Driving game playing as a predictor of adolescents’ unlicensed driving in Flanders

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Biographical note

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Keith Roe (PhD) is Full Professor and Head of the School of Mass Communication Research at the KU Leuven (Belgium). He obtained his PhD from the University of Lund (Sweden) and has also spent periods as a Visiting Professor at the University of Amsterdam, The University of Chapel Hill (North Carolina), The Annenberg School for Communication (University of Pennsylvania), and Princeton University. His research interests include the sociology of the media, media effects, and the digital divide.
Driving game playing as a predictor of adolescents’ unlicensed driving in Flanders

ABSTRACT

The purpose of the current study is to examine whether adolescents’ playing of racing and drive’em up games predicts unlicensed driving in Flanders. A longitudinal panel survey (2006, 2008) was executed among a sample of 1104 adolescent boys and girls (17-18 years old at baseline measurement) in the Flemish region of Belgium. Logistic regression analysis was used in order to examine whether driving game playing predicts self-reported unlicensed driving. The analyses indicated that the odds of having engaged in unlicensed driving were nearly 2 times greater for moderate players (playing once a week or less) compared to those who never play these games. The odds of being an unlicensed driver were nearly four times greater for those playing at least a few times a week (OR=3.709) compared to non-players. Playing driving games appears to be a better predictor of unlicensed driving than other variables which one would expect to predict this form of risk taking such as gender, school level, sensation seeking and risk perception.

Keywords: adolescents, media effects, risk taking, unlicensed driving, video games.
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Introduction

It is well known that young drivers are overrepresented in road crash statistics throughout the Western world (World Health Organization, 2004). Research has documented that risky driving is an important contributor to road crashes (Jonah, 1986). Despite a vast amount of research on risky driving and its predictors, one particular kind of risk taking in traffic, namely unlicensed driving, has not received much attention. Nevertheless driving without a driver’s license constitutes a considerable threat to the health of these drivers, their passengers, and other road users as unlicensed drivers have a higher risk of being involved in a crash (Blows, Ivers, Connor, & Ameratunga, 2005; Hanna, Taylor, Sheppard, & Laflamme, 2006). Hanna et al. (2006) reported that more than 10% of the fatal crashes of young drivers involves a young unlicensed driver. Hasselberg and Laflamme (2009) found that unlicensed drivers had between 52% and 87% more chance of being involved in a specific type of crash, namely those with a single vehicle compared to licensed drivers.

The present research examines whether adolescents’ playing of racing and drive’em up games is a significant predictor of self-reported unlicensed driving. In these games players take the position of drivers on a racing track or in a virtual city. In general the purpose of racing games is to finish first. In so-called drive’em up games points can also be gained by dangerous driving behaviors such as hitting other cars or pedestrians.

Recent studies have reported associations between media use and traffic-related risk taking. The results of Fischer et al.’s (2009) experimental research showed that the playing of driving games had an impact on players’ self-perceptions. More specifically, driving game players appeared to perceive themselves as risk-takers, which in turn affected their risk taking.
inclinations. Based on a longitudinal design, Beullens, Roe and Van den Bulck (2011) concluded that the playing of racing and drive’em up games in adolescence was a significant predictor of later risky driving behavior such as speeding and driving to fulfil a need for excitement and fun, even after controlling for certain personality characteristics.

Theoretically social-cognitive models offer an interesting explanation of how the playing of particular games may result in the engagement in a specific behavior such as risky or unlicensed driving. Social Learning Theory (Bandura, 2002a; Tan, 1986) explains how behavior could be learned by observation and modelling. Several steps are required before observational learning results in matching performances (Tan, 1986). First, a particular external event must be attended (Tan, 1986). The more distinctive, positive, simple, prevalent and useful an event is considered to be, the more likely it will be attended to. However this attention is also determined by certain attributes of the actor such as his attention span, arousal level, preferences etc. Next the event must be remembered. This retention is the second crucial step before observational learning can occur. Tan (1986, p. 43) argued that this retention can be completed through 4 processes, namely symbolic coding (this is the symbolic mental representation of the event), cognitive organization (arranging an event into distinct steps), symbolic rehearsal (mentally rehearsing the event) and enactive rehearsal (acting out the event). Once an event has been remembered, motivational processes such as external, vicarious and self-initiated rewards determine whether the learned event will actually be performed (Tan, 1986, p. 43).

These conditions illustrate that observational learning might also occur from playing video games. In racing and drive’em up games risky driving behavior is extremely present. The players are not mere observers of risky driving, but conduct the required actions to play the game. In order to complete driving games successfully, they have to engage in speeding, overtaking dangerously, joy riding or hitting other cars or pedestrians. Successfully
completing these games also demands a high level of attention to and involvement in the content of these games. Furthermore playing racing and drive’em up games might also function as a kind of symbolic rehearsal of (risky) driving behavior. This holds especially among drivers without driver’s license, since they do not have real world driving experience yet. In addition players are highly rewarded within the game context for engaging in risky driving behavior since these behaviors eventually result in a transition to the next game level and a particular game score. The adverse outcomes of risky driving behavior on the other hand are largely absent from the games. If for instance speeding results in a car crash, you can simply continue the game or start over with a new car. Consequently the frequent playing of these driving games might result in observational learning.

Similarly other authors have underlined the fact that video games are more likely to affect their users compared to other media. Krahé and Moller (2004, p. 54) cited Dill and Dill (1998) who ascribed the impact of video games to the fact that they provide direct rewards, they allow rehearsal of specific skills, they facilitate identification by letting the player select certain attributes (such as racing team, circuit or city car etc.) and are photographically highly realistic nowadays.

Several authors have indicated that both short and long term effects might be explained through observational learning (Anderson et al., 2010; Huesmann, 2007). With regard to short term effects from playing video games, Anderson et al. (2010) and Huesmann (2007) have argued that people have the tendency to mimic observed behavior. Such mimicry leads to the better learning of a new script (namely risky driving) which in turn might result in the displaying of this behavior. Anderson et al. (2010) argued that this effect is most likely to occur when the particular participant does not have a well-learned script for this behavior yet, when the player is confronted with a novel behavior, and when there is a close resemblance between the game and a later situation. Although these arguments were made in relation to the
effect of playing games on aggressive behavior, they might also hold in the context of the
effect of playing driving games on driving behavior. Given Anderson and collegues’ (2010)
arguments young people without a driver’s license seem to be particularly ‘at risk’ since they
are not likely to have developed well-learned driving scripts yet.

In line with what Huesmann (2007) and Anderson et al. (2010) have argued in the
context of aggression observational learning also explains video games’ long term effects.
More specifically, in the long run repeated video game playing might affect beliefs, attitudes,
expectations, scripts etc. Analogous to the effects of violent games on aggression, the frequent
exposure to risky driving behavior in racing and drive’em up games might lead to a chronic
accessibility of scripts related to risk taking (e.g. attitudes and beliefs). Having certain
behaviors reinforced by rewards in a game may, however, not automatically lead to social
learning as normative beliefs play an important role in this process. These normative beliefs
determine which behaviors are considered to be appropriate in a certain situation. As such
they act as filters to limit morally inappropriate behavior (Huesmann, 2007).

However, Bandura (1991, 2002b) has argued that people have the capacity to
disregard these normative beliefs through the process of moral disengagement. Essentially
this means that there are occasions when people temporally suspend their moral standards.
Klimmt, Schmid, Nosper, Hartmann and Vorderer (2006) have shown that a similar process
may occur while playing games since players engage in behaviors which they would probably
find unacceptable in real life, for instance shooting people or hitting other cars. Their study
indicated that players mostly have no difficulties in dealing with their moral concerns during
game play. Whilst gaming players find effective strategies to cope with their moral concerns
in order to maintain and enhance their game enjoyment (Klimmt et al., 2006). Recently Raney
(2011, p. 175) cautioned for this moral disengagement for the sake of game enjoyment and
stated that “If we can and are willing to quickly stretch our real-world moral code for the sake
of enjoyment, then it seems reasonable to think that we can become conditioned to do so in real-world situations too. Investigations into what are possibly long-term effects of this process are warranted” (Raney, 2011, p. 175).

Unfortunately the research on this question is scarce. In one of the few studies on this topic, Godoy and colleagues (Godoy, Appleby, Christensen, Miller, & Read, 2007; Godoy et al., 2008) looked at the choices people make in a virtual environment that is similar to their every day environment and examined whether these choices predicted their behavior in the real world. Their results confirmed the hypothesis and showed that the engagement in risk taking in a virtual environment was significantly related to past and future real-life risk taking. Thus the participants appeared to behave consistently in both the real world and a virtual environment.

Based on previous research on media use and risky driving and in accordance with the insights from Social Cognitive Theory, the current study hypothesizes that there may be a relationship between the playing of racing and drive’em up games and one particular form of risky driving behavior, namely unlicensed driving. Therefore the current study examined whether adolescents’ playing of these games predicts their engagement in unlicensed driving. In line with what can be expected based on observational learning, it is hypothesized that the more frequent players have a higher chance of getting involved in this form of risk behavior compared to those who played less. Following observational learning theory this might especially be the case for players without a driver’s license since they have had no proper training and have no or little driving experience.

The relationship between video game playing and unlicensed driving is examined among a sample of 1104 adolescent boys and girls. Logistic regression analysis is employed to examine whether the playing of these games predicts driving on the public road before having obtained a valid driver’s license. Several variables which have been found to be
associated with media use and risky driving (Beullens et al., 2011; Beullens & Van den Bulck, 2008) were controlled for in the analyses (e.g. sensation seeking, risk perceptions, respondents’ sex and school level).

From a prevention point-of-view, it is very important to know which variables predict adolescents’ engagement in this form of risk taking. Knowledge concerning the lifestyle predictors of risky driving is relevant for prevention campaign planners since they provide information on which youngsters to address and how they can be reached.

Methods

Sample

The data used for this study stem from a prospective cohort study with a two-year interval. For the first wave of data collection (2006) questionnaires were administered to a stratified random sample of 17 and 18-year-old secondary school students in Flanders (Belgium). From the official list of secondary schools in Flanders 20 schools were randomly selected. These schools were asked to participate in a large scale study on adolescents’ leisure activities (part 1) and traffic (part 2). When a school agreed to cooperate, all students from the 5th and 6th year were included in the sample. This procedure was repeated until 15 schools agreed to participate in the study.

In total 2193 pupils filled out a standardized, self-administered questionnaire including measures of video game playing (1), risk perceptions regarding risk taking in traffic (2), sensation seeking (3) and demographics (4). 65.2% of the respondents were boys, 34.8% were girls. 5% of the respondents were at least 20 years old, 16.5% were 19, 41.7% were 18, 36.5% were 17 and 0.2% were 16 years old. The strict confidentiality of the respondents’ answers was emphasised before as well as after the completion of the questionnaire.
Two years after the first wave of data collection the second wave was administered (2008). Respondents not answering the follow-up web survey were sent a paper version of the questionnaire and a stamped and addressed envelope at their home address. In line with the Total Design Method (Dillman, 1978) several follow-up e-mails and letters were sent in order to maximize response. The postal survey and the web survey together resulted in a response of 1104 respondents. Thus 50% of the respondents who completed the first questionnaire took part in the second wave of the study. For the current study this subsample was used.

Measures

In accordance with Beullens et al. (2011), in both waves respondents were asked how often they played (1) ‘Circuit racing games’ such as Gran Turismo, Ridge Racer, and MotoGP or (2) ‘Drive’em up games’ such as Driver, Carmageddon, Burnout, Need for Speed. Response categories were (0) never, (1) a few times a year, (2) about once a month, (3) a few times a month, (4) about once a week, (5) a few times a week, (6) (almost) every day. Theoretically as well as methodologically it seemed advisable to sum these two items and divide them by 2 in order to obtain one variable indicating the frequency with which driving games were played. First, both genres share a lot of characteristics on the level of the content of the game. For racing as well as drive’em up games the players have to engage actively in one or another form of risky driving behavior in order to complete the game successfully. In both genres players are rewarded for exhibiting risky driving behaviors such as speeding and in both genres risky driving is associated with intrinsic (enjoyment) and extrinsic rewards (points to win the game). From a methodological perspective too we chose to sum both items since both were significantly correlated (r=.72, p<.001). Next this variable was recoded into six categories: Two categories (a few times a week and almost every day) were combined since the highest category did not occur frequently (less than 2% of the sample in the first
wave, and less than 3% in the second wave). This variable was entered as a categorical variable in the logistic regression.

*Risk perception* (first wave) was measured by several questions. First respondents were asked to indicate how dangerous they perceived unlicensed driving on the public road to be (risk_perc1). Response categories ranged from 1 (not at all dangerous) to 7 (very dangerous). Second respondents were asked to estimate how likely it is that they would be involved in a car crash (risk_perc2). Answering categories ranged from -5 (very unlikely) to +5 (very likely) (Beullens & Van den Bulck, 2008).

*Sensation Seeking* (first wave) was measured using Arnett’s Inventory of Sensation Seeking (AISS) (Arnett, 1994). Haynes, Miles and Clements (2000) analyzed this scale in comparison with Zuckerman’s Sensation seeking scale form V and concluded that a modified version of the AISS provides a more appropriate measure of sensation seeking. Respondents were asked to indicate their sex and school level. These variables were entered as categorical variables in the logistic regression.

Finally, *unlicensed driving* was queried (wave 2). Respondents indicated whether they had ever driven on the public road before they had obtained a valid driver’s license ((0) no, (1) yes). In Belgium a provisional driver’s license can be obtained after passing a theoretical test in order to be able to practice driving skills on the public road (for instance accompanied by a family member or a driving instructor). Although these drivers do not have a definitive driver’s license yet, this type of unlicensed driving is not included in this measure. Also revoked or suspended drivers are not included in these data.

**Analyses**

Logistic analyses were executed with SPSS 16.0.
### Results

22.2% of the girls in the sample and 40.9% of the boys indicated to have driven on the public road before legally being allowed to do so. In the first wave driving games were played by 70.8% of the respondents. They appeared to be significantly more popular among boys than among girls ($t(625.298)=13.071$, $p<.001$). Of the respondents, 29.2% never played driving games, 21.2% played a few times a year, 16.0% about once a month, 13.5% a few times a month, 8.8% about once a week and 11.4% a few times a week or more. At time 2 playing driving games appeared to be less popular among the respondents in the sample ($M_{Time1}=2.070$, $M_{Time2}=1.4880$, $t(622)=9.256$, $p<.001$). Table 1 gives a detailed overview of the correlations between the constructs included in this study, and their descriptives.

| TABLE 1: ABOUT HERE |

In order to examine whether or not driving video game playing predicts unlicensed driving a logistic regression was executed. Gender, school level, risk perceptions and the two factors of sensation seeking (intensity and novelty seeking) were added to this model as control variables. Two measures of video game playing were added to the model, namely driving game playing during the first wave of data collection and driving game playing in the second wave. The analyses indicated that game playing in wave 1 was a small but significant predictor of unlicensed driving. However, game playing in wave 2 as well as the sensation seeking measures and school level did not explain a significant part of the dependent variable. Furthermore sensation seeking appeared not to moderate the relationship between game playing and unlicensed driving. Thus, the model was re-estimated without these variables.
The Hosmer and Lemeshow test of this new model was non-significant which is an indication of a good model fit (cf. table 2, $\chi^2$: 4.780, df: 8, $p=.781$; Nagelkerke $R^2=0.115$).

**TABLE 2: ABOUT HERE**

Table 2 indicates that the playing of driving games during adolescence significantly predicted self-reported unlicensed driving, even after controlling for gender and risk perceptions. The girls in the sample were less likely to have engaged in unlicensed driving than the boys were (OR=.671) [marginally significant $p=.057$]. Respondents who perceived unlicensed driving to be very dangerous were less likely to have engaged in this behavior (OR=.841). Those who estimated the chance of being involved in a car crash as very likely, were also more likely to have reported unlicensed driving (OR=1.094). Finally driving game playing in adolescence significantly predicted unlicensed driving. This concept appeared to be a better predictor than adolescents’ risk perceptions or gender. Table 2 gives a detailed overview of the predictive value of the playing of driving games on unlicensed driving. It indicates that the odds of having engaged in unlicensed driving were about 2 times greater for adolescents who reported playing driving games a few times a year (OR=2.296), about once a month (OR=2.012), a few times a month (OR=1.843) and about once a week (OR=2.015) compared to respondents who never played these games. For adolescents playing driving games at least a few times a week, the odds of having engaged in unlicensed driving were nearly 4 times greater compared to the non-players (OR=3.709). In line with Willoughby, Chalmers and Busseri’s (2004) recommendations, this means that driving game players have an increased chance of being involved in unlicensed driving. However, given that the odds ratio increased considerably (OR=3.709) for the group playing more than a few times a week, this group seems to be particularly at-risk.
Discussion

Playing video games is one of the most popular pastimes today among adolescents. At the same time traffic crashes remain the leading cause of death among young people (World Health Organization, 2004). Although unlicensed driving is a serious health threat for young drivers, the predictors of this form of risky driving behavior have largely remained unexamined. The present study found that the playing of driving games is a significant predictor of unlicensed driving. In general game playing appeared to be a better predictor of unlicensed driving than other variables which one would expect to predict this form of risk taking such as sensation seeking and risk perception. Adolescents who indicated playing driving games between a few times a year and about once a week were approximately 2 times more likely to have engaged in unlicensed driving. This means that these young people have an elevated risk of being an unlicensed driver. One group of particular concern, however, are those who play racing or drive’em up games a few times a week or almost every day. The odds of being an unlicensed driver were nearly 4 times greater for these respondents compared to those never playing driving games. Thus, this group seems to be particularly at-risk and requires extra attention. While a significant odds ratio may refer to a significant difference compared to the reference group, it is not necessarily a meaningfully large difference. Willoughby et al. (2004) therefore argue that an OR should exceed 2 in order to be conceptually meaningful. The OR in our study were all close to 2 and some exceeded this cut-off point considerably.

The results of the current study are congruent with what is proposed in social cognitive models (Bandura, 2002a; Tan, 1986). One possible explanation is that a kind of model
learning took place among driving game players. The observed relationship between driving game playing and unlicensed driving might occur from recurrent active engagement in racing and/or drive’em up games, which may lead to the better learning of risky driving scripts, eventually resulting in the displaying of risky driving behavior (such as unlicensed driving). The fact that the current sample mainly consisted of young people without driver’s license is in support of this hypothesis. Since these drivers have not gone through a formal driver education program, they probably do not have well established scripts yet, which makes it more likely that a game effect will occur. Also in support of Social Learning Theory is the fact that for heavy driving game players, namely those playing more than a few times a week, the odds of having engaged in unlicensed driving were considerably higher than for those playing less. Thus, greater exposure to driving games seemed to lead to better learning of the risky driving script.

Following Social Learning Theory it might be assumed that the active involvement in racing an drive’em up games in which risky driving behavior is highly rewarding results in increased odd of engagement in this behavior later on. Yet these results are preliminary, and this is only one of many possible explanations for the results found in this study. It is clear that more research is needed in order to determine the exact relationship between media use and risky driving. In line with what has been suggested in Fischer et al.’s (2009) research, playing video games might also alter adolescents’ self-concept. Highly skilled video game players might infer that they have acquired real driving skills, which may encourage them to engage in unlicensed driving. Another explanation is proposed in Jessor’s and Jessor’s (1977) Problem Behavior Theory. According to this theory, risk behaviors that share the same meaning for the adolescent co-occur and constitute a cluster of problem behaviors. Following this perspective, video game playing and unlicensed driving may both be a part of such a cluster or syndrome of problem behavior. Under the condition that these two behaviors share
the same meaning for adolescents they might simply co-occur, without one causing the other. Krcmar and Greene (2000) used a similar perspective. Their study supported the existence of a cluster of problem behaviour and showed also that this cluster is associated with certain media use. More specifically they considered media use in their study as a system-level variable and found a relationship between certain media content such as violent television and various problem behaviours such as alcohol abuse, driving under influence and reckless driving.

Unfortunately the present study cannot determine unambiguously what the explanation for the association between video game playing and unlicensed driving is. However, it does show that this relationship needs further exploration. From a prevention point-of-view the results indicate that adolescents’ video game playing is a marker for unlicensed driving and that mainly heavy driving game players warrant attention. Given the scarce number of studies on unlicensed driving this is in itself already an important finding. The results indicate that adolescents playing a lot of racing and drive’em up games have a heightened chance of being an unlicensed driver two years later. This means that this group of video game players constitutes an important target for prevention campaign planners trying to prevent traffic-related risk taking among young people. In addition, the results indicate that it is important to incorporate video game playing in future studies examining the lifestyle of risk-takers.

The study has several important limitations. First, although the results seem to support Social Learning Theory in some ways, the study was not originally designed as a study to test this theoretical framework. Resultantly some of the aspects of Social Learning Theory are not addressed in the study. More specifically, the current study found support for a correlation between playing particular game genres and unlicensed driving but cannot explain this relationship. For instance, the study gives no insight in respondents’ motivations for engaging in risky driving. It is possible that video game players engage more frequently in risky
driving because they want to re-enact the scripts learned in video games. Thus, they might engage in risky driving in an effort to gain increased arousal or enjoyment through re-enacting the learned scripts. Future research should examine this assumption through focusing on the risky drivers’ motivations for engaging in risk-taking.

Likewise future research designed as a test of Social Learning Theory might want to use experimental designs in order to test the different effects racing and drive’em up games might have. Although racing and drive’em up games share certain similarities with regard to their content (risky driving, cf. supra), they also have important differences. While racing games are enacted on a racing circuit in a rules-governed environment, drive’em up games adhere more to a fantasy simulation. Even though in the current study the heavy players of one genre also seemed to frequently engage in the other genre, this does not automatically imply that both genres have similar effects. They might both be associated with a different set of attitudes and motivations.

Third, the study was based on self-report measures. Therefore the extent to which these data reflect actual unlicensed driving is unsure. However research has indicated that when confidentiality is assured self-report measures are a valid measure of traffic-related risk taking behaviors (Campanelli, Dielman, & Shope, 1987).

Fourth, only a limited number of variables are included in this study and unlicensed driving was measured with only one dichotomous variable. In-depth research in which the extent to which this behavior is exhibited is charted in more detail and in which the predictors of unlicensed driving (including media use) are examined is required.

Finally, unlicensed driving appeared to be quite prevalent in the sample, especially among boys (40.9% versus 22.2% of the girls). As Hanna et al. (2006) have discussed, it is difficult to get precise numbers on the prevalence of this behavior since unlicensed drivers are generally not known to authorities until they crash or violate the traffic rules. Consequently it
is not possible to compare the prevalence of this behavior to national trends. However survey studies executed in the United States and New Zealand do give an indication of the prevalence of this behavior in other countries. For instance among a sample of New Zealand adolescents, Harré, Field and Kirkwood (1996) found that 28% of the males and 41% of the females considered themselves to be drivers beyond the learning stage although they did not have a driver’s license. In a study across several American states the percentage of young people engaging in unlicensed driving varied between 35% and 58% (Ferguson, Leaf, Williams, & Preusser, 1996). Thus, although there seems to exist a great variability in the percentage of unlicensed drivers between countries, these percentages seem to indicate that this is not a phenomenon only occurring in Belgium (or only in this sample). Self-evidently more research is needed to examine the prevalence of this form of risk behavior and its antecedents in other samples more into detail.
References


Table 1: Descriptives: correlations, range, means and standard deviations

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<td>2. School level</td>
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<td>3. Risk_perc1</td>
<td>.187**</td>
<td>.138**</td>
<td>1 Range: 6; M: 5.27; SD: 1.707</td>
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<td>4. Risk_perc2</td>
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<td>-.019</td>
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<td>-.371**</td>
<td>-.336**</td>
<td>-.102**</td>
<td>.042</td>
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<td>-.276**</td>
<td>-.065</td>
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<td>.544**</td>
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<td>-.211**</td>
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<td>.350**</td>
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<td>1 Range: 20; M=17.71; SD=3.39</td>
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<td>.045</td>
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<td>-.072</td>
<td>.144**</td>
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<td>9. Unlicensed driving</td>
<td>-.198**</td>
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<td>-.201**</td>
<td>.080*</td>
<td>.194**</td>
<td>.179**</td>
<td>.166**</td>
<td>.014</td>
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</table>

Gender: 1= boys, 2= girls; Unlicensed driving: 1=yes, 0=no. 
M=Mean; SD= Standard Deviation; **correlation is significant at 0.01 level (2-tailed); 
* correlation is significant at 0.05 level (2-tailed)
### Table 2: Predictors of unlicensed driving (logistic regression)

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<tr>
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Gender: 1= boys, 2= girls; Unlicensed driving: 1=yes, 0=no.

Hosmer and Lemeshow test: χ²: 4.780, df: 8, p=.781; Nagelkerke R²=0.115; Model χ²: 60.767, df=8, p<.001