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Preventing risky driving: A novel and efficient brief intervention focusing on acknowledgement of personal risk factors

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ABSTRACT

Impulsive personality is an important predictor of risky driving. Acknowledging their impulsive tendencies may help novice drivers to drive more safely. The aim of this study was to evaluate the efficacy of a novel brief intervention targeting novice drivers' risky behavior in traffic, taking into account potential moderator effects. Driving school students ($n = 1866$) were divided into an intervention group and a control group. The intervention consisted of a lecture and group work (1.5 h). Subjects' traffic offenses and crashes were monitored during the following year using police and traffic insurance fund databases. The groups were similar in their baseline characteristics. The intervention group had half as many speeding violations in the year following the intervention compared with the controls. The proportion of speeders was significantly lower in the intervention group compared with the control group in subgroups of subjects with medium cognitive abilities and low or medium BIS-11 impulsiveness levels. In alpha$_{2A}$-adrenoceptor gene (*ADRA2A*) G allele carriers, general traffic risk and speeding decreased in response to the intervention, unlike in subjects with the CC genotype. It is concluded that brief interventions that are integrated into the driving education program and focus on personal psychological risk factors may be effective for improving traffic safety.

1. Introduction

Road traffic accidents are among the leading causes of mortality of youth worldwide (World Health Organization, 2007). In an effort to save lives, governments are building safer roads and companies are developing safer cars. However, human error is the major contributory factor in road crashes (Makeham, 2000). A remarkable number of studies describe several predictors of traffic risk and characteristics of accident-prone drivers. However, few randomized controlled trials of efficient accident prevention programs have been researched.

The riskiest drivers are young people during their first months driving unsupervised in traffic (Isler et al., 2009; McKnight and McKnight, 2003; Twisk and Stacey, 2007). Accident-proneness in novice drivers has several causes. Young drivers are characterized by sensation seeking, which leads to risk-taking for the sake of excitement. Furthermore, inexperienced drivers may not fully acknowledge the danger of impulsive and thoughtless decisions while driving, e.g., passing other vehicles when it may not be safe to do so or driving after drinking alcohol (Steinberg, 2007). Studies have shown that poor impulse control, sensation seeking, low constraint and attention problems are the psychological factors that best predict risky driving (Paaver et al., 2006; Jonah, 1997; Begg and Langley, 2004; Iversen and Rundmo, 2002; Barkley and Cox, 2007). Other researchers have concluded that the most important risk factor in novice drivers is low risk awareness (McKnight and McKnight, 2003; Frank and Lee, 2007; Deery, 1999) or thoughtless risk-taking (Clarke et al., 2005). It has also been noted that reflection on one's individual risk factors and weaknesses should be part of driver education (Hatakka et al., 2002). Thus, acknowledging one's specific impulsive tendencies should be one target for intervention in novice drivers.

Prior research has shown that psychological programs for the prevention of risky driving that focus solely on attitudes and general statistical knowledge have little effect on behavioral change (Frank and Lee, 2007; Harré and Field, 1998). Changing attitudes or building new values is a long, multilevel process and people do not adopt new views easily. Interventions that focus on general knowledge of accident risk may scare people away or make them feel that the dangers of driving do not concern them. For example, a study of young drivers' personal risk perception showed that although young drivers demonstrated a thorough awareness that speeding may lead to accidents, they did not regard speeding as a

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particularly risky activity for themselves (Falk and Montgomery, 2007). Interventions aimed at using threats to change people's health behaviors have also had limited success or yielded controversial results (Maes and Boersma, 2004; Taubman-Ben-Ari, 2000). A textbook knowledge of health psychology would indicate that successful interventions should focus on primary prevention because it is easier for a person to avoid forming a habit than it is to change a pre-existing habit later (Westmaas et al., 2007). Risky driving has been decreased successfully by such indirect methods as teaching social competencies and relaxation skills (Deffenbacher et al., 2000; Griffin et al., 2004). In general, teaching behavioral methods for controlling risky behavior is a more effective approach to the prevention of crashes than attempting to change underlying attitudes (Makeham, 2000).

To understand the mechanism of action of a specific intervention and to design better interventions, it is important to identify moderators of the effect of an intervention. Although a substantial amount of research has been performed on the role of personality and cognitive abilities in traffic behavior and risk-taking, fewer studies have investigated individual differences in response to safety campaigns and preventive programs. Prior research has concluded that angry drivers who acknowledge their anger need different interventions than those who are not aware of their problem (Deffenbacher et al., 2003). An earlier study found that subjects with low anger and low sensation seeking were more responsive to a traffic campaign (Ulleberg, 2001). One potential psychological moderator is the level of impulsiveness as a character trait. It is important to investigate whether interventions targeting impulsivity decrease risky driving in impulsive people or simply make non-impulsive people behave even more safely. The ability to understand, generalize and integrate knowledge that is presented in an intervention is another potential moderator. The effect of general cognitive abilities should be controlled for because subjects with low intelligence may not be able to process the information delivered.

Another potential moderator derives from current developments in behavioral genetics. Genetic markers provide indirect ways to understand neurophysiological processes underlying risky behavior itself and the ability to pick up on new information provided by intervention programs. If unsafe driving derives partly from poor impulse control or attentional difficulties, genes regulating these functions may play a significant role. Neurotransmission mediated by noradrenaline is pivotal in the modulation of attention and central arousal. *ADRA2A* is a gene that encodes alpha$_{2A}$-adrenoceptors and a candidate gene for attention deficit hyperactivity disorder (ADHD) (Comings et al., 2000). A-1291 C-to-G single-nucleotide polymorphism (SNP) creates an MspI site (rs1800544) in the promoter region of the *ADRA2A* gene (Lario et al., 1997). Thus, some individuals are homozygous and have two C alleles (CC genotype); others are heterozygous and have both a C and a G allele (CG genotype); and the smallest subgroup of people are homozygous for the G allele (GG genotype). This polymorphism has been associated with differences in neuropsychological executive function in some studies (Waldman et al., 2006). Individuals with at least one G allele have a higher likelihood of concentration difficulties and symptoms of attention deficit and impulsivity (Comings et al., 2000; Roman et al., 2006). Individuals who carry the G allele also respond better to treatment with methylphenidate (Polanczyk et al., 2007). In contrast, it has recently been found that maltreatment in the family predicts symptoms of inattention in individuals with the CC genotype (Kiive et al., 2010).

The aim of the current study was to test the efficacy of a new brief psychological intervention in driving schools for prevention of traffic violations and crashes in novice drivers. Additionally, the analysis explored whether the efficacy of the intervention is moderated by the driver's impulsivity, cognitive abilities or *ADRA2A* genotype. In relation to the moderators, it is hypothesized that: (1) the effect of the intervention will be stronger in the subgroup of more intelligent subjects; (2) the effect of the intervention will be stronger in the subgroup of impulsive subjects; and (3) the effect of the intervention will be modulated by *ADRA2A* genotype, which affects novel information processing and attention.

2. Methods

2.1. Participants

The sample was formed as a part of the Estonian Psychobiological Study of Traffic Behaviour (EPSTB) and included driving school students applying for a passenger car driving license. At least 10% of prospective novice drivers obtaining passenger car licenses during the following year in the cities or counties of Tallinn or Tartu (the two largest cities in Estonia) were targeted for recruitment into the study. As it is known that approximately 50% of driving-school students obtain a driving license during the first year after attending driving school, the number of subjects to be recruited from the driving school was increased to 1800 subjects.

Driving schools using Estonian as a main language of instruction, granting passenger car driving licenses and located in the cities or counties of Tallinn or Tartu were considered eligible for the study. Twenty-four driving schools out of a total of 54 were considered eligible and agreed to participate. A total of 113 groups of students from these driving schools participated in the study, with fewer groups from small driving schools and more groups from larger driving schools (median = 4 groups per school, minimum = 1, maximum = 17). All of these groups were approached in the framework of their standard driving school lessons. The study was briefly described to the potential participants. Participants were offered feedback from the personality scales as a benefit of participation, but no monetary compensation was provided. The students who agreed to participate signed an informed consent form.

A total of 1866 students participated in the study, corresponding to approximately 15% of the people who acquired a primary driving license in the two biggest cities in Estonia, Tallinn and Tartu, in 2007. The driving school groups were allocated to experimental conditions according to the starting time of the classes. Every first and second group of students were assigned to the intervention condition (initial $n = 1349$) and every third group was assigned to the control condition (initial $n = 517$). Students who were initially appointed to the intervention group but did not participate in the intervention ($n = 291$) were eliminated from the intervention group and were classified as lost. The makeup of the sample is graphically depicted in Fig. 1. Altogether, 1977 subjects were contacted, 83 refused to give informed consent and 28 did not return the questionnaire. The overall percentage of refusals was therefore 5.6%. Altogether, 761 subjects (40%) donated blood samples and the proportions of subjects giving blood samples were similar in the control and intervention groups. This study was approved by the institutional Ethics Review Committee of University of Tartu, Estonia.

2.2. Initial assessment

Subjects completed a questionnaire and blood samples were drawn at the driving school. The Adaptive and Maladaptive Impulsivity Scale (AMIS) was used to measure four constructs related to impulsivity: thoughtlessness and Fast Decision-Making (based on the functional and dysfunctional impulsivity constructs of the Dickman Impulsivity Inventory, Dickman, 1990) and Disinhibition and Excitement Seeking (based on impulsivity-related subscales of the NEO Personality Inventory, Costa and McCrae, 1989). Each