

**Does it count who wins?**

**The effect of perceived negative peer norms on negative- and  
prosocial risk-taking in relation to externalizing problems**

Csenge Boros, 1566296

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Dr. Nikki Lee, Dr. Hend Eltanamly

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**Abstract**

Adolescents are influenced by their perception of what is normative in their peer groups. Adolescents with higher externalizing problems are especially susceptible to peer influences. The current study aimed to examine how the perception of negative peer norms influences adolescents with higher externalizing problems to engage in more negative risk-taking and less prosocial risk-taking. The SDQ, Perception of Peer Group Norms Questionnaire, and a modified version of BART (the Balloon for Friend task) were used to collect data from friend dyads aged 12-16 years old. In the negative condition of the task, participants could win points or lose points from themselves. In the prosocial condition, participants could win points for their friend they signed up with or lose points from themselves. To motivate their decisions, points collected during this task affected their own and their friend's chance of winning a 20-euro gift card. Results show that adolescents took significantly more risks if they could win (negative risk) compared to situations where their friend could win (prosocial risk). Externalizing did not significantly predict more negative risk-taking or less prosocial risk-taking. Additionally, adolescents' perception of negative peer norms had no significant moderating effect on either of those relationships. It is plausible that the low range of externalizing in the current sample hindered the demonstration of its effects. Furthermore, adolescents with lower externalizing may be more resilient to peer influences. However, as these moderation analyses were underpowered, results should be interpreted with caution. Strengths, limitations, and future research directions are discussed.

*Keywords:* adolescence, prosocial risk-taking, negative risk-taking, externalizing, perception of negative peer norms, Balloon Analogue Risk Task, Strengths and Difficulties Questionnaire, Perception of Peer Group Norms Questionnaire

### **Does it count who wins? The effect of perceived negative peer norms on negative- and prosocial risk-taking in relation to externalizing problems**

Adolescence is a complex and challenging developmental stage. Behavioral problems during this developmental phase can have consequences that extend beyond adolescence itself. A group of behavioral problems that have major effects on adolescents' lives and are fairly common are externalizing behaviors (Samek & Hicks, 2014; Solmi et al., 2022). Externalizing problem behaviors range from hyperactivity, and non-compliance, to more severe problems, such as theft and various hostile behaviors (American Psychiatric Association, 2013). Mental disorders commonly grouped into externalizing disorders are ADHD, oppositional-defiant disorder, and conduct disorder (Samek & Hicks, 2014). Adolescents with externalizing disorders face both short-term and long-term adversities, for instance, dropping out of school or developing depression later in adulthood (Hetlevik et al., 2018; Loth et al., 2014). However, it is not only youth with diagnosed externalizing disorders who are a vulnerable group. Even mild externalizing problems in adolescence can predict mental health problems and adversities later in life (Colman et al., 2009). Adolescents showing more externalizing behaviors also engage in more reckless behaviors (Bai & Lee, 2017), such as unsafe sexual behaviors or alcohol use (Gonzales et al., 2017). Although these risk-taking behaviors hold uncertain costs to adolescents' health or social status, risk-taking significantly increases in adolescence (Strang et al., 2013). An explanation of risk-taking behaviors peaking at this age could be increased sensation seeking and lower self-control in adolescence (Mancinelli et al., 2022; Murray et al., 2021). Sensation seeking is a trait defined as the seeking of novel experiences and intense sensations (Zuckerman, 2007). It leads to engagement in activities that provide intense sensations to the adolescent, which can include but are not restricted to risky behaviors. On the other hand, low self-control is defined as the inability to persist with behaviors that would result in achieving desired long-term outcomes, instead opting for alternative behaviors that provide immediate gratification (Gillebaart, 2018). Thus, although risk-taking behaviors are often dangerous, the immediate intense sensation is chosen over the long-term state of safety. Additionally, sensation seeking and lack of self-control have been linked with both negative risk-taking behaviors (Duell & Steinberg, 2020), and externalizing (Sarracino et al., 2011). Due to the potentially harmful consequences of these risk-taking behaviors, often all risk-taking behaviors are framed as negative.

However, there is another type of risk-taking that is positively viewed. That is prosocial risk-taking, which is defined as a behavior intended to benefit someone else while holding an uncertain cost to oneself (Do et al., 2017). An example of this form of risk-taking can be seen if an adolescent stops a bully from hurting someone. This benefits the person who was being bullied, while the adolescent faces the risk of becoming the bully's next target. This risk-taking does not hold a direct benefit to the adolescent. Prosocial development shows a similar trend in adolescence as risk-taking. Prosocial behaviors increase in mid-adolescence and then slightly decrease in late-adolescence (Van

der Graaff et al., 2018). The increase of both prosociality and risk-taking in adolescence may lead to an increase in prosocial risk-taking as well in this age group.

Although prosocial risk-taking is different from other types of risk-taking behaviors, as it benefits someone else. Do et al. (2017), who first defined prosocial risk-taking, theorized that only individuals inclined to both prosociality and risk-taking will likely engage in prosocial risk-taking. A factor that could support this notion is sensation seeking. Negative risk-taking has been most commonly linked with sensation seeking. Yet, a recent study on adolescents' decision-making found sensation seeking to positively correlate with prosocial tendencies and prosocial risk-taking as well (Armstrong-Carter et al., 2021). Thus, adolescents may engage in prosocial risk-taking to seek intense sensations the same way they engage in negative risk-taking behaviors. However, prosocial risk-taking was also found to positively correlate with prosocial tendencies and empathy. Therefore, it is likely that adolescents lacking empathy or those who engage in fewer prosocial behaviors would also engage in fewer prosocial risk-taking behaviors. Additionally, research shows that adolescents who engage in more negative risk-taking engage in less prosocial risk-taking behaviors (Armstrong-Carter et al., 2021). Adolescents may be motivated by different factors to engage in one or the other risk-taking behavior. Adolescents may engage in negative risk-taking due to personal interests or influence of peers, whereas adolescents may engage in prosocial risk-taking due to empathic concern for the other (Armstrong-Carter et al., 2021). This would be in line with previous findings regarding risk-taking and externalizing. As externalizing predicts higher negative risk-taking behaviors (Bai & Lee, 2017) and fewer prosocial behaviors (Hay et al., 2010). Externalizing adolescents might engage in prosocial risk-taking due to personal interests, or peer influences instead of prosocial concern.

Nevertheless, these behaviors do not occur in isolation. Adolescents engage in externalizing, risk-taking, and prosocial behaviors within their social environment. As a consequence, these behaviors not only have an impact on their peers but are also influenced by their peers. Especially, as adolescence is marked by a fear of social exclusion and a heightened importance of social evaluation and belonging to a community (Tomova et al., 2021). Making adolescents more susceptible to peer influences than older age groups are (Laursen & Veenstra, 2021). Adolescents seem to align their behaviors to what is seen as common, thus normative, in their peer groups in order to avoid social exclusion (Tomova et al., 2021). Adolescents are specifically influenced by their own perception of what is normative in their group, instead of what is truly the most common behavior (Ciranka & van den Bos, 2021). Depending on the kind of behaviors they perceive as common in the peer group, adolescents show an increase in such behaviors. Adolescents who perceive negative behaviors, such as bullying or lying, as normative in their peer group also engage in increased negative risk-taking behaviors (Telzer et al., 2021). Although, adolescents may be more motivated to engage in negative risk-taking due to peer influences, and more motivated by empathy to engage in prosocial risk-taking. Research shows that engagement in prosocial behaviors can be also influenced by the perception of

peer norms (McKeown & Taylor, 2018). Perception of positive peer norms leads to increased engagement in prosocial behaviors. A group of adolescents who are even more susceptible to being influenced by their peers compared to other adolescents are those with higher externalizing problems (Stalker, 2020). Thus, adolescents with higher externalizing problems may be more influenced by positive and negative peer norms to engage in different risk-taking behaviors.

However, no study so far examined the influence of perceived peer norms on prosocial risk-taking. Perception of negative peer norms may influence adolescents to engage in even less prosocial risk-taking behaviors. Moreover, no research has studied the relationship between externalizing and prosocial risk-taking. Thus, the aim of the current study is to investigate the relationship between externalizing, negative risk-taking, prosocial risk-taking, and the influence of perceived peer norms in adolescents. This study contributes to the limited body of research on prosocial risk-taking and will help advance the understanding of externalizing behaviors in youth.

Therefore, the following question is posed. How do perceived negative peer norms affect the relationship between externalizing and risk-taking in adolescents and do their decisions differ based on who is benefiting from the risk-taking behavior? First, it is essential to establish whether the measures assessing negative and prosocial risk-taking behaviors indeed capture distinct behavioral constructs. To address this, the first hypothesis posits a significant difference in adolescents' engagement in prosocial risk-taking and negative risk-taking behaviors. Adolescents who engage in more negative risk-taking behaviors engage in less prosocial risk-taking behaviors (Armstrong-Carter et al., 2021). Thus, a difference in engagement is expected in the current sample. Existing literature has established that adolescents with externalizing problems exhibit elevated levels of negative risk-taking behaviors and reduced engagement in prosocial behaviors (Bai & Lee, 2017; Hay et al., 2010). However, no prior research has specifically explored the occurrence of prosocial risk-taking among adolescents with externalizing problems. Therefore, the second hypothesis posits that higher levels of externalizing behaviors in adolescents predict increased engagement in negative risk-taking behaviors, and this association is further strengthened by their perception of negative peer norms. As it is recognized that adolescents with externalizing problems are highly susceptible to peer influences (Stalker, 2020). Moreover, adolescents who perceive negative behaviors as socially accepted within their peer group are more prone to engaging in negative risk-taking behaviors (Telzer et al., 2021), whereas positive peer norms foster adolescents' involvement in prosocial behaviors (McKeown & Taylor, 2018). To examine a previously unexplored relationship between externalizing and prosocial risk-taking the third hypothesis posits that higher levels of externalizing behaviors in adolescents predict decreased engagement in prosocial risk-taking behaviors due to its prosocial aspect, and this negative association is further strengthened by their perception of negative peer norms.

In order to test these hypotheses the target sample for this study was friend dyads in their mid-adolescent years, as risk-taking peaks in that age (Strang et al., 2013). To measure externalizing problems, and perceived peer norms, self-reports were used. To measure negative- and prosocial risk-taking a modified version of the Balloon Analogue Risk Task (BART) (Lejuez et al., 2002), an already established computerized risk-taking task, was used. Additionally, the BART has been previously used to research risk-taking in externalizing youth (Bai & Lee, 2017). In the current study, this task was modified to be able to measure prosocial risk-taking.

### **Methods**

To investigate the aforementioned research question, a quasi-experimental design was created. Prior to the start of data collection, ethical approval was obtained from the Ethics Review Board of the Faculty of Social and Behavioral Sciences at Utrecht University.

#### **Participants**

Participants were same-gendered friend dyads aged 12-16, speaking fluent Dutch or English, and living in the Netherlands. Participants were included in the study if they had access to the internet, as well as a laptop or personal computer with a camera and microphone. To check participants' attentiveness, four control questions were embedded in the study. Participants were excluded if they answered more than one control question incorrectly. After excluding individuals who did not meet the inclusion criteria, the final sample consisted of 45 adolescents with a mean age of 15.12 years ( $SD=1.3$ ; 56% boys, 44% girls). All participants were born in the Netherlands.

#### **Procedures**

Participants were recruited using multiple methods, including the distribution of posters, door-to-door approaches, and presentations at various high schools in the Netherlands. The incentive for participation involved the opportunity to win a 20-euro gift card, with a total of 18 individuals randomly selected as recipients. After signing up, both the participants and their parents gave informed consent. The study was conducted online where participants were monitored by a researcher through video calls. The researcher ensured that participants were in a calm environment separated from the friend they signed up with. To minimize potential communication between participants during data collection, members of friend dyads participated simultaneously in separate video calls.

First, as part of a larger research project, several online questionnaires were used. In the present study, data from the Perception of peer group norms questionnaire (Marshall-Denton et al., 2016), and the Strength and Difficulties Questionnaire (SDQ) were used (Muris et al., 2003). Lastly, participants played a modified version of BART online, called the Balloon for Friend game. To ensure participants' comprehension of the game, the researcher gave a brief training on the rules using

example images from the game. These rules were then again emphasized at the beginning of the game. Each participant completed the same questionnaires and the same conditions within the balloon game. Participants took around 45 minutes to complete the whole study.

## **Measures**

### ***Perception of Peer Group Norms Questionnaire***

To measure participants' perception of negative peer norms the Perception of Peer Group Norms Questionnaire was used (Marshall-Denton et al., 2016). The questionnaire consists of 8 items regarding negative norms and 9 items regarding positive norms. Participants were requested to rate, on a 6-point Likert scale, from 0 to 5, the extent to which their peers engage in negative and positive behaviors, such as "My peers smoke" or "My peers treat other peers with respect". This questionnaire has high validity in measuring adolescents' perception of peer norms (Marshall-Denton et al., 2016). In order to measure perceived peer norms on one scale from more positive to more negative, the positive items need to be reverse coded. The questionnaire shows acceptable reliability in the current sample (Cronbach's  $\alpha = .705$ ). However, reverse coding positive items leads to an interpretation that less frequent positive behaviors are considered equivalent to more frequent negative behaviors. Moreover, the negative items alone also show acceptable reliability (Cronbach's  $\alpha = .74$ ). Hence, participants' perception of negative norms was measured using only the negative items of the questionnaire. Total scores on these items can range from 0 to 40. Higher scores indicate that participants perceive negative behaviors as more normative within their peer group.

### ***Strengths and Difficulties Questionnaire***

The externalizing behaviors of participants were assessed using the conduct and hyperactivity subscales of the Strengths and Difficulties Questionnaire (SDQ) (Goodman et al., 2010). Participants indicated the extent to which certain behaviors applied to them on a 3-point Likert scale, from 1 to 3. Examples of these behaviors include "I get very angry and often lose my temper" or "I take things that are not mine from home, school or elsewhere". The total score for externalizing behaviors can range from 10 to 30. This scale shows good validity in measuring externalizing problems in youth (Muris et al., 2003). In the present sample, the externalizing scale results in acceptable reliability (Cronbach's  $\alpha = .72$ ). Therefore, it reliably measured overall externalizing problems in the current adolescent sample. Moreover, using both conduct problems and hyperactivity subscales allows for the assessment of a wide variety of externalizing problem behaviors.

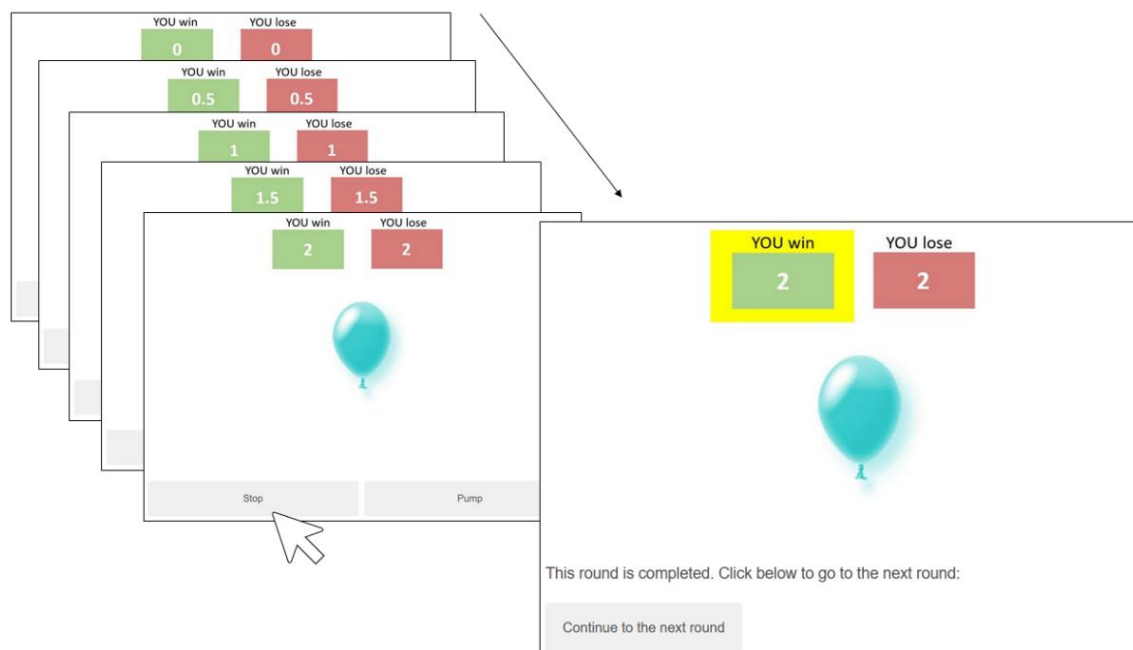
### ***Balloon for Friend***

Finally, a modified version of Balloon Analogue Risk Task, the Balloon for Friend online game was used to measure risk-taking. The original BART has acceptable reliability and is a valid

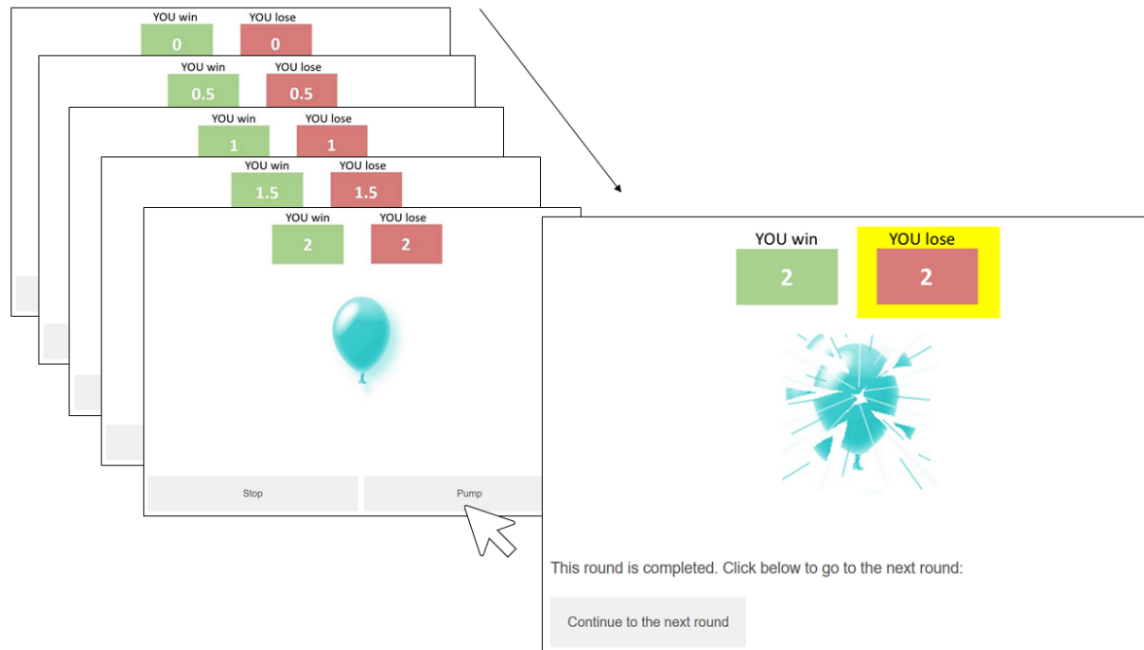
measurement of risk-taking behaviors in adolescents (Lejuez et al., 2007). Scores on the original BART strongly relate to real-life risk-taking behaviors, such as substance use, unsafe driving, and unsafe sexual behaviors. These behaviors are categorized as negative risk-taking. The original BART consists of participants inflating a computerized balloon, with each pump they collect points for themselves, however, if the balloon explodes, they lose those points. To measure the participants' prosocial risk-taking behaviors a new condition was added to the task. The game consisted of multiple trials in which participants could inflate a balloon to win points while facing the risk of the balloon exploding and losing points (see Figure 1). In each trial, the participant started with 5 points. If the balloon exploded points were deducted from the starting points. If they chose to stop inflating before the balloon exploded, the points were saved and added to the starting points. The number of points they could win or lose increased with each pump by 0.5 points. In order to give real-life consequences to their decisions, the participant's chances of winning the gift card increased by the total points collected during the game. Thus, participants could help their friend's chance of winning too by collecting points for them in the prosocial condition. The game included 5 conditions, each containing 7 trials. The predetermined explosion points ranged from 11 pumps to explode to 5 pumps to explode across the 7 trials. The same 11 to 5 predetermined explosion points were set for all conditions. To avoid predictability of explosion points, the order of all 35 trials was randomized, and participants were told that the balloons can explode after any random number of pumps.

**Figure 1**

*Example diagram presenting the flow of the Balloon for Friend game.*







*Note.* Example of a trial where participant stopped pumping and won points before explosion (upper image). Example of a trial where balloon exploded after 5 pumps (bottom image).

In the current study, data from two conditions were used. For easier differentiation, different conditions were marked by different colored balloons (see Figure 2). Additionally, the rules of who could win and lose were indicated in each trial. In the negative risk condition, participants could earn points for themselves while facing the risk of losing their own points. This condition was used to measure the participant's negative risk-taking. In the prosocial risk condition, participants could win points for their friend by inflating the balloon, while they risked losing their own points if the balloon exploded. This way the condition sufficed for both criteria of prosocial risk-taking, the intention and risk. Participants were able to intentionally help someone else while facing the uncertain cost of losing. The remaining three conditions are part of a larger research project and were not used in the current study. To calculate risk-taking for each condition, the average number of pumps was computed using data only from trials where the balloon did not explode. This adjusted mean presents a more optimal measure of risk-taking compared the total average number of pumps, as participants' decisions can be limited by the low explosion threshold in certain trials (Lejuez et al., 2007).

## Figure 2

*Example images of the different conditions in the Balloon for Friend game.*



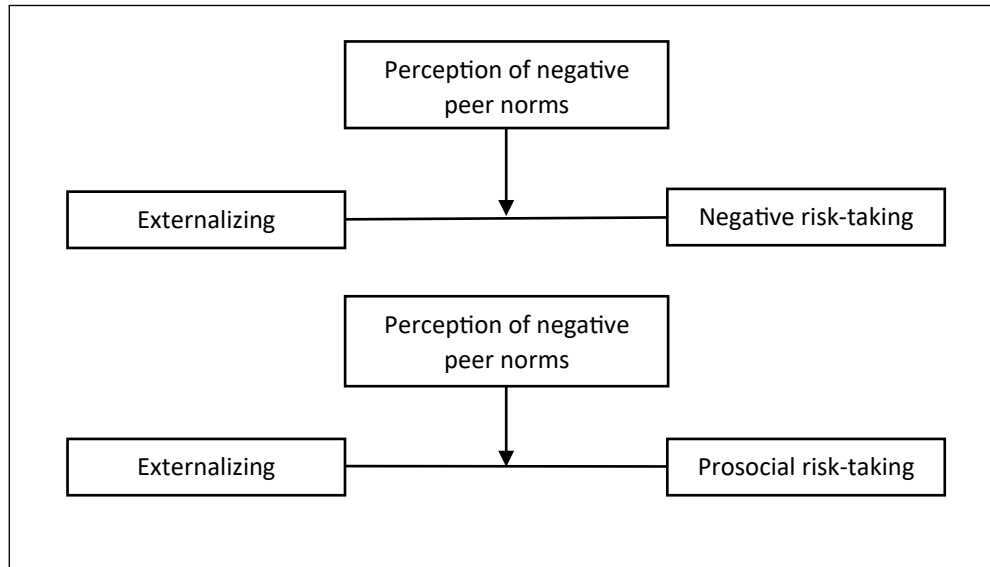
*Note.* Negative risk-taking condition on the left, and the prosocial risk-taking condition on the right.

### Data analysis:

A paired samples t-test was used to check if scores on the negative risk-taking condition and on the prosocial risk-taking condition were significantly different. This test was necessary to establish that different risk-taking behaviors are measured in the negative and in the prosocial conditions. To test moderation both externalizing and perception of negative peer norms variables were mean centered in order to help the interpretation of the linear regression models. The first regression model aimed to determine whether there is a positive relationship between participants' externalizing problems and negative risk-taking. With negative risk-taking as the dependent variable and externalizing as the predictor. The second model investigated whether the perception of negative peer norms moderates this positive relationship. With negative risk-taking as the dependent variable, externalizing as the predictor, and peer norms as the moderator. Lastly, another set of linear regression models were used to test the final hypothesis about prosocial risk-taking. One model explored whether there is a negative relationship between prosocial risk-taking and externalizing problems. The last model examined whether the perception of negative peer norms moderates this negative relationship. With prosocial risk-taking as the dependent variable, externalizing as the predictor, and peer norms as the moderator. A post hoc power analysis with the current sample size of 45 yielded good power ( $1-\beta = .91$ ) to detect even small effects in a two-tailed paired samples t-test. However, there is insufficient power ( $1-\beta = .52$ ) to detect small or medium effects (Cohen's  $f^2 < .15$ ) in a linear regression. The current sample size has only enough power ( $1-\beta > .80$ ) to detect large effects (Cohen's  $f^2 > .30$ ) in a regression analysis. This prompts careful interpretation of the results of the regression analyses.

### Figure 3

*Model visualization of the main hypotheses*



**Results**

Prior to conducting the analyses, all assumptions were tested and confirmed (see Appendix). Table 1 displays the total sample means. The paired samples t-test showed a significant result ( $t=4.61$ ,  $p < .001$ ), with a significantly higher mean score in the negative risk-taking condition compared to the prosocial risk-taking condition. This indicates that the current adolescent sample on average engaged in significantly more negative risk-taking than prosocial risk-taking. These results show sufficient support for the first hypothesis.

**Table 1**

*Total sample means of tested variables*

	Minimum	Maximum	Mean	Std. Deviation
Perceived negative peer norms	3	31	15.7778	6.0898
Externalizing	10	21	15.9556	2.9462
Prosocial risk-taking	2.43	7	4.6674	1.1493
Negative risk-taking	3	7	5.1984	.7772

The linear regression models yielded no significant results (see Table 2). Contrary to previous empirical findings, the linear regression analysis revealed no significant association between externalizing and negative risk-taking in the present sample ( $F(1, 43) = .010$ ,  $p = .921$ ). Furthermore, no moderation effect of the perception of negative peer norms was found on the association between externalizing and negative risk-taking ( $F(3, 41) = .671$ ,  $p = .575$ ). Regarding prosocial risk-taking, the linear regression models also failed to yield significant results. The findings indicated no significant

association between externalizing problems and prosocial risk-taking ( $F(1, 43) = .620, p = .435$ ). Additionally, the perception of negative peer norms did not show a significant moderating effect on the association between externalizing and prosocial risk-taking ( $F(3, 41) = .313, p = .816$ ). In the current sample, adolescents with higher externalizing problems did not engage in more negative risk-taking nor in less prosocial risk-taking. Their perception of negative peer norms did not have a significant effect on their risk-taking and externalizing behaviors. These results show insufficient support for the second and third presented hypotheses.

**Table 2**

*Linear regression analysis results for predictors of negative risk-taking and prosocial risk-taking*

Model		Unstandardized Coefficients	Standardized Coefficients	Sig.	95% Confidence Interval	
1 <sup>a</sup>	Constant	5.198		.000	4.962	5.434
	Externalizing	-.004	-.015	.921	-.085	.077
2 <sup>a</sup>	Constant	5.198		.000	4.959	5.437
	Externalizing	-.006	-.022	.889	-.089	.078
	Perceived negative peer norms	.004	.033	.835	-.036	.044
3 <sup>a</sup>	Constant	5.232		.000	4.990	5.473
	Externalizing	-.004	-.013	.932	-.087	.080
	Perceived negative peer norms	-.001	-.004	.978	-.041	.040
	Interaction: Externalizing x Perceived negative peer norms	-.009	-.217	.169	-.022	.004
1 <sup>b</sup>	Constant	4.667		.000	4.320	5.014
	Externalizing	-.047	-.119	.435	-.166	.073
2 <sup>b</sup>	Constant	4.667		.000	4.316	5.019
	Externalizing	-.047	-.120	.447	-.170	.076
	Perceived negative peer norms	.001	.005	.974	-.059	.061
3 <sup>b</sup>	Constant	4.688		.000	4.327	5.050
	Externalizing	-.045	-.117	.465	-.170	.079
	Perceived negative peer norms	-.002	-.011	.947	-.063	.059
	Interaction: Externalizing x Perceived negative peer norms	-.006	-.092	.562	-.025	.014

*Note.* a) negative risk-taking is the dependent variable, b) prosocial risk-taking is the dependent variable. Effect size (R squared) of each model: model 1<sup>a</sup> = .0002; model 2<sup>a</sup> = .0012; model 3<sup>a</sup> = .0468; model 1<sup>b</sup> = .0142; model 2<sup>b</sup> = .0142; model 3<sup>b</sup> = .0224.

## Discussion

Using data gathered from adolescents aged 12 to 16 years, this study presents findings that show higher engagement in negative risk-taking behaviors as opposed to prosocial risk-taking behaviors. The participants exhibited a higher inclination towards taking risks when they themselves could win, as compared to situations where they could win for a friend. Notably, adolescents characterized by higher levels of externalizing problems did not exhibit an increased tendency towards negative risk-taking. Furthermore, their perception of negative peer norms did not serve as a moderating factor influencing the extent to which they engaged in negative risk-taking. Accordingly, participants with elevated externalizing problems demonstrated a consistent level of involvement in negative risk-taking, regardless of their perception of normativity of such behaviors within their peer groups. Similarly, adolescents with elevated externalizing problems did not display a lower inclination towards engaging in prosocial risk-taking behaviors. Likewise, their perception of negative peer norms did not show any moderating influence on their engagement in prosocial risk-taking. Overall, the findings of this study indicate that the extent of externalizing problems and the perception of negative peer norms do not exert an influence on negative and prosocial risk-taking.

Previous research consistently demonstrates a positive association between heightened externalizing problems and increased engagement in negative risk-taking behaviors among adolescents (Bai & Lee, 2017; Gonzales et al., 2017). However, the present study did not yield supportive findings regarding this relationship. One plausible explanation for this discrepancy could be the limited range of externalizing scores within the current sample. The adolescents in the present study obtained scores primarily in the lower third of the externalizing scale, with the highest score only reaching the midpoint of the scale. In contrast, previous studies investigating the link between externalizing problems and risk-taking included participants with a wide spectrum of externalizing scores, ranging from low to high. Some studies specifically focused on youths diagnosed with externalizing disorders (Bai & Lee, 2017), while others obtained similar results using a sample from healthy adolescent population (Gonzales et al., 2017). In contrast, the current sample consisted solely of adolescents exhibiting low levels of externalizing problems, potentially leading to a restriction of range issue. Another important contributing factor to negative risk-taking behaviors among externalizing youth is impulsivity. A prior study using comparable measures, such as the original BART and a self-report for externalizing problems, found that externalizing symptoms no longer predicted risk-taking behaviors in adolescents once impulsivity was taken into account (Romer et al., 2009). Hence, it is plausible that higher externalizing problems may only predict heightened risk-taking tendencies among adolescents who also exhibit elevated levels of impulsivity. This implies that impulsivity is a crucial underlying factor. In the current sample, it is possible that impulsivity was relatively low, which could have resulted in a nonsignificant relationship between externalizing problems and negative risk-taking behaviors.

Existing research indicates a negative association between prosocial risk-taking and negative risk-taking, as well as a positive association between prosocial risk-taking and prosociality (Armstrong-Carter et al., 2021). Based on this, it was hypothesized that adolescents with higher levels of externalizing problems would engage in fewer prosocial risk-taking behaviors due to the prosocial nature of it. This assumption stems from previous evidence demonstrating that adolescents with higher externalizing problems tend to engage in fewer prosocial behaviors (Hay et al., 2010). However, the present study did not find a significant relationship between externalizing problems and prosocial risk-taking. One possible explanation for this finding is that there was not enough variety of externalizing scores, which did not allow to see its effects on prosocial risk-taking. Another possible explanation could be different motivation across different levels of externalizing. Adolescents with higher externalizing engage in more risk-taking behaviors compared to adolescents with low or no externalizing problems. Whereas adolescents with low or no externalizing problems engage in more prosocial behaviors compared to adolescents with higher externalizing. As prosocial risk-taking has both risky and prosocial aspects to it. Adolescents with no externalizing might have engaged in more prosocial risk-taking primarily motivated by its prosocial aspect, the possibility to help their friends. Whereas adolescents with externalizing problems may have been primarily motivated to engage in prosocial risk-taking by its risky aspect. Together with the low variety of externalizing scores in the current sample, the different motivation to engage in prosocial risk-taking may have resulted in participants scoring similarly across different levels of externalizing.

The present study did not yield a significant moderating effect of perceived peer norms on either type of risk-taking behavior. However, prior research indicates that adolescents who perceive more negative peer norms tend to engage in higher levels of negative risk-taking (Telzer et al., 2021). Additionally, externalizing youth are particularly susceptible to peer influences (Stalker, 2020). Thus, it was expected that participants' risk-taking behaviors would be influenced by their perception of negative peer norms, especially in adolescents with higher externalizing problems. It is plausible that the current study design may not have allowed participants' perceptions of peer norms to exert an influence on their behaviors. Adolescents often align their behaviors with what they perceive as normative within their peer groups in order to avoid social exclusion (Tomova et al., 2021). However, in the present study, participants were explicitly informed that their responses would not be shared with their friends. Therefore, the participants' friends would not have been aware of the specific number of points collected on their behalf. As a result, participants were not presented with the risk of social exclusion from their friends. This lack of social context and potential for social exclusion may have led adolescents to disregard aligning their behaviors with perceived peer norms, thereby diminishing any significant moderating effect. Therefore, it is likely that adolescents' perception of peer norms only influences their behaviors in a truly social context, where their peers can know their

decisions. Consequently, the absence of an incentive to follow such norms in the current study may explain the lack of a detected moderating effect.

The present study exhibits several strengths and weaknesses. Firstly, it contributes to the limited body of empirical research on prosocial risk-taking. Secondly, it introduces a new measurement of prosocial risk-taking. Although the modified BART used in the study has not been formally validated, it encompasses a condition that aligns with all criteria of prosocial risk-taking, involving uncertain costs to oneself while helping another individual. In comparison to previous measures of prosocial risk-taking, the current task may yield less biased results as it employs a behavioral task rather than self-report measures. Self-reports can be susceptible to response biases influenced by participants' perceptions of social desirability (Krumpal, 2013). Furthermore, the study opens up ways for further investigation of the interplay between externalizing, risk-taking and peer norms.

However, it is crucial to acknowledge some limitations of the study. The primary weakness of the current study lies in the limited sample size. With data collected from only 45 participants, it is crucial to interpret all findings with caution. While a small sample size can still provide sufficient statistical power to detect small effects in a t-test, it lacks the power to identify medium or small effects in a linear regression analysis. The low statistical power increases the likelihood of committing a type II error, which means that significant effects may have gone undetected. Additionally, the study's sample composition may pose limitations. Being restricted to adolescents with low levels of externalizing problems can limit the generalizability of the findings. Including participants with a wider range of externalizing scores could provide a more comprehensive understanding of the relationship between externalizing problems and risk-taking. Furthermore, the sign-up process employed in the study introduced an additional limitation. Participants were required to ask a friend to sign up with them, exposing them to the risk of social rejection. Given that adolescence is characterized by heightened sensitivity to social rejection (Andrews et al., 2021), it is possible that this process filtered out a number of potential participants. Adolescents who were reluctant to ask a friend or who became discouraged after facing initial rejection may have been excluded from the sample. For future research, it is advisable to consider alternative sign-up procedures that minimize the potential for social rejection and attract a larger and more diverse sample.

Although the present study did not yield significant findings regarding the impact of peer norms, it is important to note that externalizing youth are particularly susceptible to peer influences. Future research should focus on identifying factors that influence the perception of peer norms, enabling the development of interventions aimed at positively shaping externalizing youth through modifying their perceived peer norms. Such interventions may have the potential to reduce adolescents' engagement in dangerous negative risk-taking behaviors. However, the current results

indicate no influence of peer norms. It is plausible that the current sample, characterized by low externalizing scores, may be less affected by perceived negative peer norms. Adolescents with fewer externalizing problems might be more resilient against negative peer influences when engaging in risk-taking. Future research should explore the factors that contribute to adolescents' resilience against negative peer influences to possibly help the vulnerable externalizing youth. While research has extensively focused on promoting prosocial behaviors due to their positive social implications. Little is known about the long-term effects of prosocial risk-taking on physical and mental health among externalizing youth. Future research should explore the potential long-term health outcomes for engaging in increased prosocial risk-taking behaviors during adolescence.

In conclusion, the current study has shed light on the complex relationship between externalizing problems, risk-taking behaviors, and perceived peer norms among adolescents. While the findings did not support the hypothesized associations, they highlight the need for further research. Future studies should also develop interventions focused on promoting positive peer environments and influencing adolescents' perceptions of normative behaviors. By addressing these areas, interventions may effectively reduce dangerous negative risk-taking while promoting prosocial risk-taking behaviors among externalizing youth, leading to a potentially healthier developmental outcomes of a vulnerable group.



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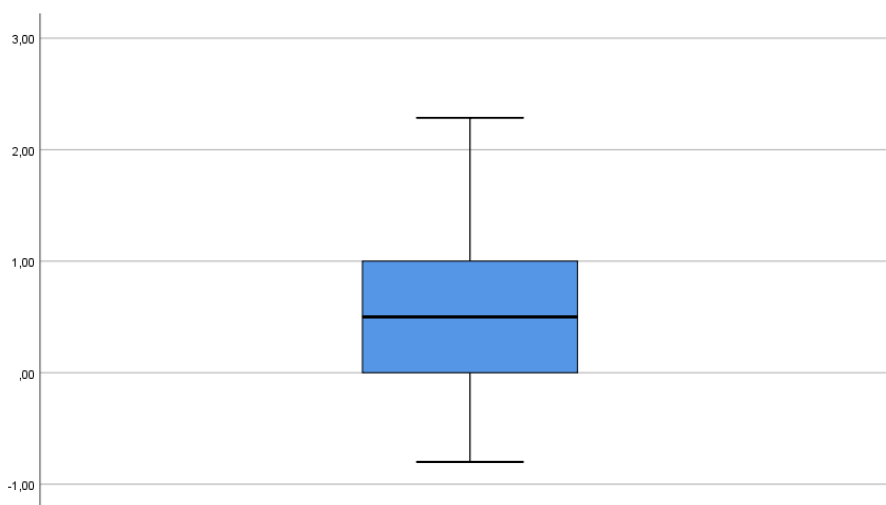
## Appendix

### Assumptions of paired samples t-test

To evaluate the underlying assumptions of a paired samples t-test, a difference score was calculated by subtracting the scores on the prosocial risk-taking condition from those on the negative risk-taking condition. Subsequently, the Shapiro-Wilk normality test was conducted on these difference scores, yielding non-significant results (Statistic (45) = .977,  $p = .491$ ), thereby indicating a normal distribution. Furthermore, an examination of the boxplot revealed the absence of outliers in the difference scores (see Figure 4).

**Figure 4**

*Boxplot of the difference scores between conditions*



### Assumptions of linear regression

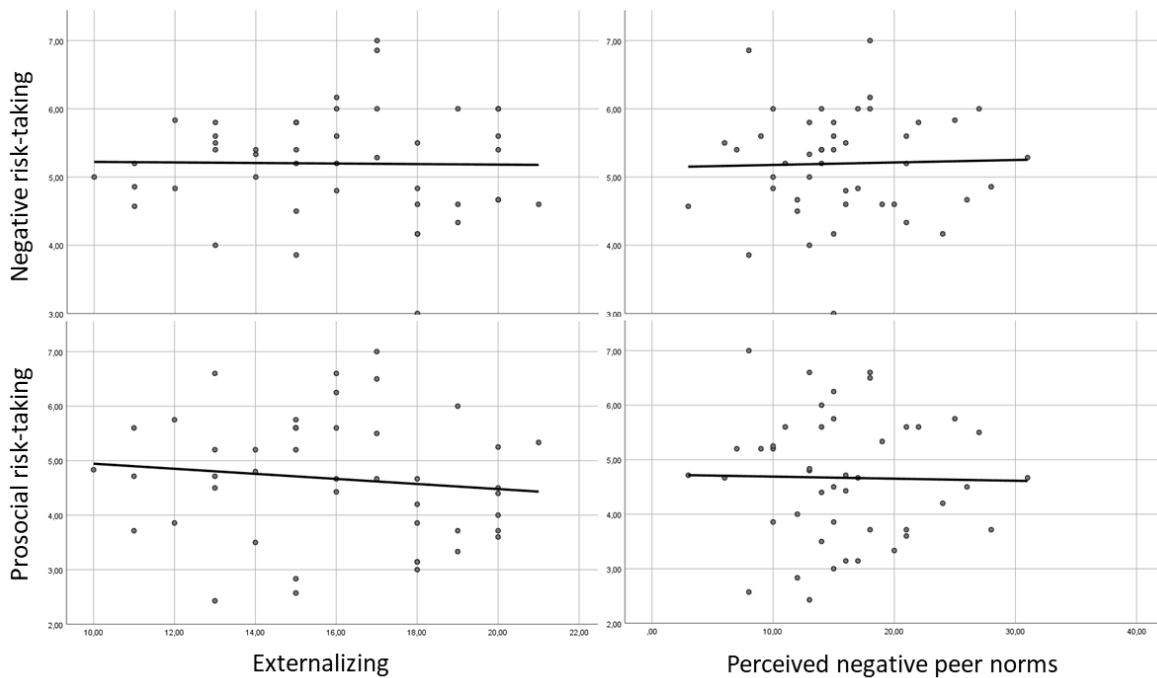
For the linear regression analyses, first the linearity assumption was tested. No significant linear associations were observed between the predictors and the dependent variables (see Table 3). However, upon visual inspection of the scatter plots no apparent trends were detected (see Figure 5). Thus, it can be inferred that the linearity assumption is not violated.

**Table 3**

*Linearity tests between each dependent variables and predictors*

	Sum of Squares	df	F	Sig.
Negative risk-taking * Perceived negative peer norms	.021	1	.029	.867
Negative risk-taking * Externalizing	.006	1	.013	.911
Prosocial risk-taking * Externalizing	.827	1	.676	.417
Prosocial risk-taking * Perceived negative peer norms	.024	1	.012	.915

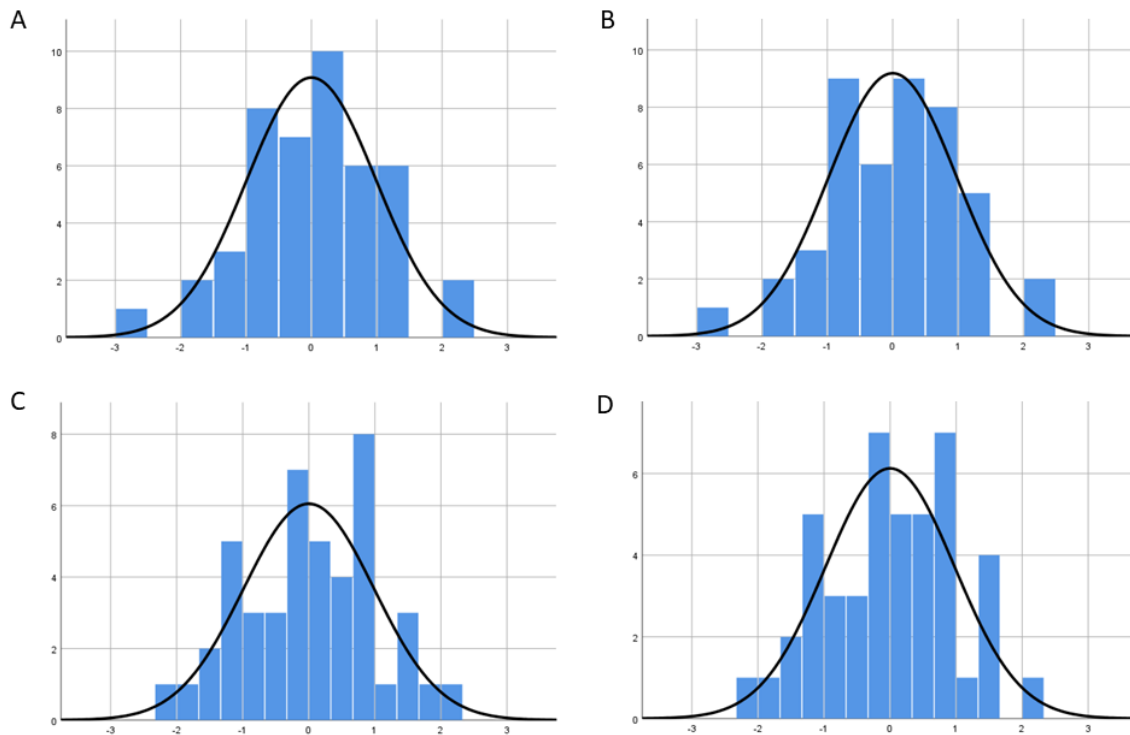
**Figure 5**

*Scatter plots for linearity testing*

Next, the normality assumption was assessed by examining the histograms of the residuals for the dependent variables. The histograms displayed bell-shaped patterns, suggesting a normal distribution (Figure 6). Thus, the normality assumption can be confirmed. To address the potential issue of multicollinearity resulting from multiple predictors in the regression models, the variance inflation factor (VIF) was calculated for externalizing and perceived peer norms variables. The VIF score was found to be very low, indicating no multicollinearity problems. Specifically, the VIF value of 1.05 obtained for the predictors in the current sample is far from the threshold of 10 that would indicate serious multicollinearity problem. Hence, no evidence of multicollinearity was detected.

**Figure 6**

*Histogram of standardized residuals of dependent variables*

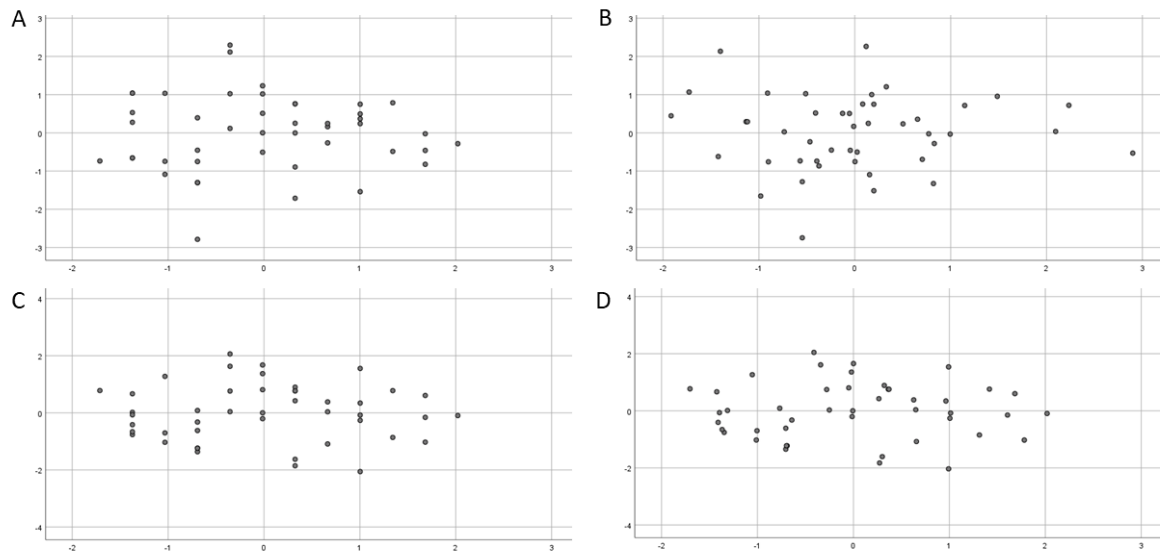


*Note.* A) Standardized residuals of negative risk-taking in a regression model with externalizing as predictor. B) Standardized residuals of negative risk-taking in a regression model with externalizing and perceived negative peer norms as predictors. C) Standardized residuals of prosocial risk-taking in a regression model with externalizing as predictor. D) Standardized residuals of prosocial risk-taking in a regression model with externalizing and perceived peer norms as predictors.

To examine homoscedasticity in each hypothesized relationship, scatter plots were created to visualize the relationship between standardized residuals and standardized predicted values. Upon careful inspection of these scatter plots no discernible patterns were observed (see Figure 7). Consequently, the absence of any visible fan-shaped or funnel-shaped trends suggests the absence of heteroscedasticity. Thus, it can be concluded that homoscedasticity is confirmed in the analysis.

### **Figure 7**

*Scatter plots of standardized residuals x standardized predicted values*



*Note.* A) Scatter plot of negative risk-taking in regression model with externalizing as predictor. B) Scatter plot of negative risk-taking in regression model with externalizing and perceived negative peer norms as predictors. C) Scatter plot of prosocial risk-taking in regression model with externalizing as predictor. D) Scatter plot of prosocial risk-taking in regression model with externalizing and perceived negative peer norms as predictors.

To detect outliers in the regression analyses, multiple methods were employed. First, the studentized residuals were examined to identify any outliers in the residuals. According to a rule of thumb, studentized residuals exceeding a value of 3 or lower than -3 are considered outliers. Additionally, centered leverage values were checked for outliers in predictor scores. An upper limit criterion was applied, where values surpassing the upper limit were deemed outliers. The upper limit was calculated using the formula:  $3 * (\text{number of predictors} + 1) / \text{total sample size}$ . Furthermore, to assess influential cases that could potentially distort the slope of the regression, Cook's distance was examined. The rule of thumb suggests a Cook's distance larger than 1 in an outlier. However, adhering to these guides, the current sample exhibited no outlier cases (see Table 4). Thus, based on these assessments, the assumption of no outliers can be affirmed.

**Table 4**

*Residuals statistics of linear regression analyses*

	Minimum	Maximum
Stud. Residual <sup>a</sup>	-2.834	2.327
Cook's Distance <sup>a</sup>	.000	.138
Centered Leverage Value <sup>a</sup>	.000	.093
Stud. Residual <sup>b</sup>	-2.796	2.293
Cook's Distance <sup>b</sup>	.000	.120
Centered Leverage Value <sup>b</sup>	.000	.197
Stud. Residual <sup>c</sup>	-2.107	2.089



Cook's Distance <sup>c</sup>	.000	.105
Centered Leverage Value <sup>c</sup>	.000	.093
<hr/>		
Stud. Residual <sup>d</sup>	-2.082	2.120
Cook's Distance <sup>d</sup>	.000	.126
Centered Leverage Value <sup>d</sup>	.000	.197
<hr/>		

*Note.* a) Residuals statistics of regression model with negative risk-taking and externalizing. b) Residuals statistics of regression model with negative risk-taking, externalizing, and perceived negative peer norms. c) Residuals statistics of regression model with prosocial risk-taking and externalizing. d) Residuals statistics of regression model with prosocial risk-taking, externalizing, and perceived negative peer norms.