Check for updates

Article

Journal of Early Adolescence
2017, Vol. 37(8) 1125–1141
© The Author(s) 2016
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0272431616648453
journals.sagepub.com/home/jea
SAGE

An Experimental Study of Risk Taking Behavior Among Adolescents: A Closer Look at Peer and Sex Influences

Anouk de Boer[1], Margot Peeters[1], and Ina Koning[1]

Abstract

In this experimental study, it was examined to what extent peers and sex were important predictors of risk taking behavior of adolescents. Participants were 140 Dutch adolescents (52.9% boys, 12-15 years) who completed the Balloon Analogue Risk Task (BART) as a measure of risk taking behavior, either individually or in the presence of homogenous or heterogeneous peer groups. Results showed that (a) adolescents took significantly more risk when they completed the BART with peers than when they completed the risk taking task individually, (b) boys took significantly more risk when they completed the task with peers than girls but not when they completed the task individually, and (c) boys in "boy-only triads" revealed the strongest risk taking behavior compared with "mixed-girl triads" or "girl-only triads." These results suggest that boys appear to be more susceptible to the influence of peers on risk taking behavior than girls.

Keywords

risk taking behavior, peer influence, adolescents, sex differences, BART

[1]Utrecht University, The Netherlands

Corresponding Author:
Margot Peeters, Department of Child and Adolescent Studies, Utrecht University, Heidelberglaan 1, 3584 CS Utrecht, The Netherlands.
Email: m.peeters1@uu.nl

In adolescence, youth are more involved in risk taking behavior than at any other age (Gardner & Steinberg, 2005). Risk taking behaviors, such as early alcohol use, reckless driving, and unprotected sex, are part of the normal development (Arnett, 1992) and peak at the adolescent phase and decrease in emerging adulthood (Steinberg, 2005). One reason why risk taking behavior peaks in adolescence is that during this particular period adolescents are more susceptible to the influence of peers (Steinberg & Monahan, 2007). Susceptibility to peer influence peaks in early adolescence, before the age of 14 (Forbes & Dahl, 2010; Fuligni & Eccles, 1993; Steinberg & Silverberg, 1986). Many studies have shown that the presence of peers results in more risk taking behavior among adolescents (Cavalca et al., 2012; Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Curry, Mirman, Kallan, Winston, & Durbin, 2012; Gardner & Steinberg, 2005; Simons-Morton et al., 2011). However, none of these studies have examined the differential effect of sex on actual risk taking behavior in a controlled and experimental setting. Although studies suggest that boys evaluate risk differently than girls (Gardner & Steinberg, 2005), it is unclear whether boys actually take more risk in the presence of peers and whether group composition matters (same sex or mixed sex). Curry and colleagues (2012) found differences between male versus female passengers in risky driving situations; however, this non-experimental study only investigated teens involved in crashes. Moreover, Gardner and Steinberg (2005) examined sex differences, yet they only studied differences in risk evaluations and not in actual risk taking behavior. In the current study, we therefore examined the influence of peer presence on actual risk taking behavior and investigated the differential impact of sex and group composition on risk taking behavior in an experimental setting.

Why Is There an Increase in Risk Taking Behavior During Early Adolescence?

Peer relations and social status become more important during adolescence; risk taking behavior might be encouraged by motivations such as receiving peer approval and a higher social status. Adolescents feel an increasing motivation to attract friends, to attain social status, and more generally, to pay more attention to, care about, and react to peer contexts (Forbes & Dahl, 2010). They have a stronger motivation for peer acceptance compared with both children and adults (Newcomb, Bukowski, & Pattee, 1993). Particularly during adolescence, when there is a shift from self-oriented behavior toward other-oriented (prosocial) behavior, peer acceptance is important. Peer pressure, concerns about social rejection, and the desire to be popular have a big

influence on adolescents' behavior (Forbes & Dahl, 2010), and peer influence susceptibility is enhanced by this desire to be liked by peers (e.g., social acceptance; Prinstein, Brechwald, & Cohen, 2011). Adolescents feel compelled to conform to the norms and perceived expectations of their peer group (Baumeister, 1990) and by conforming to, for example, risk taking norms, adolescents might increase their social status. Adolescents might weigh this benefit of risk taking (i.e., a higher social status/popularity) heavily, and might therefore increase their risk taking to impress their peers. Engagement in risk taking behaviors is related to more popularity over time (Mayeux, Sandstrom, & Cillessen, 2008). As a result, in the presence of peers, adolescents might be more strongly motivated to increase their risk taking as this might increase their social status and peer acceptance. This process is influenced by testosterone levels (Wallen, 2001) which appear to be stronger for boys (Peters, Jolles, van Duijvenvoorde, Crone, & Peper, 2015). To increase their social status, boys might feel more inclined to increase their risk taking when encouraged to do so by their peers. Therefore, in line with Gardner and Steinberg (2005) and other studies examining peer influence (Cavalca et al., 2012; Chein et al., 2011; O'Brien, Albert, Chein, & Steinberg, 2011), we hypothesized that adolescents, particularly boys, will take more risk when they complete a risk taking task with peers compared with completing the task alone.

Sex Differences in Risk Taking Behavior

Previous research suggests different engagement in risk taking behavior of boys and girls. Overall, middle adolescent boys more likely take risk compared with girls (Harakeh, De Looze, Schrijvers, van Dorsselaer, & Vollebergh, 2012). In addition, risk taking behavior among boys is differently predicted by factors such as outweighing of benefits and peer susceptibility than risk taking behavior among girls. Young adolescent boys, for example, attribute more injuries to bad luck and express more optimism bias than girls as they believe that they are less susceptible to injury than their peers (Morrongiello & Rennie, 1998). Moreover, the study of Gardner and Steinberg (2005) found that boys gave significantly greater weight to the benefits of risk taking behavior compared with girls. Furthermore, they found that especially in the younger age group, young adolescent boys weighted the benefits of risk taking behavior more heavily when they were in the presence of peers than when they were alone. In addition, adolescent boys appear to be influenced more by peers than girls (Steinberg & Monahan, 2007; Steinberg & Silverberg, 1986). For example, it was found that males who drove a car with peer passengers were more likely to perform an aggressive act before

crashing than males driving alone (Curry et al., 2012). Males are more likely to change their risk taking behavior and attitudes over time in the direction of what they believe the norm is (Borsari & Carey, 2001).

The sociobiological theory of Wilson and Daly (1985) suggests that from an evolutionary point of view, males' fitness arises from risky social competition. Successful competition increases the chance of admiration from peers and such behavior results in (social) power and dominance. According to this theory it would be expected that a context of competition would trigger risk taking behavior, particularly in boys (Byrnes, Miller, & Schafer, 1999). In this view, risk taking would be a means of maintaining or strengthening the leadership role in a group. For our hypothesis, this would suggest that boys would presumably take more risk than girls, particularly in the peer condition, where they complete the risk taking task with peers, as in this condition competition appears to be elevated. When boys complete the risk taking task with only boys, competition for dominance and the leadership role might be even stronger than in the mixed group, where they complete the task with boys and girls. Therefore, we expected to find the highest level of risk taking behavior in the same sex condition for boys. Studies indeed suggest higher competition and dominance among groups of men (Courtenay, 2000; Pellegrini & Archer, 2005).

The Current Study

In the present study, we examined differences in risk taking behavior among adolescents who completed a risk taking task individually and those who completed it with peers. Furthermore, we examined whether risk taking behavior in the presence of peers differs among boys and girls. Although Gardner and Steinberg (2005) found differences in self-reported risk assessment between men and women, such an effect was not found for actual risk taking behavior. A possible explanation for this might be that Gardner and Steinberg (2005) examined these differences on a group level, including adults, children, and adolescents. Perhaps sex differences are particularly visible in young adolescents. In the present study we therefore focused on young adolescents (12 to 15 years). We expected to find sex differences for boys and girls, with boys taking more risk than girls when they complete the task with their peers. Furthermore, we expected this effect to be the strongest in "boy-only triads" compared with "mixed triads" and "girl-only triads." We included mixed groups (boys and girls), to mimic the natural environment (e.g., schools, parties, nightlife) in which adolescents engage in risk taking behavior, as close as possible.

Methods

Participants

The sample consisted of 140 adolescents between the ages of 12 and 15 ($\bar{X}$ = 13.43, SD = 0.64). Participants were 74 boys (52.9%) and 64 girls (45.7%). Two participants did not fill in their sex. Adolescents were selected from two different (pre-vocational and general) secondary schools in the Netherlands (region Utrecht) from the seventh (4.3%), eighth (72.1%), or ninth (22.9%) grade classes. One participant did not fill in his/her grade.

In accordance with the ethical standards, participation was voluntary and anonymity was guaranteed. Parental passive consent was obtained by a letter which was sent to the parents and informed them about the nature of the study. Adolescents could decline participation; however, there were no refusals to participate by either adolescents or parents. As only two participants had missing data on sex and age, pair wise deletion was used to handle these missing values.

Procedure

Participants were randomly divided over the control (n = 65) and experimental condition (n = 75). For both conditions, three adolescents were randomly selected and taken away from the classroom to complete the Balloon Analogue Risk Task (BART) and questionnaire (one group in the control condition was a dyad as no more triads could be formed in the particular class). By doing so, we attempted to minimize the chance that participants knew beforehand whether they would complete the control or experimental condition. Triads were all selected within classes, resulting in triads of classmates only. A measure of friendship (see also description of measures) further analyzed the degree of friendship between participants within a triad in the experimental condition. In the control condition, participants' degree of friendship was not an issue because the BART was completed individually. In both conditions, multiple research assistants were present during the completion of the task. All participants received the instruction to gain as much points as possible. In the experimental condition, participants were placed next to each other in such a way that they could watch each other's progress. Participants were instructed to complete the task individually; however, collaborating with each other was allowed. The triads were allowed to watch, consult, help, encourage, and communicate with their group members, but each participant had his or her own computer task with an individual score.

In the control condition, the participants were also selected in groups of three but unlike the experimental group, participants were not allowed to collaborate and communicate during completion of the risk taking task and had to complete the task on their own. The three participants were placed far apart so that they could not see the computer screen of the other participants or communicate non-verbally. Multiple research assistants were in the room to assure that participants in the control condition could not communicate or consult each other on their performance during the completion of the risk taking task. After the task was completed, participants from both conditions individually completed a questionnaire. All participants received some candy after completing the session, irrespective of their performance on the BART.

In the experimental condition, participants completed the BART in triads that consisted of only boys (seven triads), only girls (seven triads), or mixed groups (10 triads). Mixed triads consisted of either two males and one female (four triads) or of two females and one male (six triads). The composition of one triad could not be determined as one participant in the experimental condition did not fill in his/her sex.

Measures

Risk taking behavior. To assess risk taking behavior, an adapted version of the youth version of the BART (BART-Y) was used (Lejuez et al., 2007). The BART is a computer task that assesses risk taking behavior. The task has successfully been used with young adolescents (Fernie et al., 2013). As Maclean, Geier, Henry, and Wilson (2014) state, elevated risk taking on the BART is associated with increased alcohol consumption (Fernie, Cole, Goudie, & Field, 2010; Fernie et al., 2013), substance use (Pleskac, Wallsten, Wang, & Lejuez, 2008), and aggression (Crowley, Raymond, Mikulich-Gilbertson, Thompson, & Lejuez, 2006). Furthermore, elevated risk taking on the BART is associated with self-reported measures of sensation seeking and impulsivity (Lejuez, Aklin, Zvolensky, & Pedulla, 2003). The BART requires participants to inflate a computer-generated balloon. By inflating the balloon, participants can earn points. In the version of the BART used in this study, participants move around a slider to indicate with how many pumps the balloon should be inflated. When the slider was released, the number of pumps was shown, and the participant could choose to inflate the balloon by pressing the button "pump." This is different from the most used version where participants need to pump the balloon manually by pressing the button repeatedly to inflate the balloon but similar to the one used by Pleskac and colleagues (2008). The more pumps, the more points could be earned. However, the balloon could also explode and when this happened no points were

earned. The balloons exploded at predetermined points and sequences (computerized algorithm) but always between the one and 128 pumps, with a mean breaking point of 64 pumps. Hence, balloons exploded at random between trials but at the exact same number of pumps between participants to assure that this was held constant for each trial across conditions and sex and to enable a fair comparison between the different subgroups of participants. In total, participants had to inflate 20 balloons. After each balloon, whether the balloon exploded or not, the participant received feedback about at what number of pumps the balloon (would have) exploded (Pleskac et al., 2008). A mean BART score was computed by taking the average score of the unexploded balloons. This is the common approach used by Lejuez and colleagues (2007). Higher BART scores indicate more risk taking behavior.

Degree of friendship. In the experimental condition, where participants completed the risk taking task with peers, participants were asked to indicate to what degree they were friends within the triad with whom they completed the experiment on a scale from 1 (*not friends at all*) to 10 (*very good friends*). Mean group scores were created for the degree of friendship within each triad.

Strategy of Analysis

Per condition and separately for boys and girls, the mean age and mean BART score are displayed in Table 1. First, simple *t* tests are discussed with respect to differences between conditions and differences between sexes. To investigate whether there was a difference between boys and girls in the amount of risk that they took when they completed the BART in the presence of their peers or when they completed the task alone, a multigroup analysis was performed using Mplus (version 7.3; Muthén & Muthén, 2012). Bayesian Information Criteria (BIC) and Akaike Information Criteria (AIC) were both examined in relation to the model fit. Next, for the experimental condition ($n = 74$), an analysis of variance (ANOVA) was performed examining the effect of the composition of triads on the mean BART scores of the triads. For each individual, a new variable was created indicating whether he or she was part of a mixed group or same sex group ("boys only" or "girls only"), and when part of a mixed group, it was established if this was a two-boy or two-girl triad. This new variable was then used as a factor with the BART scores as the outcome measure. A post hoc analysis was conducted to investigate how the mean BART scores of the triads differed between the "boys-only triads," "girls-only triads," or "mixed triads" (boys-mixed and girls-mixed). Lastly, it was examined what the relationship was between the mean degree

Table 1. Descriptive Statistics of the Sample per Condition.

	Control condition			Experimental condition		
	Boys	Girls	Total	Boys	Girls	Total
Sex (%)	58	42		50	50	
Mean age (*SD*)	13.51 (0.73)	13.59 (0.64)	13.55 (0.69)	13.35 (0.48)	13.30 (0.66)	13.32 (0.58)
Mean BART score (*SD*)	37.20 (13.78)	36.81 (12.64)	37.00 (13.11)	51.77 (11.70)	42.79 (11.30)	47.24 (12.20)
Friendship grade (*SD*)				7.57 (2.18)	7.03 (2.12)	7.29 (2.14)

Note. BART = Balloon Analogue Risk Task.

of friendship within a triad and the mean BART scores using a linear regression analysis with BART scores as the outcome variable and friendship as the predictor. This analysis was only performed in the experimental group (n = 74) as the question about the degree of friendship was only relevant for adolescents in triads who completed the task together. Therefore, this measure was not included as a confounding variable in the multigroup analysis. Statistical Package for Social Sciences (SPSS, IBM 20) was used to complete these analyses.

Results

Descriptive Statistics

In Table 1, the descriptive statistics for BART scores are presented. The mean scores on the BART significantly differed between the control condition and the experimental condition, $t(138) = 4.79$, $p < .01$. Boys in the control condition scored significantly lower compared with boys in the experimental condition, $t(72) = 4.90$, $p < .01$. For girls, a similar pattern was present, yet this effect did not reach significance, $t(62) = 1.99$, $p = .05$. With respect to sex differences, boys scored significantly higher than girls in the experimental condition, $t(72) = 3.36$, $p < .01$, while no such effect was present in the control condition, $t(62) = 0.12$, $p = .91$.

Multigroup Analysis of Sex Differences

To examine sex differences in risk taking behavior, a multigroup analysis was performed. As can be observed in Table 2, the model fit of the single-group model was worse than the multigroup model where differences between sexes were allowed. Both the BIC and AIC were lower for the multigroup model (BIC BART = 1,111 and AIC BART = 1,093) than for the single-group model (BIC BART = 1,120 and AIC BART = 1,111), suggesting that the model accounting for sex differences better fitted the data. There was a relatively strong effect for boys ($B = .50$, $SE = .08$, $p < .01$), indicating that boys in the experimental condition took more risk than boys in the control condition. For girls, the effect was smaller, though still significant ($B = .25$, $SE = .12$, $p = .03$). For boys, condition explained 25% of the variance in the mean BART scores, for girls the explained variance was 6%.

The Composition of the Triads

In the experimental condition, there were seven (28.0%) triads that consisted of girls only, seven (28.0%) triads that consisted of boys only, and 10 (40.0%)

Table 2. Summary of Multigroup Model With Sex as Grouping Variable and the BART Measures as Outcome Variable.

	R^2	*B*	*SE*	*p*	BIC	AIC
Mean BART score					1,111 (1,120[a])	1,093 (1,111[a])
$\text{Condition}_{\text{boys}}$	.25	.50	.08	<.01		
$\text{Condition}_{\text{girls}}$	.06	.25	.12	.03		

Note. BART = Balloon Analogue Risk Task; BIC = Bayesian Information Criteria; AIC = Akaike Information Criteria.
[a]BIC and AIC for model without sex differences.

mixed triads that consisted of both girls and boys (e.g., triads with two boys [$n = 4$] and triads with two girls [$n = 6$]). The composition of groups had a significant effect on the mean BART scores of the triads in the experimental condition, $F(3, 68) = 4.51$, $p \leq .01$. Boy triads ($\bar{X}_{\text{boys}} = 53.48$, $SD = 6.53$) had significantly higher mean BART scores than girl triads ($\bar{X}_{\text{girls}} = 41.27$, $SD = 6.80$, $p < .01$), and mixed-girl triads ($\bar{X}_{\text{mixedgirl}} = 44.80$, $SD = 13.82$, $p = .03$). Mixed-boy triads ($\bar{X}_{\text{mixedboy}} = 50.47$, $SD = 14.66$) appeared to have higher mean BART scores than girl triads ($p = .02$). In the experimental condition, there was no significant relationship between the degree of friendship and risk taking scores, while controlling for sex ($B = .16$, $SE = .62$, $p = .80$).

Discussion

The results of the present study confirmed that adolescents take significantly more risk when they complete the risk taking task with peers compared with when they complete the task individually. Sex differences in the effect of peer presence on risk taking were found. That is, boys took significantly more risk than girls when they had the possibility to communicate and collaborate with peers when completing the risk taking task. However, no significant sex differences were found when the BART was completed individually. Furthermore, the composition of groups had a significant effect on BART scores when adolescents had the option to communicate and collaborate with peers. We expected that the effect of the condition was the strongest for "boy-only triads" compared with "girl-only triads" and "mixed triads." This hypothesis was partly confirmed by the results. "Boy-only triads" had higher mean BART scores compared with "girl-only triads" and "mixed-girl triads" but not to the "mixed-boy triads." Hence, this study demonstrates that adolescents, particularly boys, are more inclined to engage in risk taking behavior in the presence of peers.

Our results corroborate previous studies that found that adolescents take more risk with peers. Several studies have found that adolescents show greater preference for immediate rewards when they are with peers than when they are alone (O'Brien et al., 2011; Weigard, Chein, Albert, Smith, & Steinberg, 2014). Furthermore, adolescents might take more risk in the presence of peers because they want to gain peer acceptance and a higher social status (Crone & Dahl, 2012), and they might believe that increased risk taking helps them achieve this goal. Moreover, it could be that the presence of peers increases arousal, and increases sensitivity for social evaluation, a process specifically present in adolescents (Somerville, 2013; Somerville et al., 2013). According to Reynolds, MacPherson, Schwartz, Fox, and Lejuez (2013), the effect of peer presence alone did not increase risk taking behavior among adolescents (18-20 years). The authors found that only active peer encouragement significantly increased risk taking behavior among (older) adolescents, while peer presence without interaction, and a control condition where adolescents performed the BART alone, revealed no significant difference in risk taking behavior. This finding indicates that the mere presence of peers does not significantly change risk taking behavior, a finding supported by results of van Hoorn, van Dijk, Meuwese, Rieffe, and Crone (2014) who found similar results in a sample of younger adolescents (12-16 years). Although we have no information about the exact communication between peers in the experimental condition, based on the findings above it is likely that peer encouragement is also an important factor in our study explaining why adolescents take more risk in the presence of peers and not in the control condition where no interaction between peers was allowed. It should be noted, however, that risk taking measures differed between studies as well as the age of participating adolescents.

With respect to sex differences and risk taking behavior, perhaps biological processes underlie the increased risk taking behavior observed in boys in the experimental condition. Boys' testosterone might increase their motivation to attain higher status in social contexts (Wallen, 2001) and therefore, boys feel more inclined to increase their risk taking as they think that risk taking is part of a tough and popular reputation. Associations between risk taking behavior and levels of testosterone indeed have been found for boys and not for girls (Peters et al., 2015). These findings in combination with the results of our study suggest that the active involvement (e.g., communication and collaboration with peers) might underlie the increased risk taking observed in the experimental condition. Adolescents might be sensitive to the social evaluation and feedback from other peers and are focused on gaining acceptance of peers by conforming to the behavior of others. Conforming to the behavior of others may result in risk taking behavior as well as in more

prosocial behavior depending on the norm behavior of the peer group (see van Hoorn et al., 2014, for a more detailed discussion). Particularly boys might be inclined to gain dominance and power (e.g., norm behavior and biological processes) and by taking risk they presume that they will gain social status. However, more research is needed to gain insight in the process of peer influence including broader age ranges that could explain the difference between sexes. As suggested by Willoughby, Good, Adachi, Hamza, and Tavernier (2013), risk taking behavior could be expressed in different ways during the phase of adolescence and as adolescents mature peers may have a varying influence on risk taking behavior.

Furthermore, we found an influence of the composition of groups. Boy triads took significantly more risk than girl triads and mixed-girl triads. Mixed-boy triads took more risk than girl triads. These results suggest that particularly groups with boys are susceptible to the influence of peers with respect to risk taking behavior. This finding is supported by Curry and colleagues (2012) who found that male drivers were influenced by the presence of a male passenger, whereas female drivers were not. However, results of our study should be interpreted with some caution as the sample size was rather small for comparison of the four different groups.

In addition, the degree of friendship did not appear to be associated with risk taking behavior within the triad. Hence, when adolescents communicated and collaborated with peers during the risk taking task, the degree of friendship did not affect the influence of peer presence on risk taking behavior. However, the measure of the degree of friendship was limited. Participants had to grade the friendship with the two other members of the triad with one grade. This could be difficult as participants might see one member of the triad as a good friend while they are not friends with the other.

Strengths and Limitations

This experimental study provides more insight into sex differences in risk taking behavior and the influence of peers. However, there were some limitations of our study. First of all, our sample was too small to draw firm conclusions with regard to the relation between sex compositions of groups and risk taking. The results suggest that the mere presence of a boy was related to more risk taking in a group. Future research should focus on this finding as it could have implications for practice, as interventions could be made more sex-specific. Second, our study showed that adolescents take more risk when they complete the risk taking task with peers, yet more research is needed to investigate the underlying peer influence mechanisms that make adolescents engage in more risk taking behavior in the presence of peers. It would be

interesting to tape the conversations between participants to gain more insight into the underlying peer influence mechanisms such as active (peer pressure) and passive (modeling) peer influence. Third, our study did not take into account pubertal development while it is known that puberty influences the development of brain systems that play a role in processing affective and social stimuli (Forbes & Dahl, 2010). However, we can assume that in the current study, sex differences in pubertal development did not explain the different levels of risk taking of boys and girls because we only found sex differences in the experimental condition and not in the control condition. Future research should include a measure of pubertal development to examine how this affects the susceptibility to peer influence.

Despite of its limitations, the study also had strengths. One strength of this study is the observational-experimental design. This enabled us to draw conclusions about the direction of effects. Furthermore, compared with the study of Gardner and Steinberg (2005), this study also focused on mixed groups as youth in a real-life setting are also accompanied by other sex peers, for example, when they go out or at school. The study also expands our knowledge on adolescent risk taking behavior among relatively young adolescents, as well as on sex differences in the effects of peer influence on risk taking behavior. This study showed that adolescents take significantly more risk when they complete a risk taking task with peers compared with when they complete the task individually, and that this is especially the case for boys.

Implications

The current study emphasizes the need to take the influence of peers into consideration in the study of risk taking behavior among adolescents. Intervention research has shown that a multicomponent approach, that is, targeting adolescents and their peers, is more effective than targeting either of them (cf. Koning et al., 2009; Salmivalli, 2010). As adolescents take significantly more risk with peers, probably because they want to achieve peer acceptance and a high social status (Crone & Dahl, 2012), it might be efficient if future studies and intervention programs focus on how peers can influence adolescent risk taking behavior. Supported by the evolutionary developmental psychology theory (Ellis et al., 2012), peers can play an effective role in diffusing health promotion messages by taking into account the functional role of peer status attainment. For example, interventions should promote group structures and behavioral strategies that enable adolescents to earn status for prosocial behaviors and at the same time avoid dynamics that encourage social status and peer reward for antisocial behavior (Ellis et al., 2012). Moreover, this study points at the importance of targeting young

adolescents and even young children (cf. Snyder et al., 2005) as their risk taking behavior already appears to be influenced by their peers.

Conclusion

This study showed that adolescents are more inclined to engage in risk taking behavior when they completed the risk taking task with their peers than when they completed the task individually. In particular, boys appear to take significantly more risks when completing the task with their peers, compared with when they completed the task individually. The mere presence of a boy in a group may already evoke more risk taking behavior in that group. Future studies can build upon this study by examining the peer influence mechanisms underlying the increase of risk taking behavior. For interventions aiming to reduce risk taking behavior, it is important to take the influence of peers into consideration.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Arnett, J. (1992). Reckless behavior in adolescence: A developmental perspective. *Developmental Review*, *12*, 339-373.

Baumeister, R. (1990). *Meanings of life*. New York, NY: Guilford Press.

Borsari, B., & Carey, K. B. (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*, *13*, 391-424.

Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin*, *125*, 367-383.

Cavalca, E., Kong, G., Liss, T., Reynolds, E. K., Schepis, T. S., Lejuez, C. W., & Krishnan-Sarin, S. (2012). A preliminary experimental investigation of peer influence on risk-taking among adolescent smokers and non-smokers. *Drug and Alcohol Dependence*, *129*, 163-166.

Chein, J. M., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. (2011). Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Developmental Science*, *14*(2), F1-F10.

Courtenay, W. H. (2000). Constructions of masculinity and their influence on men's well-being: A theory of gender and health. *Social Science & Medicine*, *50*, 1385-1401.

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*, 636-650.

Crowley, T. J., Raymond, K. M., Mikulich-Gilbertson, S. K., Thompson, L. L., & Lejuez, C. W. (2006). A risk-taking "set" in a novel task among adolescents with serious conduct and substance problems. *Journal of the American Academy of Child and Adolescent Psychiatry*, *45*, 175-183.

Curry, A. E., Mirman, J. H., Kallan, M. J., Winston, F. K., & Durbin, D. R. (2012). Peer passengers: How do they affect teen crashes? *Journal of Adolescent Health*, *50*, 588-594.

Ellis, B. J., Del Giudice, M., Dishion, T. J., Figueredo, A. J., Gray, P., Griskevicius, V., . . .Wilson, D. S. (2012). The evolutionary basis of risky adolescent behavior: Implications for science, policy, and practice. *Developmental Psychology*, *48*, 598-623.

Fernie, G., Cole, J. C., Goudie, A. J., & Field, M. (2010). Risk-taking but not response inhibition or delay discounting predict alcohol consumption in social drinkers. *Drug and Alcohol Dependence*, *112*(1-2), 54-61.

Fernie, G., Peeters, M., Gullo, M. J., Christiansen, P., Cole, J. C., Sumnall, H., & Field, M. (2013). Multiple behavioural impulsivity tasks predict prospective alcohol involvement in adolescents. *Addiction*, *108*, 1916-1923.

Forbes, E. E., & Dahl, R. E. (2010). Pubertal development and behavior: Hormonal activation of social and motivational tendencies. *Brain and Cognition*, *72*, 66-72.

Fuligni, A. J., & Eccles, J. S. (1993). Perceived parent-child relationships and early adolescents' orientation toward peers. *Developmental Psychology*, *29*, 622-632.

Gardner, M., & Steinberg, L. (2005). Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: An experimental study. *Developmental Psychology*, *41*, 625-635.

Harakeh, Z., De Looze, M. E., Schrijvers, C. T. M., van Dorsselaer, S. A. F. M., & Vollebergh, W. A. M. (2012). Individual and environmental predictors of health risk behaviours among Dutch adolescents: The HBSC study. *Public Health*, *126*, 566-573.

Koning, I. M., Vollebergh, W. A. M., Smit, F., Verdurmen, J. E. E., Van Den Eijnden, R. J. J. M., Ter Bogt, T. F. M., . . .Engels, R. C. M. E. (2009). Preventing heavy alcohol use in adolescents (PAS): Cluster randomized trial of a parent and student intervention offered separately and simultaneously. *Addiction*, *104*, 1669-1678.

Lejuez, C. W., Aklin, W., Daughters, S., Zvolensky, M., Kahler, C., & Gwadz, M. (2007). Reliability and validity of the youth version of the Balloon Analogue Risk Task (BART-Y) in the assessment of risk-taking behavior among inner-city adolescents. *Journal of Clinical Child and Adolescent Psychology*, *36*, 106-111.

Lejuez, C. W., Aklin, W. M., Zvolensky, M. J., & Pedulla, C. M. (2003). Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviours. *Journal of Adolescence*, *26*, 475-479.

Maclean, R. R., Geier, C. F., Henry, S. L., & Wilson, S. J. (2014). Digital peer interactions affect risk taking in young adults. *Journal of Research on Adolescence*, *24*, 772-780.

Mayeux, L., Sandstrom, M. J., & Cillessen, A. H. N. (2008). Is being popular a risky proposition? *Journal of Research on Adolescence*, *18*, 49-74.

Morrongiello, B. A., & Rennie, H. (1998). Why do boys engage in more risk taking than girls? The role of attributions, beliefs, and risk appraisals. *Journal of Pediatric Psychology*, *23*, 33-43.

Muthén, L. K., & Muthén, B. O. (2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Author.

Newcomb, A. F., Bukowski, W. M., & Pattee, L. (1993). Children's peer relations: A meta-analytic review of popular, rejected, neglected, controversial, and average sociometric status. *Psychological Bulletin*, *113*, 99-128.

O'Brien, L., Albert, D., Chein, J., & Steinberg, L. (2011). Adolescents prefer more immediate rewards when in the presence of their peers. *Journal of Research on Adolescence*, *21*, 747-753.

Pellegrini, A. D., & Archer, J. (2005). Sex differences in competitive and aggressive behaviour. In B. J. Ellis & D. F. Bjorklund (Eds.), *Origins of the social mind* (pp. 219-244). New York, NY: The Guilford Press.

Peters, S., Jolles, D. J., van Duijvenvoorde, A. C. K., Crone, E. A., & Peper, J. S. (2015). The link between testosterone and amygdala-orbitofrontal cortex connectivity in adolescent alcohol use. *Psychoneuroendocrinology*, *53*, 117-126.

Pleskac, T. J., Wallsten, T. S., Wang, P., & Lejuez, C. W. (2008). Development of an automatic response mode to improve the clinical utility of sequential risk-taking tasks. *Experimental Clinical Psychopharmacology*, *16*, 555-564.

Prinstein, M. J., Brechwald, W. A., & Cohen, G. L. (2011). Susceptibility to peer influence: Using a performance-based measure to identify adolescent males at heightened risk for deviant peer socialization. *Developmental Psychology*, *47*, 1167-1172.

Reynolds, E. K., MacPherson, L., Schwartz, S., Fox, N. A., & Lejuez, C. W. (2013). Analogue study of peer influence on risk-taking behavior in older adolescents. *Prevention Science*, *15*, 842-849.

Salmivalli, C. (2010). Bullying and the peer group: A review. *Aggression and Violent Behavior*, *15*, 112-120.

Simons-Morton, B. G., Ouimet, M. C., Zhang, Z., Klauer, S. E., Lee, S. E., Wang, J., & Dingus, T. A. (2011). The effect of passengers and risk-taking friends on risky driving and crashes/near crashes among novice teenagers. *Journal of Adolescent Health*, *49*, 587-593.

Snyder, J., Schrepferman, L., Oeser, J., Patterson, G., Stoolmiller, M., Johnson, K., & Snyder, A. (2005). Deviancy training and association with deviant peers in young children: Occurrence and contribution to early-onset conduct problems. *Development and Psychopathology*, *17*, 397-413.

Somerville, L. H. (2013). The teenage brain: Sensitivity to social evaluation. *Current Directions in Psychological Science*, *22*, 129-135.

Somerville, L. H., Jones, R. M., Ruberry, E. J., Dyke, J. P., Glover, G., & Casey, B. J. (2013). The medial prefrontal cortex and the emergence of self-conscious emotion in adolescence. *Psychological Science*, *24*, 1554-1562.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, *9*(2), 69-74.

Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology*, *43*, 1531-1543.

Steinberg, L., & Silverberg, S. B. (1986). The vicissitudes of autonomy in early adolescence. *Child Development*, *57*, 841-851.

van Hoorn, J., van Dijk, E., Meuwese, R., Rieffe, C., & Crone, E. A. (2014). Peer influence on prosocial behavior in adolescence. *Journal of Research on Adolescence*, *24*(3), 1-11.

Wallen, K. (2001). Sex and context: Hormones and primate sexual motivation. *Hormones and Behavior*, *40*, 339-357.

Weigard, A., Chein, J., Albert, D., Smith, A., & Steinberg, L. (2014). Effects of anonymous peer observation on adolescents' preference for immediate rewards. *Developmental Science*, *17*, 71-78.

Willoughby, T., Good, M., Adachi, P. J. C., Hamza, C., & Tavernier, R. (2013). Examining the link between adolescent brain development and risk taking from a social-developmental perspective. *Brain and Cognition*, *83*, 315-324.

Wilson, M., & Daly, M. (1985). Competitiveness, risk-taking, and violence: The young male syndrome. *Ethnology and Sociobiology*, *6*, 59-73.

Author Biographies

Anouk de Boer is a graduated research master student at Utrecht University. Her research focuses on risk behavior and peer influences in young adolescents.

Margot Peeters is a post-doctoral researcher at Utrecht University. Her research focuses on cognitive processes (reward sensitivity, decision making) involved in risk behavior of adolescents. She is interested in the role of behavioral control in relation to risk behavior among adolescents.

Ina Koning is an assistant professor at Utrecht University. Her research focuses on parenting practices in relation to adolescent alcohol use. She is interested in implicit processes in relation to parenting and intervention research.