results partially support previous research indicating that young males report more risky attitudes toward driving than females do (Harré et al., 2000; Ulleberg, 2004; Yagil, 1998). Females reported significantly less overall risky attitudes towards unsafe driving than males did, which did not change from T1 to T2. Females also reported less risky specific attitudes towards riding with an unsafe driver, concern about hurting others, joyriding, daring to speak to an unsafe driver, and risk of accidents. Overall attitudes of both males and females who had taken the training became more risky, both immediately after the training and also 6 weeks later (Fig. 2). Pre-course to immediate post-course effects were carried by riskier attitudes towards riding with an unsafe driver, speeding, showing off driving skill to others, traffic flow, and daring to speak up to an unsafe driver. Riskier attitudes towards speeding and traffic flow were maintained at 6-week follow-up, when riskier attitudes towards speeding were significantly more likely to be carried by females, and riskier attitudes showing off driving skill to others were significantly more likely to be carried by males. The main finding on perceived risk of unsafe driving behaviors was that this remained unchanged after the training.

H2a predicted that no differences in attitudes towards unsafe driving for either males or females would be found in the control group from prior to the program (T1) to 6-week follow-up (T3) and that program participants (intervention group) would report less risky attitudes toward unsafe driving both immediately after the program (T2) and at 6-week follow-up (T3) compared with T1. While the results indicated no change in overall attitudes towards unsafe driving, for either males or females, from prior to the intervention program (T1) to 6 weeks following the program (T3), a significant interaction indicated that while no difference occurred in the control group, the intervention group showed significantly increased risky attitudes towards unsafe driving from T1 to T3. The intervention group had significantly increased risky attitudes towards unsafe driving from T1 to immediately following the program (T2), and although there was a significant decrease from T2 to T3, this group maintained significantly riskier attitudes at T3 compared with T1. When analysing specific attitudes towards unsafe driving, the results suggested that the intervention group had significantly riskier attitudes from T1 to T2 in the subscales of attitudes towards riding with an unsafe driver, speeding, traffic flow, and daring to speak up to an unsafe driver. Conversely, showing off driving skill to others showed a significant decrease in risky attitudes from T1 and T2, complemented with a significant increase in risky attitudes from T2 to T3, which resulted in no significant differences between T1 and T3.

Overall, H2a was partially supported. No differences in attitudes towards unsafe driving were found in the control group from prior to the program (T1) to the 6-week follow-up (T3). However, not only were decreases in risky attitudes towards unsafe driving not found from T1 to T2, but increases in reported risky attitudes towards unsafe driving were found for the intervention group. The only exception to this was a decrease in showing off driving skill to others. Thus, the results do not support the program goal of reducing risky attitudes towards unsafe driving. A possible explanation could be found in the manner in which attitudes were addressed in the intervention. The program aimed to address overall attitudes towards unsafe

driving, but its delivery might not have been specific enough. Ulleberg and Rundmo (2002) argued that campaigns aimed at influencing safety attitudes in general have been unsuccessful because they do not focus on the specific attitudes likely to influence risk-taking behavior, agreeing with research demonstrating that general attitudes are poor predictors of specific behaviors (Ajzen and Fishbein, 1991), such as unsafe driving (Iversen, 2004; Iversen et al., 2005). Targeting more specific predictors of unsafe driving behavior, such as attitudes towards rule violations (Iversen, 2004; Ulleberg and Rundmo, 2002; West and Hall, 1997), joyriding, and speeding (Iversen, 2004; Ulleberg and Rundmo, 2002), might have improved the ability of the intervention to achieve its aims (Iversen et al., 2005).

4.2. Perceived risk of unsafe driving

The expected gender effect on perceived risk supported previous research that young males report lower perceived risk about driving unsafely than females do (Farrand and McKenna, 2001; Ginsburg et al., 2008; Ivers et al., 2009; Ulleberg, 2004). Results indicated that compared with males, females reported significantly higher perceived risk towards unsafe driving, and that this difference did not change from T1 to T3.

H2b predicted that while no differences in perceived risk towards unsafe driving for either males or females would be found in the control group from prior to the program (T1) to 6-week follow-up (T3), program participants (intervention group) would report higher perceived risk, both immediately after the program (T2) and at 6-week follow-up (T3) compared with T1. The results showed no significant difference in perceived risk towards unsafe driving for either males or females from prior to program involvement (T1) to 6 weeks after the program (T3). Results also suggested that no significant difference existed between the control and intervention groups and that this did not change from T1 to T3. Accordingly H2b was partially supported. Increases in perceived risk towards unsafe driving were not

found from T1 to T3 for either the intervention or control group. Overall, expected effects were not obtained. Specifically, the results suggested that the intervention had no impact on participants' perceived risk of unsafe driving.

The lack of success of driver training programs in the past has been attributed to the limited attention given to psychological aspects, such as perceived risk (Deery, 1999), with arguments being forwarded that psychological processes associated with individual risk judgements require further investigation (Price, 2001). The current results might be explained by a lack of knowledge and understanding throughout the design of the intervention on how to appropriately address and increase program participants' perceived risk.

4.3. General discussion

Although males reported more risky attitudes towards unsafe driving and lower perceived risk than females did, the entire young driver population needs to be targeted in road safety interventions and evaluations (Ivers et al., 2009). While gender differences in unsafe driving participation have been replicated (Lonczak et al., 2007), young women are not immune to either the social values or cultural fantasies attached to cars (Redshaw and Noble, 2005). A potential problem arises from findings based on data combining different unsafe driving behaviors. In a meta-analysis of 150 studies, Byrnes et al. (1999) reported that while males engaged in greater risk taking, the gap between the sexes is context and age dependent. This suggests that gender differences in unsafe driving behaviors need to be better understood (Bina et al., 2006), and that context appreciation may increase understanding (Simon and Corbett, 1996). Distinct training strategies for male and female novice drivers may help to maximize effectiveness.

Evaluations of novice driver skill-based programs in several countries have found contrary effects. Improvements in crash rates have rarely been detectable as a result of novice driver

training programs, which in most documented cases have been associated with higher crash rates, perhaps as a result of trainees having more driving lessons, earlier licensing, a greater than warranted confidence in their subsequent driving ability, and higher risk exposure from more driving (e.g., Christie, 2001; Elvik and Vaa, 2004; Ker et al., 2003; Langford, 2006; Roberts and Kwan, 2005; Vernick et al., 1999). Researchers have argued that the effectiveness of road safety programs tend to be short-lived unless their key messages are reinforced over time (Elkington, 2005), indicating that single occasion delivery is likely to be less effective than providing repeated information. In this way, program delivery may have contributed to the intervention's lack of effect on both males' and females' attitudes and perceived risk towards unsafe driving from before the program implementation to the 6-week follow-up.

Another possible explanation for the current results, especially the intervention being associated with riskier attitudes towards unsafe driving, is through the mortality salient messages conveyed through the program. Terror management theory explains that the fear of death underlies anguish and distress within the human condition, and that a primary motivation is to cope with this fear (Greenberg et al., 1986). Defense mechanisms, operating through cognitive distortions, are implemented with the principal purpose of denying vulnerability through the ignorance or suppression of the threat or exaggeration of immunity from death (Pyszczynski et al., 1999). Thus, there is potential for exposure to mortality salient road safety appeals to motivate defensive responses, which could lead to increased intentions to take driving risks (Carey and Sarma, 2011; Jessop et al., 2008). In the current study, this could have been manifested as riskier attitudes towards unsafe driving practices instead of instilling the intended motivation to avoid such behavior (Ray and Wilkie, 1970). This is thought to occur through an increase in driving-related self-esteem in order to deny vulnerability (Carey and Sarma, 2011; Taubman, 2000). With this in mind, driving-related

self-esteem should be a variable of interest for future road safety intervention and evaluation research in order to determine its role in the efficacy of interventions.

For classroom-based rather than driving skills-based road safety programs, potential threats to the integrity of such programs incorporating psychological threats to participants (e.g., confrontations with seriously injured crash survivors, police accounts of horrific crash scenes, or demonstrations of stopping distances) could include possible "rebound effects" whereby threatening messages or events may have an effect opposite to that intended. The psychological rebound effect has been known for some time and continues to be documented (Muris et al., 1992; Nestler and Egloff, 2010; Wilson and Lassiter, 1982). A similar outcome, described as the "boomerang effect", occurs when an observed behavior change is the reverse of that prescribed, for example by a safety or risk communication, which also shows gender differences (e.g., Goldhaber and deTurck, 1988). Another possibility is that of "third person effects" in which a safety or risk communication may be perceived as relevant to a third party but not to the intended recipient. This phenomenon is also known to show gender differences and "reverse effects" (e.g., Davison, 1983; Duck et al., 1995; Glendon and Walker, 2013; Lewis et al., 2003, 2007; Mutz, 1989; Tay and Watson, 2002). Future research could usefully determine which, if any, of these effects might operate within the context of novice driver or pre-driver training in order to incorporate potential counter measures.

The results should be understood within the limitations of the study. The constraints imposed on the evaluation study meant that it was not possible to randomly assign participants to each condition. Thus, School A students formed the entire intervention group and part of the control group, with approximately 62% of the control group coming from School B. Although the age, gender, and license-type distributions of the intervention and control groups were comparable and School B was selected to be as similar as possible to School A, it is possible that certain characteristics inherent in the respective environments or cultures of the two schools meant that the groups of students answered the questionnaire items

differently. It is also possible that School A students who participated in the training, thereby forming the intervention group, could have been in some critical way different from those who did not participate, which could have led to a self-selection bias. Also, all measures were self-report where the possibility of social desirability influences could not be accounted for, especially since for longitudinal tracking purposes, responses could not be given anonymously (Lajunen and Summala, 2003).

4.4. Implications

This study has road safety practice and policy implications. While findings showing that evaluated novice driver training programs frequently fail to meet their objectives or seem to produce effects opposite to those intended (Mayhew and Simpson, 1996, 2002; McKenna, 2012; Williams and Ferguson, 2004), evaluation of the novice driver and pre-driver training program in the current study revealed that participation was associated with effects opposite to those intended. Given that, as Groeger and Banks (2007) pointed out, it is extremely unlikely that what is learned during any driver training will be successfully transferred to a wider range of situations than can possibly be anticipated during training, those who develop training programs must aim to maximize their effectiveness. Brown et al. (1987) advocated establishing clear program objectives operationalized so that it is clear when the required changes have been achieved and that procedures to achieve and maintain them are effective. While outside the scope of this paper, a wide variety of approaches to this end has been suggested (e.g., Brown et al., 1987; Lonero and Mayhew, 2010; Mayhew and Simpson, 2002; Mayhew et al., 1998; McKenna and Albery, 2001; Senserrick and Swinburne, 2001; Williams, 2006; Wilson, 2011; Woolley, 2000). Program developers should also construct interventions based on research and best practice to ensure that the results of the current study are not replicated. If the possibility of doing harm is apparent, policy makers should

endeavour to ensure that programs meet the requirements of best practice or only certify those that do.

While developing road safety interventions is highly desirable in order to mitigate the death, injury, damage, and costs of road-related trauma, their effectiveness must be evaluated to ensure that resources are allocated appropriately and that programs demonstrably meet their prescribed aims. One option would be to introduce a combined pilot intervention evaluation study prior to full implementation of a road safety program. The pilot evaluation study could be designed to identify and adjust any program components that did not meet objectives so as to increase the likelihood of meeting the full program objectives. In any program involving psychological risk, it is important to pay particular attention to program features with the potential to deliver unintended or contrary effects to those prescribed by the program objectives. As well as investigating behavioral effects of novice driver training, it is important to research potential influencing pathways, for example affective and motivational mechanisms, to enhance understanding about psychological processes linking such training with cognitions critical to driving, including attitudes and perceptions.

The providers of the intervention were advised of the main findings of this study as soon as these became available by providing them with an initial draft of the paper. They were subsequently sent a reminder communication detailing the importance of taking account of the study's findings with a strong recommendation that a replication study by another independent research team using a comparable design be undertaken. When this paper was accepted for publication, a copy was sent to the intervention providers with an invitation to respond to the findings and a reminder that a replication study be conducted to confirm or otherwise the findings of the current study if this had not already been undertaken.

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Figure(s)

Fig. 1. Significant main effect for Gender in overall attitudes towards unsafe driving (combined intervention and control groups)

Fig. 2. Significant Time × Group interaction in overall attitudes towards unsafe driving

Fig. 3. Significant main effects for Gender and Time in overall attitudes towards unsafe driving (intervention group)

Fig. 4. Significant main effect for Gender in perceived risk of unsafe driving (combined intervention and control groups)

Fig. 5. Non-significant main and interaction effects of Time and Group in perceived risk of unsafe driving

Fig. 6. Significant main effect for Gender in perceived risk of unsafe driving (intervention group)

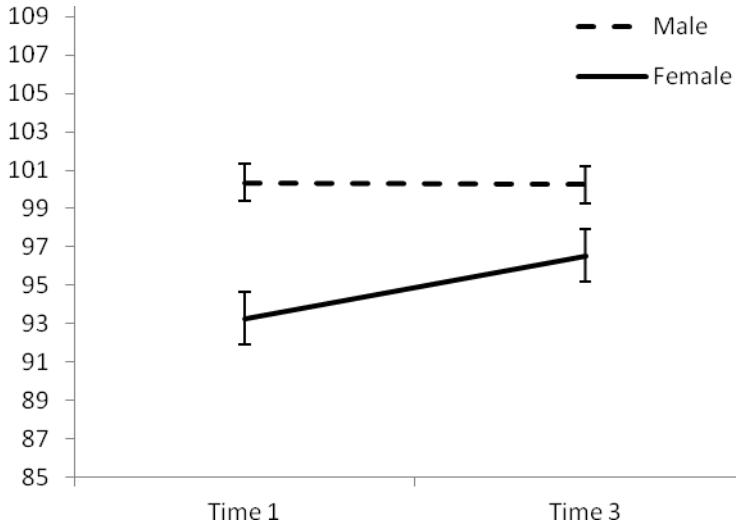

Fig. 1.
Note: Possible score range 43–215.

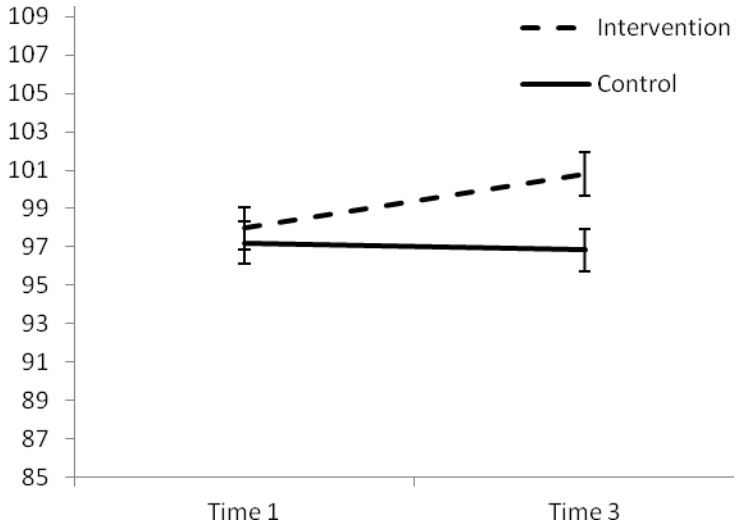

Fig. 2.
Note: Possible score range 43–215.

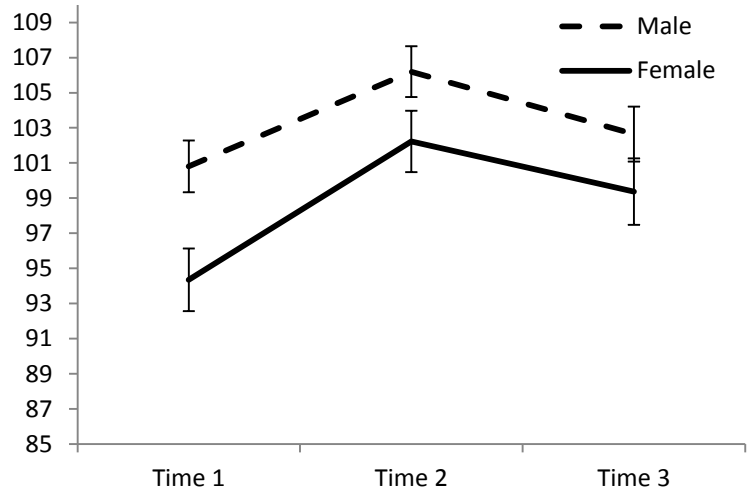

Fig. 3.
Note: Possible score range 43–215.

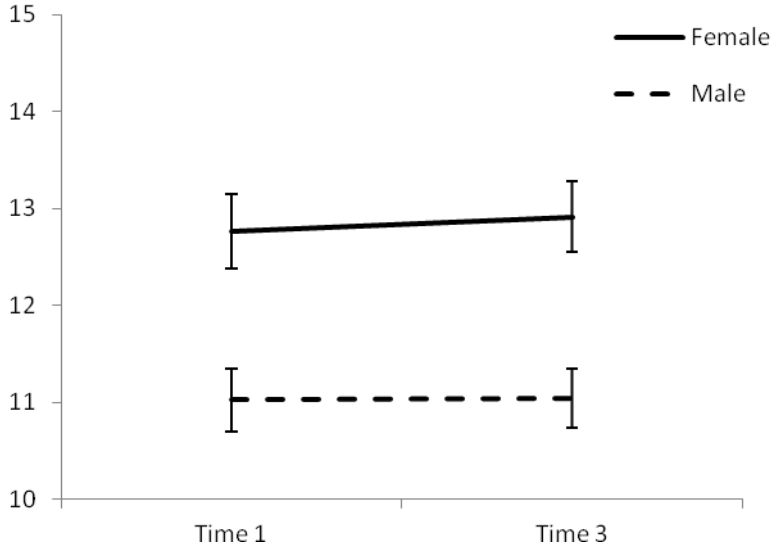

Fig. 4.
Note: Possible score range 8–32.

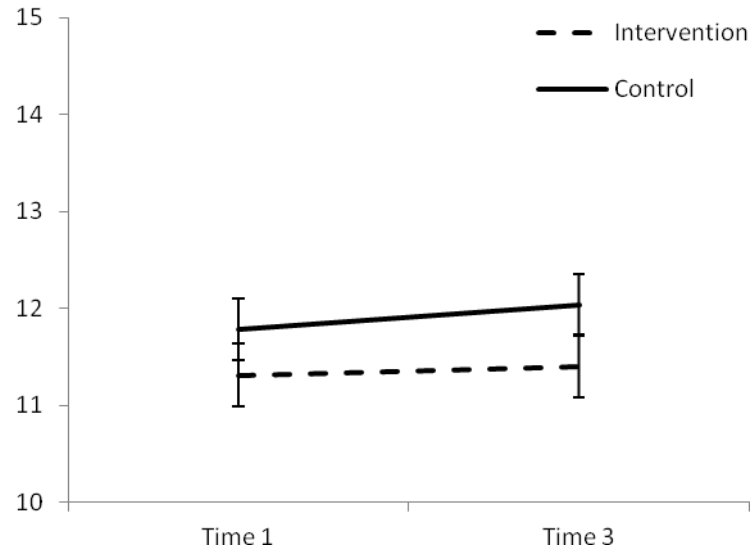

Fig. 5.
Note: Possible score range 8–32.

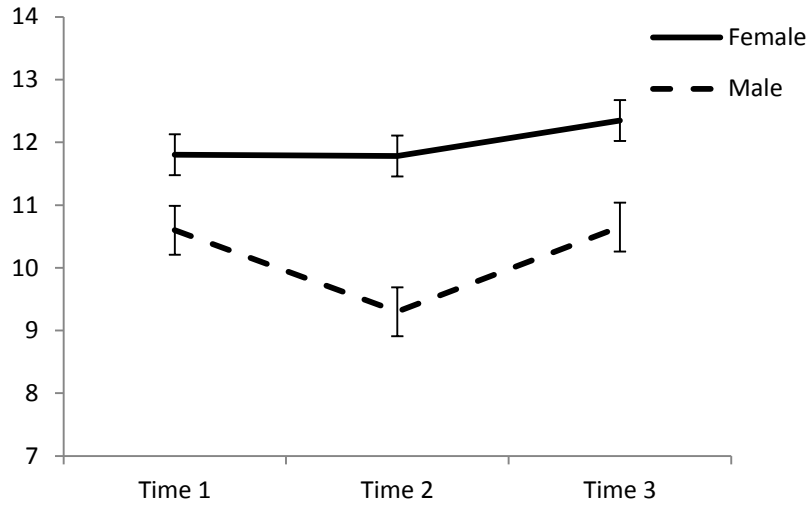

Fig. 6.
Note: Possible score range 8–32.

Table 1

Factors derived from the questionnaire items.

Item/Factor	*Loading*
Factor 1. Riding with an unsafe driver	
I might get into the car with friends who I know are unsafe drivers	.87
I would get into my friend's car even though she/he is known to be an unsafe driver	.86
I would probably ride with a friend who drives unsafely if I trusted him or her	.86
I would get into the car with a reckless driver if I had no other way to get home	.62
I might get into the car with an unsafe driver if my friends did	.68
Factor 2. Speeding	
I think it's OK to speed if the traffic conditions allow you to do so	.83
If you have good skills, speeding is OK	.72
If you are a safe driver, it is acceptable to exceed the speed limit by 10km/hr in areas where it is permitted to drive at 80-90km/hr	.71
Driving 5 or 10km/hr above the speed limit is OK because everyone does it	.70
Factor 3. Concern about hurting others	
Hurting someone else with my car would scar me for life*	.80
I couldn't live with myself if I hurt another human being in traffic*	.79
Factor 4. Drinking and driving	
I might get into the car with a driver who has been drinking	.87
I would get into the car with a driver who has been drinking if I knew and trusted him or her	.86
Factor 5. Showing off driving skills to others	
Most people like to show off their skills by driving fast	.79
When people drive they like to be different - not to be ordinary, cautious drivers	.65
People will usually drive faster when their friends are in the car	.50
Factor 6. Traffic flow vs. rule obedience	
Sometimes it is necessary to bend the traffic rules to arrive on time	.76
Sometimes it is necessary to take chances in traffic	.61
Sometimes it is necessary to break the traffic rules in order to get ahead	.55
There are many traffic rules which cannot be obeyed in order to keep up the traffic flow	.48
It is more important to keep up with the traffic flow rather than always follow the traffic rules	.35
Factor 7. Joyriding	
Speeding and excitement belong together when you are driving	.81
Driving is more important than transportation, it is also about speeding and fun	.47
Factor 8. Dare to speak up to an unsafe driver	
I would be very unpopular if I should ask the person driving to drive more carefully	.81
If I should ask my friends to drive more carefully, it would be perceived as a hassle	.64
Factor 9. Risk of accidents	
Driving-off-the-road accidents are so rare that there is no need to worry about them	.75
The risk of dying young in a traffic accident is so low that you can ignore it	.59
Factor 10. Traffic rule violations	
You should always follow the traffic rules, regardless of the driving conditions*	.91
You should always obey laws while driving*	.69
Even at night time on quiet roads it is important to keep within the speed limit*	.35

Note: *Denotes reversed scored item when calculating overall attitudes towards unsafe driving

Table 2

Effects from 2 × 2 factorial ANOVAs for attitudes towards unsafe driving subscales.

Subscale	Effect	*F*	*p*	*df*	η^2
1. Riding with an unsafe driver	**Main: Time**	**26.77**	**< .001**	**2, 183**	**.21**
	Main: Gender	**5.22**	**.02**	**1, 99**	**.05**
	Interaction: Time × Gender	0.60	.54	2, 183	.01
2. Speeding	**Main: Time**	**13.23**	**< .001**	**2, 188**	**.12**
	Main: Gender	1.87	.17	1, 99	.02
	Interaction: Time × Gender	**3.36**	**.04**	**2, 188**	**.03**
3. Concern about hurting others	Main: Time	0.83	.44	2, 198	.01
	Main: Gender	**-6.97**	**.01**	**1, 99**	**.07**
	Interaction: Time × Gender	1.24	.30	2, 198	.01
4. Drinking and driving	Main: Time	0.66	.52	2, 190	.01
	Main: Gender	1.66	.20	1, 99	.02
	Interaction: Time × Gender	0.05	.95	2, 190	.01
5. Showing off driving skills to others	**Main: Time**	**7.33**	**< .001**	**2, 198**	**.07**
	Main: Gender	1.86	.18	1, 99	.02
	Interaction: Time × Gender	**3.62**	**.03**	**2, 198**	**.04**
6. Traffic flow vs. rule obedience	**Main: Time**	**12.96**	**< .001**	**2, 192**	**.12**
	Main: Gender	0.67	.42	1, 99	.01
	Interaction: Time × Gender	0.01	.99	2, 192	.00
7. Joyriding	Main: Time	0.87	.42	2, 189	.01
	Main: Gender	**4.91**	**.03**	**1, 99**	**.05**
	Interaction: Time × Gender	1.09	.34	2, 189	.01
8. Dare to speak up to an unsafe driver	**Main: Time**	**5.61**	**< .01**	**2, 198**	**.05**
	Main: Gender	**13.58**	**< .001**	**1, 99**	**.11**
	Interaction: Time × Gender	0.23	.79	2, 198	.01
9. Risk of accidents	Main: Time	1.28	.28	2, 198	.01
	Main: Gender	**4.71**	**.03**	**1, 99**	**.05**
	Interaction: Time × Gender	0.40	.67	2, 198	.01
10. Traffic rule violations	Main: Time	1.91	.15	2, 188	.02
	Main: Gender	1.68	.20	1, 99	.02
	Interaction: Time × Gender	0.18	.83	2, 188	.01

Note: Significant effects are in **bold type**.