**PAPER**

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# Family conflict shapes how adolescents take risks when their family is affected

João F. Guassi Moreira[1] | Eva H. Telzer[2]

[1]Department of Psychology, University of California, Los Angeles, CA, USA

[2]Department of Psychology & Neuroscience, University of North Carolina, Chapel Hill, NC, USA

**Correspondence**
João F. Guassi Moreira, 502 Portola Plaza, Los Angeles, CA 90095, USA.
Email: jguassimoreira@ucla.edu

**Abstract**

Numerous studies have established that the social context greatly affects adolescent risk taking. However, it remains unexplored whether adolescents' decision-making behaviors change when they take risks that affect other individuals such as a parent. In the current study, we sought to investigate how the social context influences risky decisions when adolescents' behavior affects their family using a formalized risk-taking model. Sixty-three early adolescents ($M_{age}$ = 13.3 years; 51% female) played a risk-taking task twice, once during which they could make risky choices that only affected themselves and another during which their risky choices only affected their parent. Results showed that adolescents reporting high family conflict made more risky decisions when taking risks for their parent compared to themselves, whereas adolescents reporting low family conflict made fewer risky decisions when taking risks for their parent compared to themselves. These findings are the first to show that adolescents change their decision-making behaviors when their risks affect their family and have important implications for current theories of adolescent risk taking.

## RESEARCH HIGHLIGHTS

- Prior work examining risk-taking behaviors in adolescence focused on how adolescents take risks that only affect themselves.
- We employed a novel experimental paradigm in which adolescents made risky decisions that affected their parent and themselves.
- Adolescents reporting high conflict with their parents made more risky decisions when their parents were affected.
- Adolescents who reported low conflict with their parents made fewer risky decisions when their parents were affected.
- These findings have implications for theories of adolescent risk taking.

## 1 | INTRODUCTION

Several biological, social, and psychological changes occur during puberty that render adolescents increasingly sensitive and attuned to social contexts, constituting a social reorientation (Nelson, Leibenluft, McClure, & Pine, 2005; Nelson, Jarcho, & Guyer, 2016). In fact, adolescence has been described as a sensitive period for sociocultural processing (Blakemore & Mills, 2014). For example, adolescents' risk-taking behaviors are particularly susceptible to differing social contexts, such that they take more or fewer risks in the presence of peers and parents (e.g., Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Gardner & Steinberg, 2005; Telzer, Ichien, & Qu, 2015). However, many prior studies examining social influences on adolescent risk taking focus on how adolescents take risks that solely affect themselves, and not others. This is a significant limitation given that adolescents are frequently faced with choices that affect other individuals, including those closest to them. In the current study, we investigated whether adolescents alter their decision-making behaviors when their family stands to gain or lose as a result of their decisions.

### 1.1 | Social context modulates adolescent risk taking

Prominent models of adolescent development explain risk taking as an imbalance between developmentally heighted sensation seeking (e.g., Steinberg et al., 2008, 2017) and slow-to-develop cognitive control (Casey, 2015; Shulman et al., 2016). Theoretically, it is posited that

adolescents find rewards to be more hedonically pleasurable than children or adults and do not have mature impulse inhibition systems to regulate themselves in the face of risky scenarios that may yield such rewards. Extant work does indeed show that adolescence is a period of increased risk taking (DeFoe, Dubas, Figner, & van Aken, 2015; Steinberg et al., 2008). However, adolescents' risky tendencies are not ubiquitous across all contexts. Importantly, adolescents are sensitive to the social context in which risk taking occurs and subsequently augment or attenuate their rate of risky decisions when other individuals are present. Teenagers look to peers and parents for important social information (e.g., Pfeifer et al., 2009) and are highly swayed by their influence (e.g., Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015; Steinberg & Monahan, 2007; Welborn et al., 2016). It is perhaps for this reason that studies have found adolescents to be more likely than adults or children to take greater risks in the presence of a peer compared to when alone (Chein et al., 2011; Gardner & Steinberg, 2005). Similarly, adolescents can also be swayed to behave more safely, as they are less likely to take risks when in the presence of slightly older adults or their mothers (e.g., Silva, Chein, & Steinberg, 2016; Telzer et al., 2015).

Prior work has focused on adolescent risky decisions that solely affect the individual adolescent. For instance, existing protocols for investigating the social context of teenage risk taking involve informing participants that another individual (e.g., mother or peer) is passively watching them complete a risk-taking task with no stake in the outcome to test whether the mere presence of others alters adolescent decision-making (e.g., Chein et al., 2011; Smith, Chein, & Steinberg, 2014; Telzer et al., 2015). Other studies present adolescents with information on how their peers, parent, or adults behaved in the same situation to see if adolescents change their decision-making behaviors when exposed to explicit social influence (e.g., Knoll et al., 2015; Welborn et al., 2016). While such experiments have significantly contributed to our understanding of adolescent decision-making, prior research has not examined how adolescents' decisions change when they take risks that affect individuals other than themselves, a type of behavior that occurs frequently in adolescents' daily lives. For example, consider an adolescent who takes the family car on a joyride. By doing this, he is not only risking his own safety but he is also placing his family at risk if he totals the car since this would cause significant financial and emotional strain for his family.

An existing body of supporting work suggests that adolescents may alter their decision-making behaviors as a function of who is affected (i.e., themselves versus another). Crone, Bullens, Van der Plas, Kijkuit, and Zelazo (2008) found that adolescents understand other individuals have different risk-taking preferences from their own, suggesting they may be cognizant of others' perspectives when making risky choices that affect others. Similarly, neuroimaging research has shown that adolescents are sensitive to vicarious rewards for others stemming from decisions they made (Braams, Peters, Peper, Güroğlu, & Crone, 2014). These results suggest that adolescents are not only capable of taking others' perspectives while risk taking but that they may be motivated to behave differently in order to achieve a specific outcome when someone else is affected.

## 1.2 | Family relationships and adolescent risk taking

Of the many relationships that populate the adolescent social ecology, those between teenagers and their parents tend to exert a profound influence on behavior. Although adolescence is a period where individuals begin to spend more time with peers than parents (Csikszentmihalyi, Larson, & Prescott, 1977), adolescent–parent relationships still play a prominent role in the lives of teenagers. On average, adolescents report valuing their parents (Tsai, Telzer, & Fuligni, 2013) despite also reporting developmentally typical increases in family conflict (Steinberg & Morris, 2001). Prior experimental studies have shown that adolescents take fewer risks in the presence of their mothers than when alone or in the presence of an unknown adult (Guassi Moreira & Telzer, 2016; Telzer et al., 2015), suggesting that adolescents think about their parents when taking risks. Because many adolescents' risk-taking decisions not only affect themselves, but also affect their parents, adolescents likely decrease their risk-taking decisions when their parents stand to gain or lose due to their risky choices.

However, there is a great deal of heterogeneity in the quality of adolescent–parent relationships (Steinberg & Morris, 2001). Although adolescents may take fewer risks overall when their parents are affected, this likely depends on facets of relationship quality between parents and teens. Family conflict tends to increase during adolescence (Steinberg & Morris, 2001; Tsai et al., 2013), with heightened family conflict associated with increases in adolescent risk taking (McCormick, Qu, & Telzer, 2016). Thus, in low conflict relationships, adolescents may change their behavior to be less risky, but in high conflict relationships they may increase their risky behavior. Indeed, research has shown that the mere psychological representation of a relationship partner (e.g., mother), even in her absence, activates and guides behavior (Fitzsimons & Bargh, 2003). In particular, social influence extends to the "psychological presence" of significant relationship partners, such that cognitive representations incorporate the goals, values, and expectations of these close others, thereby influencing self-regulation (Shah, 2003a). Indeed, when in the "psychological presence" of their father, students show decreases in cognitive persistence in low cohesion families but increases in persistence in high cohesion families (Shah, 2003b). Thus, representations of close others from high conflict relationships may actually impair cognitive control (Fitzsimons & Bargh, 2003; Shah, 2003b). Therefore, making decisions in the context of a high conflict family may cause teenagers to poorly regulate their behaviors. By comparison, adolescents who report relatively low levels of conflict with their parents are perhaps more likely to display the opposite trend. They may be particularly motivated to obtain rewards for their parents, opting to take fewer risks in order to avoid harming their parents.

## 1.3 | The current study

In the current study, we utilized a well-validated risk-taking task (Galván & McGlennen, 2011) in which participants' choices between

certain and uncertain (i.e., risky) outcomes were associated with specific probabilities of monetary outcomes. We implemented a novel manipulation, in which adolescents completed the task twice: once during which their decisions impacted only themselves (monetary gains and losses), and the other during which their decisions impacted only their parent's outcomes. This manipulation allowed us to understand how adolescent behavior during risk taking changes as a function of who is directly affected by their decisions. Thus, our manipulation captures a previously unexamined element of the adolescent risk-taking ecology—how one's risks affect their parents. Adolescents also completed self-report measures to assess family conflict. Since research has indicated early adolescence as a crucial time of dynamic change in both risk-taking behaviors (Steinberg et al., 2008) and family relationships (Larson & Richards, 1991), we specifically focused on 12–14-year-olds in order to understand this important period during which teenagers begin to show peaks in risk taking and family conflict.

We sought to address two key questions. First, we tested whether adolescents altered their decision-making behaviors when their parent was affected. We expected that, overall, adolescents would take fewer risks for their parents than when playing for themselves. Second, we tested whether adolescent decision-making for self and parent differed as a function of perceived family conflict. We expected that adolescents with greater experiences of family conflict would be more likely to make greater risky decisions during the risk-taking task when playing for their parents compared to themselves. Conversely, we expected that adolescents with fewer experiences of family conflict would be less likely to take risks for a parent compared to themselves.

## 2 | METHODS

### 2.1 | Participants

Sixty-three early adolescents ($M_{age}$ = 13.31 years, $SD$ = 0.66, range = 12.11–14.77; 32 female), accompanied by their primary caregiver (42 female), attended a laboratory visit where they completed a computerized task as well as self-report measures. Two additional participants were not included in this sample due to non-compliance while performing the experimental task. The sample was ethnically diverse (White = 33, Asian = 3, Black = 14, Mixed Race/Other = 13), and over 70% of the caregivers who accompanied the participants reported having at least graduated college. We ran as many participants as possible over a six-month span before terminating data collection, with a goal of achieving a sample size comparable to prior studies of a similar research topic (e.g., Crone et al., 2008; Weller, Moholy, Bossard, & Levin, 2015). Adolescents and their parent were each compensated $30 for their participation along with an additional monetary incentive based on task earnings. All procedures were approved by the university's Institutional Review Board. Data and self-report measures are publicly available on the Open Science Framework (osf.io/by8wc).

## 2.2 | Self-report measures

### 2.2.1 | Family conflict

Family conflict was assessed by asking adolescents to complete an eight-item measure indicating how often they fight, disagree, or argue with their parents (1 = "Almost Never" to 5 = "Almost Always"; Ruiz, Gonzales, & Formoso, 1998). Example items include "you and your parents yelled or raised your voices at each other" and "you and your parents ignored each other". This measure has been previously used in adolescent samples (e.g., McCormick et al., 2016; Telzer, Gonzales, & Fuligni, 2014) to assess normative levels of family conflict and links to risk taking and substance use (α = 0.89).

### 2.2.2 | Risk-taking behaviors

In addition to examining risk taking during the experimental task, we controlled for self-reported risk-taking behaviors using a modified, 12-item version of the Adolescent Risk Taking Scale (Alexander et al., 1990; Telzer, Fuligni, Lieberman, & Galván, 2013). Participants were asked to rate how often they engaged in a range of risky behaviors along a 4-point Likert scale (1 = "Never" to 4 = "Many times"). Example items include "I have snuck out of my house without my parents knowing" and "I have raced a car or motorcycle" (α = 0.73).

## 2.3 | Risky decision-making task

To measure risky decision-making, we employed a computerized version of the Cups Task (Levin & Hart, 2003), which has frequently been utilized for examining decision-making in developmental populations (e.g., Galván & McGlennen, 2011; Levin, Hart, Weller, & Harshman, 2007). Participants completed two runs of the task (1 run = 54 trials), once while making risky decisions that affected their own earnings, and once while making risky decisions that affected the earnings of their parent who accompanied them to the visit. The order of conditions (i.e., playing for self versus playing for their parent) was counterbalanced between participants.

During each trial, adolescents were shown a set of overturned cups on a computer screen. A vertical line divided the row of cups into a left side with one cup and a right side with many cups (either 2, 3, or 5). Participants were told that ± $2 was always hidden beneath the single cup on the left side, whereas ± $4, $6, or $10 was hidden beneath one of the many cups on the right side. Participants were instructed to pick between the two sides and were told that the computer would then randomly select a cup from the chosen side (see Figure 1). Participants could gain money on half of the trials and lose money on the other half. Therefore, choosing the left side was associated with a 100% probability of gaining or losing $2, whereas choosing the right side contained a 50%, 33% or 20% probability of gaining or losing a result greater than $2 ($4, $6, or $10). These probabilities were presented *ex ante* to the participant, yet varied slightly in reality so as to artificially boost outcome variability. Participants had 3 seconds to make their decision
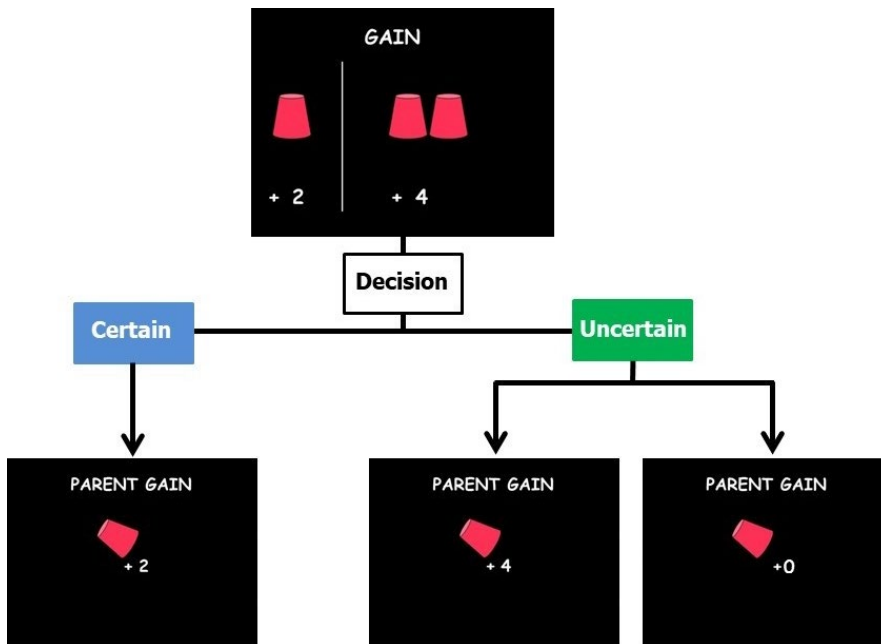
**FIGURE 1** An example gain trial of the cups task. Participants had the option to choose between the certain (safe) outcome on the left, which guaranteed $2, and the uncertain (risky) option on the right, in which they had a 50% chance of winning $4 or nothing; Reward EV = 2; Risk SD = 1.41. Participants played one round for themselves and another for the parent who accompanied them to the experiment

for each trial and were informed that a failure to respond would result in no outcome for that trial. There were 9 combinations of reward/loss outcomes (±$10, $6, or $4) and risk probabilities (20%, 33%, or 50%). Six trials per combination were presented to the participant in each run, half of which were gain trials and the other half were loss trials. The order of risk probabilities was presented in a fixed order to participants, in a such a manner that appeared random, while the trial type (i.e., gain/loss) varied randomly between subjects.

Participants were told that the reward results for each trial were not cumulative. Instead, the computer would randomly select the outcome of one of their decisions at the end of the task and add that amount to their study compensation. The experimenters emphasized to participants that money could be won or lost for themselves and their parents. Because adolescents and their parents were each receiving $30 for participating, the loss was subtracted from their overall earnings, whereas the gain was added. In reality, adolescents always received $4 when playing for themselves and $2 when playing for their parent. Parents were not made aware prior to the task that their child was completing a round of the task for them. The $2 reward for their parent was delivered to the parent in front of the adolescent at the end of the study session.

### 2.3.1 | Mathematical decision-making model

Techniques from the field of behavioral economics have been applied to developmental science, allowing researchers to study the extent to which different subcomponents of risky scenarios affect decision-making using precise, formalized mathematical models (Hartley & Somerville, 2015; Weber, 2010). Specifically, a subset of such models, termed risk-return decomposition models, break down risk taking into its underlying components: risk (outcome variability) and reward (return on risk taking). Other scholars have noted that these two elements of risky decisions are often conflated in studies of adolescent

risk taking, making it difficult to determine whether adolescent risk taking is driven by pure risk or pure reward. By decomposing risky decisions into risk and reward, we sought to gain better insight and a more nuanced understanding of the contextual factors that influence adolescent risk taking. Although such techniques have been frequently conducted with adults, they are relatively lacking in the developmental literature (van Duijvenvoorde, Blankenstein, Crone, & Figner, 2017). We employed an analytic technique adapted from prior work to fit our task parameters (van Duijvenvoorde et al., 2015), in which we decomposed risk taking into two components, the effect of reward and the effect of risk.

Consistent with recent work (van Duijvenvoorde et al., 2015), the effect of reward was operationalized as the expected value (EV) of a risky choice while the effect of risk was operationalized as the standard deviation (SD) associated with the potential outcomes of a risky choice.

Mathematically, Reward EV was defined as:

$$EV = (gain/loss\ probability \times gain/loss\ amount)$$

Risk SD was defined as:

$$SD = \sqrt{(gain/loss\ probability \times (gain/loss\ amount - EV)^2)}$$

Thus, for a trial in which +$10 was hidden under a set of three cups, the Reward EV would equal 3.33 (⅓ × $10) and the Risk SD would equal 3.85 ($\sqrt{(1/3 \times (10 - 3.33))^2}$). Given our win/loss probabilities and outcomes, the Reward EV ranged from −5 to +5, and the Risk SD ranged from 1.41 to 3.85. As previously mentioned, our use of this modeling approach is important because the effects of reward and risk are often conflated in risk-taking tasks (van Duijvenvoorde et al., 2015) and they have not been used frequently in developmental samples (van Duijvenvoorde et al., 2017).

We analyzed our data using hierarchical linear modeling (HLM for Windows, version 6.06; Raudenbush, 2004; Raudenbush & Bryk,

2002) to investigate (1) how the social context of decision-making (i.e., playing for self or parent) and the effect of reward (i.e., Reward EV) and risk (i.e., Risk SD) influence the likelihood of making a risky (i.e., uncertain) versus safe (i.e., certain) decision and (2) how individual differences in family conflict moderate the link between these variables. We estimated the following equations:

Level 1:

$$\text{Logit}(\text{Decision}_{it}) = \pi_{0t} + \pi_{1t}(\text{Context}) + \pi_{2t}(\text{Reward}) + \pi_{3t}(\text{Risk}) + \varepsilon_{it} \tag{1}$$

Decisions (1 = risky, 0 = safe) for a particular trial ($i$) for a particular individual ($t$) were modeled as a function of the context ($\pi_{1t}$) (i.e., whether the trial was being played for oneself (coded as 0) or for their parent (coded as 1)). Reward ($\pi_{2t}$) and risk ($\pi_{3t}$) were coded as the reward EV and risk SD, respectively, for a particular trial. Because individuals tend to take risks differently depending on whether they risk gaining a reward or avoiding a loss, we ran this model separately by trial type (i.e., gain and loss).

Additional HLM models were analyzed to test whether the effects of context, reward EV, and risk SD on risky decisions depend on the quality of parent–child relationships. In addition, self-reported risk-taking and gender were included as controls. The models included the same level-1 equation described above but with the inclusion of the following individual-level equations.

Level 2:

$$\pi_{0t}(\text{intercept}) = \gamma_{00} + \gamma_{01}(\text{Family Conflict}) + \gamma_{02}(\text{RiskTaking}) + \gamma_{03}(\text{Gender}) + \zeta_{0t} \tag{2}$$

$$\pi_{1t}(\text{context}) = \gamma_{10} + \gamma_{11}(\text{Family Conflict}) + \gamma_{12}(\text{RiskTaking}) + \gamma_{13}(\text{Gender}) + \zeta_{1t} \tag{3}$$

$$\pi_{2t}(\text{reward}) = \gamma_{20} + \gamma_{21}(\text{Family Conflict}) + \gamma_{22}(\text{RiskTaking}) + \gamma_{23}(\text{Gender}) + \zeta_{2t} \tag{4}$$

$$\pi_{3t}(\text{risk}) = \gamma_{30} + \gamma_{31}(\text{Family Conflict}) + \gamma_{32}(\text{RiskTaking}) + \gamma_{33}(\text{Gender}) + \zeta_{3t} \tag{5}$$

The intercept ($\pi_{0t}$) and the trial-by-trial associations of decision making with context ($\pi_{1t}$), reward ($\pi_{2t}$), and risk ($\pi_{3t}$) were modeled as a function of average self-reported family conflict and average self-reported risk taking. Family conflict and risk-taking scores were grand mean centered. Gender was dummy coded 0 = male, 1 = female and entered into all our models. We added self-reported risk taking at the second level to determine how real-world risk-taking tendencies relate to in-task risk taking.[1]

## 3 | RESULTS

### 3.1 | In-task risk taking for self and parent

First, we examined the level-1 model described in equation 1 to test how the social context and the effects of risk and reward for a given

**TABLE 1** Trial-by-trial association between risky decision-making and study variables, broken down by trial type. Robust standard errors are reported from a population-average model

| Predictor | Gain | | | Loss | | |
|---|---|---|---|---|---|---|
| | b | SE | p | b | SE | p |
| Intercept | | | | | | |
| Intercept | .271 | .194 | .167 | .030 | .195 | .878 |
| Gender | .608 | .264 | .025 | −.202 | .301 | .503 |
| Risk taking | .529 | .504 | .298 | .542 | .448 | .231 |
| Family conflict | −.021 | .175 | .905 | −.282 | .199 | .162 |
| Context | | | | | | |
| Intercept | .009 | .077 | .909 | .000 | .156 | .998 |
| Gender | −.200 | .127 | .122 | .028 | .208 | .895 |
| Risk taking | −.140 | .237 | .558 | −.067 | .324 | .836 |
| Family conflict | .351 | .074 | .000 | .127 | .120 | .296 |
| Risk SD | | | | | | |
| Intercept | −.004 | .069 | .950 | .316 | .083 | .001 |
| Gender | .036 | .102 | .725 | −.221 | .108 | .046 |
| Risk taking | .355 | .136 | .012 | −.269 | .163 | .103 |
| Family conflict | −.018 | .056 | .746 | .058 | .074 | .430 |
| Reward EV | | | | | | |
| Intercept | .283 | .080 | .001 | .425 | .078 | .000 |
| Gender | −.252 | .099 | .014 | −.231 | .105 | .032 |
| Risk taking | −.470 | .173 | .009 | −.533 | .161 | .002 |
| Family conflict | −.055 | .065 | .404 | .078 | .065 | .237 |

Note. Gender was coded Male = 0, Female = 1. Context was coded such that a 0 indicated playing for oneself, whereas a 1 indicated playing for one's parents. EV ranged from −5 to 5 and *SD* ranged from 1.41 to 3.85. Bs represent expected changes in log odds (logit) for a given variable over and above other variables in the model.

trial affect adolescents' likelihood to make a risky decision. We ran these analyses separately for gain and loss trials because gain and loss trials in the task are framed differently and therefore may have different effects on behaviors (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). As shown in Table 1, we found significant associations between the tendency to make a risky decision during a given trial and the effect of reward (Reward EV) for both trial types, such that a greater EV for a given trial was associated with a greater propensity to make a risky decision. We also found a significant association between the tendency to make a risky decision and the effect of risk (Risk SD) during loss trials, such that adolescents tended to make more risky decisions as the outcome became more uncertain. However, there was no such effect for gain trials. The context (playing for self versus parent) was not associated with the propensity to make a risky decision during a given trial for either condition. Thus, overall, adolescents were no less likely to vary their risk taking purely as a function of social context (i.e., who was affected by their risks).

## 3.2 | Family conflict moderates in-task risk taking for self and parent

Next, we examined the level-2 models described in equations 2–5 to test whether the trial-by-trial associations between social context and decision-making differed as a function of self-reported family conflict. Family conflict ($M = 1.84$, $SD = 0.70$, range = 1–4.25), which was entered as a continuous measure and grand mean centered, moderated the trial-by-trial association between social context and risk taking for gain trials but not loss trials (Table 1). In order to probe this effect, we split our sample into high and low family conflict groups by taking the highest scoring third ($n = 20$; $M = 2.66$, $SD = 0.62$, range = 2–4.25) and lowest scoring third ($n = 18$; $M = 1.20$, $SD = 0.14$, range = 1–1.38). We found a significant positive association between the social context and risky decisions in the high family conflict group ($B = .449$, $SE = .097$, $p < .001$), and a significant negative association between the social context and risky decisions in the low family conflict group ($B = −.297$, $SE = .084$, $p = .003$). That is, adolescents reporting high family conflict were significantly more likely to make risky decisions for their parents compared to themselves, whereas adolescents reporting low family conflict were significantly less likely to make risky decisions for their parents compared to themselves. As shown in Figure 2, individuals from both high and low family conflict groups showed relatively more similar risk taking when playing for themselves compared to when playing for their parent. Adolescents reporting high family conflict changed their risky behavior when their parents were affected by their decisions, such that they took significantly more risks for their parents. In contrast, adolescents reporting low family conflict changed their risky behavior in the opposite direction, such that they took significantly fewer risks when their parents were affected by their decisions. Family conflict did not moderate the association between risky decisions and any of our other predictor variables (see Table 1).
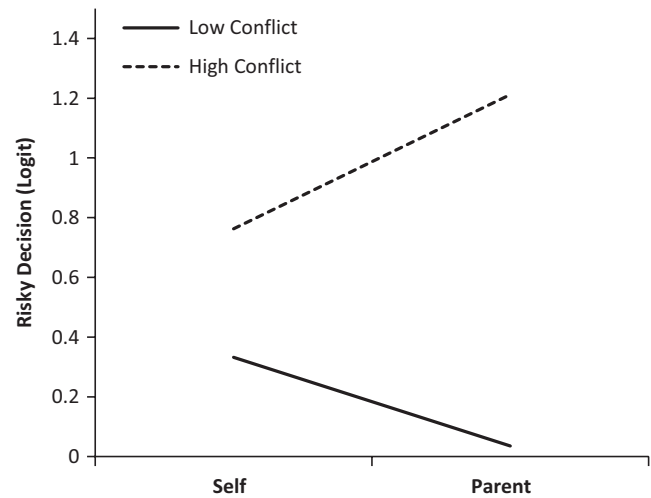


**FIGURE 2** The association between social context and trial-level risk-taking as moderated by family conflict (gain trials only). A greater value on the y axis indicates a higher likelihood of making a risky choice

## 3.3 | Gender and self-reported risk taking moderate in-task risk taking

Although not the focus of the current manuscript, we also examined how our control variables modulated in-task risk taking. As shown in Table 1, gender and risk-taking tendencies moderated adolescents' risky choices. In terms of gender, gender moderated both effect of $SD$ (loss trials only) and EV (both trial types) on in-task risky choices. Self-reported risk taking ($M = 1.36$, $SD = 0.29$, range = 1–2.33), which was entered as a continuous measure and grand mean centered, moderated the trial-by-trial association between reward value (i.e., Reward EV) and risky decisions for both gain and loss trials. In addition, as shown in Table 1, self-reported risk taking moderated the trial-level association between in-task risk taking and the effect of risk (i.e., Risk SD; gain trials only). Both gender and self-reported risk-taking results are probed and discussed in the Supplementary Materials.

## 4 | DISCUSSION

In the current study, we sought to investigate how the social context influences risky decisions when adolescents' behavior affects their family using a formalized risk-taking model. Interestingly, the social context does not have a global impact on adolescents' decision-making. That is, at the main effect level, adolescents do not differentially take risks for their family and themselves. Importantly, we show that adolescents alter their decision-making behaviors when their risks affect their family based on their experiences of conflict with their parents. Specifically, adolescents who reported greater family conflict were more likely to make risky decisions when the outcome affected their parents, but not themselves, whereas adolescents reporting lower family conflict were less likely to take risks when the outcome affected their parents. The current study significantly contributes to

our understanding of how social contexts shape adolescent decision-making across risky scenarios. That teenagers change their decision-making behaviors when their parents stand to lose or benefit suggests that information about who is affected by their risks plays a meaningful role in shaping adolescents' risky behaviors.

Intriguingly, we did not find an overall main effect of context on adolescent risk taking. That is, on average, adolescents did not take fewer risks for their parents compared to themselves. This null main effect was qualified by a significant interaction, such that adolescents only made fewer risks for their parents when they reported low family conflict. This speaks to the importance of adolescents' perceived family conflict in determining how they will make risky decisions on the behalf of their family. Just as self-oriented adolescent risk-taking behavior is not necessarily stable across all contexts (e.g., Chein et al., 2011; Telzer et al., 2015), neither is parent-oriented risk taking stable across relationships of differing levels of family conflict. These findings are noteworthy because they not only highlight how social influences do not exert uniform effects on behaviors but that they depend on the quality of the relationship. Similar to previous work examining how family and peer conflict impact adolescents' risk taking when it affects only the adolescent (McCormick et al., 2016; Telzer et al., 2015), we found that individuals who report high levels of family conflict were more likely to make a risky decision; however, this time at the expense of their parents. Conversely, individuals who report lower family conflict were less likely to make risky decisions when their parents were affected. One explanation for this is that activation of parental representations when playing for a high conflict parent actually impairs cognition and self-regulation, whereas adolescents reporting lower levels of family conflict experience the opposite. This may be because playing for a high or low conflict parent changed the goal structure that adolescents had with respect to our task (Shah, 2003b).

It is also possible that living in a high or low family conflict home is related to different orientations towards approaching and pursuing rewards, and that activating the psychological representation of a parent then affected how adolescents played the task. In fact, adolescents reporting higher levels of family conflict may not be trying to harm their parents or even showing little regard for them; instead, taking more risks for their parent may be an acceptable way, in the context of this relationship type, to try to help one's parents. In contrast, playing it safe may be a more appropriate way for adolescents reporting low family conflict to help their parents. Perhaps their goal structures incorporate values that favor certainty and stability, even if it means that they may not acquire greater rewards. Regardless of the exact reason, these findings highlight a potential caveat to the burgeoning work showing that parental presence influences teens to make safer decisions (e.g., Telzer et al., 2015), and suggests that negative family relationships may actually push adolescents towards engaging in negative behaviors, particularly when their decisions affect their parents.

Interestingly, it was only during gain trials and not loss trials in which adolescents reporting high family conflict took greater risks on behalf of their parents, whereas adolescents reporting low family conflict took fewer risks when their decisions affected their parents.

Increased risk taking for individuals reporting greater family conflict may actually reflect heightened approach motivation when faced with the opportunity to gain money, compared with a chance to avoid losing money. This would imply that the psychological representation of a high conflict relationship affects one's motivation to approach a reward (e.g., money) relative to their motivation to avoid a loss (Shah, 2003b). Similarly, the representation of a low conflict relationship may differentially alter the extent to which one chooses to approach positive rewards and not the manner in which they avoid potential losses. The lack of social context effects on behavior for losses between adolescents who report high versus low family conflict may be the result of a ceiling or floor effect when assigning subjective weights to loss outcomes (McCormick & Telzer, 2017; Tversky & Kahneman, 1992). That is, the subjective weights of losing may be more or less "fixed" and relatively immutable to social influences, whether it be because losses are too salient (Tversky & Kahneman, 1992) or because adolescents show blunted sensitivity to loss (McCormick & Telzer, 2017).

The results reported here show that adolescents likely consider their parents' viewpoints when taking risks. This particular element is absent from current theories of adolescent risk taking and should be incorporated in order to yield a more complete understanding of adolescent decision-making. Indeed, current theories of risk taking in adolescence (e.g., Casey, Galván, & Somerville, 2016; Steinberg, 2010) may only apply when adolescents are making self-oriented risky decisions—an entirely different account may be needed to explain other-oriented risk taking in adolescence (or at least parent-oriented risk taking). Our findings raise the possibility that contexts may exist in which adolescent risk-taking tendencies are attenuated or exaggerated when they consider that their parent is going to be affected. This notion not only has theoretical implications, but also possesses practical value. Scholars have suggested that cognitive reappraisal strategies, in which individuals change the ways they think about a stimulus so as to modulate its affective meaning (Buhle et al., 2014), may offer a promising avenue for reducing health compromising behaviors during adolescence (Giuliani & Pfeifer, 2015). Our study may serve as the basis for future studies to explore contexts in which adolescents decrease their risk taking when others stand to gain or lose. Such work may subsequently inform the development of interventions centered on modifying cognitive reappraisal strategies so as to remind adolescents of who else will be affected by their risky decisions. Since adolescents take others' perspectives into account when taking risks (Crone et al., 2008) and are motivated by vicarious rewards (Braams et al., 2014), the use of such reappraisal strategies may be one effective candidate for inducing behavioral change in adolescence. Yet, without taking into consideration the quality of their relationships, interventions could have iatrogenic effects if adolescents are encouraged to take the perspective of a high conflict family member.

While our findings provide the first evidence that adolescents alter their decision-making behaviors when their behavior affects another individual, our study focused specifically on family relationships. Given the importance of peers to adolescents, future studies should examine whether a similar effect occurs when teenagers take risks that affect their friends. In addition, our study only tested early adolescence.

Future research should examine whether other age groups, including children, late adolescents, and adults differentially modify their decision-making behaviors in a social context to determine whether the effects observed here change across the lifespan. Lastly, our experiment could have benefitted from a larger sample size and the subsequent boost in power. However, we do note that our 54 trials per run of the task are consistent with, or higher than, the typical number of events in statistical models that rely on hierarchical linear modeling (Haines et al., 2016; McCoach, 2010).

In conclusion, our results contribute to the growing body of work highlighting the importance of social contexts in individuals' decision-making behaviors. No other study to our knowledge has examined how adolescents behave under risky circumstances when their parents are affected by their risks. Our results highlight that the extent to which adolescents change their decision-making behaviors when their risks affect another individual is dependent upon family conflict, thereby lending greater insight into the fabric of adolescent decision-making processes.

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## AUTHOR CONTRIBUTIONS

JFGM and EHT designed the research. JFGM conducted the research and analyzed data under the supervision of EHT. JFGM and EHT interpreted the results and drafted the manuscript.

## ENDNOTE

[1] We also examined whether the influence of social context is dependent on the effects of reward EV or risk SD, we ran additional models in which we computed Context × Reward EV and Context × Risk SD interaction terms and entered them into additional first-level equations. Because analyses with these interaction terms yielded insignificant results, we have excluded them here for the sake of parsimony.

## ORCID

*João F. Guassi Moreira* (iD) http://orcid.org/0000-0001-8312-4487

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