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Risk-Perception and Dangerous Driving among Adolescents: Outcome- and Behavior-focused Questions Yield Opposite Results

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Abstract

While some studies have found that those who perceive a behavior to be more risky are less likely to engage in it, others have found that those who engage in more risky behaviors see themselves as being more at-risk. Using an online questionnaire we investigated whether such conflicting findings may be due to the types of risk-questions employed in past studies. We assessed risk-perception using outcome-focused questions (e.g. the likelihood of being in an accident) and a behavior-focused question (the riskiness of speeding). Participants who reported engaging in more risky driving gave higher estimates of their chances of experiencing a negative outcome. However, those same participants gave lower estimates of the general riskiness of risky driving. Drivers may think about the risks of risky driving in different ways depending on the focus of the questions.

Keywords

Dangerous Driving; Adolescence; Risk Taking; Risk Perception; Question Focus

INTRODUCTION

Risky health behaviors, such as smoking, drug use and dangerous driving, typically arise in early adolescence and peak in late adolescence and early adulthood (Kan, Cheng, Landale, & McHale, 2010; Livingston & Room, 2009). A number of explanations have been offered to explain this period of increased risk-taking, such as different rates of development of socio-emotional and cognitive-control neural systems (Steinberg, 2008), poor psychosocial maturation (Bingham, Shope, Zakrajsek, & Raghunathan, 2008), and, rather unexpectedly, under-reliance on emotional decision making (Reyna & Farley, 2006). Many of these

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theories have arisen in reaction to the popular perception that young people engage in more risks because they do not understand or perceive the risks of these behaviors (e.g. Lovley, 2009). Such a view of risk-taking is not supported by a number of studies that find adolescents and adults are very similar in their evaluations of risk.

Risk-perception can be studied in a number of different ways. A common technique is to ask people to indicate how much they believe themselves to be at risk of a particular outcome (absolute risk). For example, Millstein and Halpern-Felsher (2002) asked adolescents and adults to estimate the probability of a negative outcome in a specific situation (e.g. dying in a lightning storm). They found that in all cases adults rated the probability of a negative outcome happening to them as being lower than any of the adolescents. An alternative measure of risk-perception is how people perceive their own risk in comparison to others, either peers or those in other age groups (comparative risk). Quadrel, Fischhoff and Davis (1993) asked adults and their accompanying teenage children to indicate the probability of a negative outcome (e.g. auto-accident injury, unplanned pregnancy, etc.) happening to them versus others. Both the adults and the adolescents thought that the adolescents were at more at risk compared with others.

Furthermore, for some of the outcomes, adults were more likely to rate themselves as being at less risk compared with others. Quadrel et al. defined invulnerability as the belief that there is little or no chance of a negative event befalling oneself. They found that adults indicated invulnerability more often than their adolescent children did; Millstein and Halpern-Felsher found similar results. These findings do not support the assertion that adolescent risk-perception underlies increased risk taking.

An alternative approach is to examine whether, among adolescents, differences in risk-perception are associated with differences in risk-taking. Benthin, Slovic, and Severson (1993) asked participants (aged 14–18 years) about their engagement in a number of problem behaviors and asked the following question about each behavior: “If you did this activity, to what extent do you believe that you would be personally at risk of getting hurt or getting sick?” They found that, for almost all examined behaviors, those who engaged in them gave lower risk estimates compared with young people who did not engage in them. Chassin, Presson, Rose, and Sherman (2001) found that smokers assigned higher likelihood than non-smokers to the statement “If I smoke cigarettes, I will live a healthy life.” Brynin (1999) found that young current smokers were less likely to agree with statements such as “Smoking is extremely dangerous”. These results suggest that risk-perception does play a role in adolescent risk-taking; those who perceive the risks as lower are more likely to engage in the behavior.

However, the results of a number of other studies directly contradict this conclusion by demonstrating that risk-takers appear to give higher ratings of risk. Gerrard, Gibbons, Benthin and Hessling (1996) found that increased levels of risky driving were prospectively followed by increases perceived vulnerability to being in an accident. Cohn, Macfarlane, Yanez, and Imai (1995) found, among a number of outcomes, that current smokers were less optimistic about avoiding cancer than non-smokers. Murphy, Rotheram-Borus and Reid (1998) found similar trends for a number of other health behaviors, with high-risk

adolescents more likely to rate their risks as being higher compared with low-risk adolescents. For example, those engaging in higher risk sexual behavior were more likely to think they were at risk for contracting HIV.

Thus, the evidence appears contradictory, with some studies that suggest high-risk adolescents see their behavior as more risky while others report the opposite. This variation across studies may be due to the emphasis in the questions asked. The studies that found lower risk estimates among high-risk adolescents emphasized the *behavior* in their risk-perception questions e.g. Brynin (1999) asked participants to respond to the statement "Smoking is extremely dangerous". In contrast, those studies that found higher risk estimates among high-risk adolescents give emphasized specific *outcomes*. For example, Murphy et al. (1998) asked participants questions such as "Based on your behavior over the past month, how much do you think you are at risk for getting the virus that causes AIDS?".

This explanation for the contradictory findings is supported by studies that have used both behavior- and outcome-focused questions. Johnson, McCaul and Klein (2002) asked young people about their involvement in a number of risky behaviors. They then asked participants to indicate the risks of a negative outcome occurring for them and to indicate how risky they thought the behavior to be. They found that risk-takers rated their risks as higher in the outcome-focused questions compared with non-risk-takers. The results were reversed for the behavior-focused question though the difference between the groups did not reach significance. Mills, Reyna and Estrada (2008) found similar results for risky sexual behavior among adolescents. A similar pattern also emerged for driving, with Machin and Sankey (2008) finding a positive relationship between risky driving behaviors and estimates of the likelihood of being in an accident and a negative relationship between risky driving and estimates of the riskiness of certain driving behaviors. However, they found that the relationship between risky driving and negative outcome variables was much weaker than the relationship between risky driving and behavior-focused questions.

The current study represents an expansion of work by Mills et al. (2008) and Machin and Sankey (2008). Mills et al. demonstrated the significant differences in responses that can be found when the focus of a risk question is on a behavior rather than an outcome. They demonstrated this effect for sexual risk behaviors among young people and implicitly assume that their results apply to risk-taking among young people in general. Machin and Sankey asked both behavior- and outcome-focused questions in their study of risky driving among young people. However, their study had a number of limitations. Their outcome-focused scale was a combination of outcome-focused questions relating to both the participant and others, but it is unclear why such questions would be theoretically linked. Additionally, the only outcome they addressed was being in an accident. Falk and Montgomery (2007) found that risky young drivers often do not consider the actual impact of being in an accident e.g. a potentially fatal injury. Machin and Sankey's outcome-focused question was an absolute one and they did not include any comparative risk-questions e.g. "what are the chances you will be in an accident compared with others?" Few studies have investigated factors associated with differences in response elicited by absolute vs. comparative risk-questions.

The current study aims to expand the work of both Mills et al (2008) and Machin and Sankey (2008). The hypotheses of the present study are that a) higher levels of risky driving are associated with increased risk perception when measured with outcome-focused questions, and b) higher levels of risky driving are associated with decreased risk perception when measured with behavior-focused questions. Within the outcome-focused risk-questions, no hypothesis was made for the impact of absolute and comparative questions; this aspect of the study was exploratory.

METHOD

Participants

Students aged 17–21 attending a number of different colleges in Ireland were asked to complete an online questionnaire in return for entry into a raffle for a music player. The questionnaire was completed by 430 participants but 40 did not meet the inclusion criteria; they were removed for the following reasons: being older than 21 ($n=30$); reporting more penalty points than legally possible ($n=1$); indicating that they did not drive at all in the last 6 months ($n=9$). The study was aimed at 17–21 year-olds and 93% of the respondents were in this 4-year range. The remaining 7% were spread across a wide range of ages creating a large sparsity of observations among ages above 21.

The 40 (9.3%) of participants who were removed did not differ from those remaining in the study on any demographic variables or on any of the key measures (described in the Measures and procedure section below). The remaining 390 participants (59.2% [$SE = .03$] males) had a mean age of 19.7 years ($SE = 0.1$). This study was approved by the ethics committee of the School of Psychology at Trinity College, Dublin.

Measures and procedure

The questionnaire contained three questions which asked about past driving behavior; “Sometimes people drive carelessly or recklessly (too fast or in a dangerous way). How many times in the last 3 months have you driven recklessly?”, “How many times in the last 3 months have you driven at speeds that were slightly higher than the speed limit for the road you were on?”, and “In the last 3 months, how often have you driven at speeds that were much faster than the speed limit for the road you were on?” These questions were all answered on a five-point Likert scale (“Never” to “Regularly”) and risky driving score was the mean of the three questions (Cronbach’s Alpha = .84).

There were two types of outcome-focused questions: those that assessed absolute risk and those that assessed comparative risk. There were 4 absolute risk-questions: “How likely do you think it is that...” 1) “while driving, you will be involved in a car accident in the next 6 months?”; 2) “while driving, you will be involved in a car accident before you are 25”; 3) “your driving could lead to your car being damaged?”; and 4) “your driving could lead to someone being injured?” Participants responded to these questions on a seven-point Likert scale where 1 represented “No chance” and 7 represented “Will definitely happen”. Absolute risk was the average of these four questions (Cronbach’s Alpha = .83). Participants were then asked, using the same 4 scenarios, to rate their risk “compared with others your own

age". They responded to these questions on a seven-point scale with 1 representing "Much less likely than others" and 7 representing "Much more likely than others". Comparative risk was the average of these four questions (Cronbach's Alpha = .92). There was a single behavior-focused question which asked participants "How risky is it to drive at very fast speeds?" Participants responded to this question on a seven-point Likert scale ranging from "Not at all risky" to "Extremely risky". Using terminology employed by Mills et al. (2008), this single behavior-focused question was classified as a measure of global risk. This study was a part of a larger study on attitude accessibility and risky driving.

Analysis

Multiple imputation by chained equations (MICE) based on the assumption of missing at random (Little & Rubin, 2002; van Buuren & Groothuis-Oudshoorn, 2011) was used to impute missing subject and item nonresponse values in both outcome and independent variables. The algorithm recursively imputed each missing variable by estimating its distribution conditional on other variables. A total of 50 multiply imputed data sets were generated using R package "mice." Imputation addresses problems associated with loss to follow-up.

A separate analysis was carried out for each of the types of risk: absolute risk, comparative risk and global risk. Each participant's absolute risk was the mean of the responses to the four absolute risk-questions. Comparative risk was the mean of the responses to the four comparative risk-questions. Participants' global risk was the response to the single global risk-question. Three separate linear regression models were run for absolute, comparative, and global risk. In each model, the primary predictor was level of risky driving and sex, age, license type (full vs. provisional), previous accident involvement (yes vs. no), kilometers driven in the last 6 months, and time (in months) since first started driving were controlled for. All betas reported in the results section are standardized.

RESULTS

Participants reported driving for an average of 6882 km ($SE = 558$) in the last 6 months and had their driving licenses for an average of 32.5 months ($SE = 1.9$). There were 69.2% ($SE = .02$) of participants who had a full license and 10.6% ($SE = .01$) participants reported having ever been involved in an accident. The average risky driving score (on a scale of 1–5) was 2.4 ($SE = 0.1$) and the average absolute, comparative, and global risk perception scores (all on scales of 1–7) were 2.6 ($SE = 0.1$), 2.2 ($SE = 0.1$), and 5.8 ($SE = 0.1$) respectively. Absolute and comparative risk scores were highly correlated ($r = .73$, $p < .001$) while both had very small inverse correlations with global risk ($r = -.18$, $p < .001$ and $r = -.12$, $p < .05$ respectively).

The regression model for absolute risk was statistically significant, adjusted $R^2 = .18$, and the standardized betas associated with each predictor are displayed in Table 1. Risky driving was a significant predictor of absolute risk-perception, ($\beta = 0.44$). Participants who reported engaging in risky driving more often rated their absolute risk as higher. Figure 1 represents these difference with participants categorized as "less risky" or "more risk" drivers on the

basis of a median split for graphic purposes. Sex was also found to significantly predict absolute risk-perception ($\beta = 0.24$) with males rating the risk as being lower.

The regression model for comparative risk (Table 2) was statistically significant, adjusted $R^2 = .14$. Risky driving was a significant predictor of comparative risk-perception ($\beta = 0.39$). As with absolute risk, the more participants engaged in risky driving, the higher they rated their comparative risk (see Figure 1). Sex was also a significant predictor of comparative risk-perception ($\beta = 0.31$) with males rating the risk as being lower. Although more risky drivers saw their comparative risk as being higher, almost all drivers saw themselves as being less at risk than other drivers. Only 3.6% ($SE = .02$) of the sample had an average comparative risk at or above the midpoint of 4 - a score which signifies a comparative risk of no less or no greater than other drivers.

The regression model for global risk (Table 3) was statistically significant, adjusted $R^2 = .4$. Risky driving significantly predicted global risk-perception ($\beta = -0.49$). In other words, the more participants engaged in risky driving, the lower they rated the global risk of this behavior (see Figure 1). Sex was also a significant predictor, ($\beta = 0.33$), with females rating the global risk of speeding higher than males did.

DISCUSSION

Participants who reported engaging in more risky driving rated their risk of a negative outcome as being higher on both types of outcome-focused questions – comparative and absolute risk. However, participants who reported engaging in more risky driving rated the risk of risky driving as being lower on the behavior-focused questions – global risk. Both of these findings are in line with the initial hypotheses. Mills et al. (2008) found similar outcomes for risky sexual behaviors among young people. Their paper assumes that such findings apply to risk behaviors in general and the current study supports such an assertion.

The findings are also somewhat in line with those of Machin and Sankey (2008). Whereas they found that the effect size for outcome-focused questions was considerably smaller than behavior-focused ones, the current study found much less of a difference between the two types of questions. Machin and Sankey's outcome-focused analysis appears to combine participants' views of the chances of being in an accident for both themselves and others. This combination of these two different concepts may have reduced the effect size in their study. The current study found that similar relationships exist between reported risky driving and responses to both absolute (i.e. "how likely do you think it is that [x will happen to you]") and comparative (i.e. "Compared with others your age, how likely do you think it is...") outcome-focused questions.

In some cases, these opposite response patterns for outcome- and behavior-focused questions are not necessarily inconsistent. For less dangerous drivers, the results are readily interpretable in that people who see dangerous driving as risky are less likely to engage in it. Then, this lack of engagement in behaviors which they view as risky leads them to see themselves as not at risk for a negative outcome. However, for the riskier drivers, the line of reasoning is less clear. If riskier drivers rate themselves as more at risk of negative outcomes,

then should this not indicate that they recognize dangerous driving as risky? Or, if causality runs the other way, if they do not believe dangerous driving is particularly risky, then why do they see themselves as being more at risk than safer drivers? Additionally, there is a reasonably small correlation between the two types of outcome-focused questions and the behavior-focused question ($r = -.18$ and $r = -.12$ for absolute and comparative respectively). This does not offer immediate support to the idea that risky driving is mediating the relationship between the two types of responses.

A number of additional findings emerged in this study. Over 95% of participants rated their comparative risk below 4 on a scale in which 4 represented that they had the same chance as anybody else their age of being in a crash. Thus, participants overwhelmingly rated themselves as less likely to be in a crash than their peers. Reyna and Farley (2006) point to studies that found this same optimistic bias among young people in a number of behavioral domains. While results such as these may suggest that risky driving among young people is the result of such a bias, Cohn et al. (1995) found that this optimism bias is often greater for adults than for younger people. Although participants gave higher risk ratings for the behavior focused, global risk question (see figure 1) compared with the outcome focused questions, these findings should be interpreted cautiously. The questions were all responded to using a 7-point risk scale, but the anchor points for the scales differed (see the full description in the measures and procedures section).

Limitations and Future Directions

There were a number of limitations in the study. Participants were not asked about their attitudes towards the benefits of risky driving. Ben-Zur and Reshef-Kfir (2003) found that perceptions of benefits can also predict engagement in risk-taking behavior. The lack of these questions was largely due to difficulty in generating benefit-questions. For example, question "How beneficial do you think it is to drive at fast speeds?" is more ambiguous than its corresponding risk-questions in this study. Another concern with the current study was that global risk was measured using a single question. This followed from Mills et al. (2008) and the current results were in the same direction as theirs on risky sexual behaviors. Nonetheless, relying on a single item means that this part of the analysis may be more prone to item-specific variation. Questions about risky driving were all based on self-reported data and focused predominantly on speed. This was, again, due to difficulty in describing other aspects of driving behavior known to increase the crash risk. Finally, while participants were recruited from both rural and urban areas of Ireland, they were all college and university students. Therefore the generalizability of these results may be limited.

The results of the current study do not tell us whether risk perception plays a causal role in dangerous driving. Longitudinal research is needed to fully understand such a role, if indeed there is one. Additionally, a longitudinal study could investigate how risk perception changes in response to being involved in a road accident. Much of the work on the impact of outcome- and behavior-focused questions has been conducted with young participants. The extent to which these effects change with age could also have implications for how we understand the link between attitudes and risky behavior.

Conclusions

The results of this study add to those that have found that the focus of risk-perception questions can have an impact on the relationship between risk-perception and risk-taking. The explanation for underlying this phenomenon is not entirely clear, and it remains to be seen if one type of question (behavior or outcome) is “better” when investigating risk-perception. As suggested by Mills et al. (2008), it is possible that these alternate types of questions prompt different types of thinking among respondents, though further study is needed to determine if this is truly the case. Future studies could utilize both outcome- and behavior-focused questions when assessing risk-perception among young people, and perhaps for all age groups.

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Figure 1.

Comparison between less-risky and more-risky drivers on average risk ratings for the 3 types of risk-questions. For illustrative purposes, participants have been grouped in to two driving groups based on a median split of risky driving. Error bars represent standard error of the mean for between group comparisons.

Table 1

Multiple linear regression for absolute risk perception.

Variable	Standardized β	Standard Error
Risky Driving	.44 **	.05
Sex ^a	.24 *	.1
Age	-.09	.05
License Type ^b	.14	.12
Accident Involvement ^c	-.11	.15
Kilometers Driven in last 6 months	-.04	.05
Time Driving	-.07	.05

Note. Higher scores on the absolute risk perception scale (dependent variable) indicate the perception of more risk.

*
 $p < .05$.

**
 $p < .001$.

^aReference group = "male".

^bReference group = "Full License".

^cReference group = "Accident Involved".

Table 2

Multiple linear regression for comparative risk perception.

Variable	Standardized β	Standard Error
Risky Driving	.39 ^{**}	.05
Sex ^a	.31 [*]	.11
Age	-.1	.05
License Type ^b	.13	.13
Accident Involvement ^c	.04	.17
Kilometers Driven in last 6 months	-.04	.05
Time Driving	.04	.05

Note. Higher scores on the comparative risk perception scale (dependent variable) indicate the perception of more risk.

^{*}
 $p < .05$.

^{**}
 $p < .001$.

^aReference group = "male".

^bReference group = "Full License".

^cReference group = "Accident Involved".

Table 3

Multiple linear regression for global risk perception.

Variable	Standardized β	Standard Error
Risky Driving	-.49**	.05
Sex ^a	.33**	.1
Age	.05	.05
License Type ^b	.03	.1
Accident Involvement ^c	-.12	.14
Kilometers Driven in last 6 months	-.04	.05
Time Driving	-.03	.05

Note. Higher scores on the global risk perception scale (dependent variable) indicate the perception of more risk.

**
 $p < .001$.

^aReference group = "male".

^bReference group = "Full License".

^cReference group = "Accident Involved".