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The *OXTR* rs53576 impacts moral permissibility of attempted but failed harms in populations of students and prisoners

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Abstract

Previous research has highlighted the roles of oxytocin in empathy and altruistic behaviors. Based on these findings, recent studies have examined the association between the oxytocin receptor gene (*OXTR*) and outcome-based moral judgment with sacrificial dilemmas (e.g. runaway trolley case). However, little is known about the relationships between *OXTR* polymorphisms and intent-based moral judgment of harms (e.g. attempted but failed harm or intentionally committed harm). This study investigated the association between the *OXTR* rs53576 and intent-based moral judgment in college students ($N = 544$) and prisoners ($N = 540$). Results indicated that both students and prisoners with the GG genotype of *OXTR* rs53576 rated attempted but failed harm as less permissible than those with the AA and AG genotypes. These findings highlight the role of the *OXTR* gene in intent-based moral judgment.

Key words: moral judgment; accidentally committed harm; attempted but failed harm; intentionally committed harm; oxytocin receptor gene

Introduction

Evaluating the permissibility of harms committed intentionally *vs* accidentally is a typical intent-based moral judgment. This ability emerges firstly in childhood and greatly determines one's consequent morality (Cushman *et al.*, 2013; Proft and Rakoczy, 2019). Differently from outcome-based moral judgment, in which individuals judge the permissibility of preserving a greater number of people's well-being at the cost of a few others' welfare (Greene *et al.*, 2001), intent-based moral judgment greatly depends on how the observer understands the actor's intention behind committed harms and how he/she perceives the victim's pain (Cushman *et al.*, 2013). Based on the evolutionary origins and the neurobiological roots underlying the capacity of making moral judgment (Gaitan Torres, 2012; Marazziti *et al.*, 2013), studies have provided evidence on the biological basis of utilitarian moral judgment (Pellegrini *et al.*, 2017; Gong *et al.*, 2017b; Yang *et al.*, 2019). However, little is known about the biological basis of intent-based moral judgment. This study aimed to investigate whether the oxytocin receptor gene (*OXTR*), a gene involved in the ability to understand others' intention (Gong *et al.*, 2017a; Giralt-Lopez *et al.*, 2020), is related to intent-based moral judgment.

Studies have demonstrated the roles of oxytocin in empathic response to interpersonal harms (Tabak *et al.*, 2011), altruistic punishment and adherence to fairness norms (Radke and de Bruijn, 2012; Hu *et al.*, 2016; Aydogan *et al.*, 2017). Inspired by these findings, genetic association studies investigated the relationships between *OXTR* polymorphisms and moral judgment (Walter *et al.*, 2012; Bernhard *et al.*, 2016; Shang *et al.*, 2017; Palumbo *et al.*, 2020). Specifically, a study with two community samples ($N = 228$ and 332) has revealed that the *OXTR* rs237889 is associated with moral judgment of utilitarian dilemmas (Bernhard *et al.*, 2016), and another recent study with a small sample of male insurance brokers ($N = 129$) has indicated that the *OXTR* polymorphisms (i.e. accumulative scores on rs53576, rs2268498 and rs1042770)

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are associated with moral permissibility of dilemmas (Palumbo *et al.*, 2020). Moreover, a study with 154 students has revealed that the *OXTR* rs2268498 is associated with intent-based moral judgment of accidentally committed harm (Walter *et al.*, 2012), suggesting that action consequence, but not the actor's intention, modulates the association between the *OXTR* and moral judgment.

The *OXTR* rs53576 is the most widely investigated polymorphism in the *OXTR* gene. This polymorphism is related to empathic response and theory of mind (Wu and Su, 2015; Gong *et al.*, 2017a; Luo *et al.*, 2019). Specifically, the G allele carriers show greater empathic response and better ability of understanding others' mental states than the AA homozygotes (Wu and Su, 2015; Gong *et al.*, 2017a; Luo *et al.*, 2019), suggesting that individuals with the G allele perform better in understanding and sharing other's feelings in moral situations. Moreover, the G allele is related to higher sensitivity to intentionally committed harm (Kushner *et al.*, 2018) and greater autonomic arousal for social harms (Smith *et al.*, 2014), suggesting that individuals with the G allele are more sensitive to the social salience of moral harms.

Dysfunctions in morality are related to juvenile delinquency (Addad and Leslau, 1989; Stams *et al.*, 2006) and antisocial behaviors (Jaakson *et al.*, 2019). For instance, criminal offenders show delayed developments in moral intuitions, moral reasoning (Aharoni *et al.*, 2011; Spruit *et al.*, 2016; Romeral *et al.*, 2018), and differentiation between moral actions and conventional violations (Lahat *et al.*, 2015). Moreover, individuals with a high risk of crimes exhibit impaired empathy (Rodriguez and Perez, 2015; van Zonneveld *et al.*, 2017) and high callous-unemotional traits (Garcia *et al.*, 2019). Due to these deficits in empathy and morality in criminals, prisoners may show difficulties in perceiving a wrongdoer's malicious intention and a victim's pain in intentional harms.

In summary, this study aimed to investigate the link between the *OXTR* rs53576 and intent-based moral judgment in college students and prisoners. Considering that the relationship between the increase of oxytocin and the sensitivity to social cues depends on contextual variables and inter-individual factors (Shamay-Tsoory and Abu-Akel, 2016), we predicted that the association between the *OXTR* rs53576 and moral judgment may depend on the context of harms (e.g. accidentally committed harm *vs* intentionally committed harm) and the interpreter's characteristics (e.g. the alleles of *OXTR* rs53576 or educational level). Specifically, given that the G allele of *OXTR* rs53576 is related to higher empathic response and greater emotional arousal to social harms (Smith *et al.*, 2014; Gong *et al.*, 2017a), and that the permissibility of attempted but failed harm is greatly shaped by one's belief in the wrongness of the actor's malicious intention (Young and Saxe, 2009; Walter *et al.*, 2012), we predicted that the G allele would be related to less moral permissibility of intentional harms. In addition, given the impairments in empathy and morality in criminals (Rodriguez and Perez, 2015; van Zonneveld *et al.*, 2017), we expected that prisoners would endorse intentional harms as more permissible than students.

Materials and methods

Participants

Sample 1

We recruited participants through an advertisement on the website of a university. Five hundred and forty-four college students (361 females; mean age = 20.1 ± 1.5 years) were included in our study. None of them reported any history of psychiatric, neurological or cognitive disorders in the self-reported questionnaire. Each participant got a ¥10 reward for their participation. This study was in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the College of Life sciences, Northwest University, China.

Sample 2

We included 540 male prisoners who were serving sentences in a prison (mean age = 32.6 ± 9.0 years; sentence term = 21.0 ± 20.1 months). Participants were recruited in the first month of their imprisonment after introductory courses on the adaption to prison and the available mental health services. None of them were diagnosed with a severe somatic pathology or psychopathological disorder. The crime types included violent crime (27.0%), property crime (50.4%), drug-related crime (10.7%), sex crime (5.4%) and others (6.5%). Their educational levels were as follows: 26.7% below middle school, 65.6% middle school and 7.8% above middle school (vocational school, college and others). Each participant was rewarded with a jotter. This study was approved by the ethics committees of the College of Life sciences at Northwest University and the School of Psychology at Shenzhen University.

Moral judgment assessment

The permissibility of moral judgment was measured with a moral transgression task (Young and Saxe, 2009; Walter *et al.*, 2012), in which moral scenarios were created with hypothetical stories with different intentional conditions (harmful *vs* neutral) and action consequences (harmful *vs* neutral). The moral scenarios of attempted but failed harm measured the blame for harmful intention; the scenarios of accidentally committed harm measured the permissibility for harmful action consequence; the scenarios of intentionally committed harm measured the permissibility for harmful intention and action consequence and the scenarios of neutral intention and neutral action consequence were used to reduce the rote responses. Each scenario consists of three parts: foreshadow, actor's belief and action consequence. The foreshadow introduced the setting of a scenario; the actor's belief narrated whether the actor committed a harm accidentally or intentionally and the action consequence stated whether or not the individual suffered a harm (i.e. death) committed by the actor. For each scenario, participants indicated the extent to which the actor's action was permissible (1 = 'totally impermissible' to 7 = 'totally permissible').

In the pencil-and-paper test for students, 24 stories were used to create hypothetical scenarios (Supplementary Material), during which we used a Latin-square procedure to assign the hypothetical scenarios into four experimental lists. Each story was described in four conditions and was assigned to the four experimental lists separately. There were six hypothetical stories for each condition. In the test, 135, 136, 142 and 130 students were assigned to lists 1–4, respectively. In the test for prisoners, due to the time constraints of the test and the relatively slow reading speed, we implemented a short version of the task. For each condition, 3 stories with high readability were selected from the 6 hypothetical stories (see Supplementary Material for details), thus there were a total of 12 stories in the short version. In this test, 123, 148, 132 and 137 prisoners were randomly assigned to lists 1–4, respectively.

Genotyping

We extracted genomic DNA with Chelex-100 method from three to five pieces of hair of each student (de Lamballerie *et al.*, 1994) and extracted DNA from white blood cells with gnomic

DNA Kit (TIANamp: DP304) from 2–3 ml blood of each prisoner. A 231 bp DNA fragment of *OXTR* rs53576 was produced using polymerase chain reaction (PCR), with the upstream primer, 5′- ATCACTGGGTCACCTCAA -3′, and the downstream primer 5′-AACATCTGTCAGGAGCGT -3′. The PCR was conducted with an initial 3 min denaturation at 94°C, followed by 35 cycles of 94°C for 30 s, 62.5°C for 35 s, 72°C for 45 s and a final extension at 72°C for 8 min (Gong *et al.*, 2017b). The 231 bp PCR product was incubated with restriction enzyme BamHI at 37°C overnight.

Statistical analysis

Hardy–Weinberg equilibrium was tested with the FINETTI software (Sasieni, 1997). The effect of harm type on moral permissibility was examined with a repeated-measures analysis of variance (ANOVA) on SPSS 18.0 software (SPSS Inc., Chicago, IL, USA). The effects of *OXTR* rs53576 on moral permissibility were tested using a multivariate analysis (Walter *et al.*, 2012), with educational level (1 = below middle school, 2 = middle school and 3 = above middle school) and sex (1 = male, 2 = female) as covariates. The interactions between harm type and genotype were examined with a 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) × 3 (genotype: GG *vs* AG *vs* AA) mixed ANOVA. The statistical significance was considered at two-tailed $P < 0.05$.

Results

Comparison of the moral permissibility between students and prisoners

Considering that scenarios with neutral intention and neutral outcome did not involve any attempted and committed harm (Walter *et al.*, 2012), we excluded this kind of scenario from the analyses. Accordingly, a 2 (sample type: prisoners *vs* students) × 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) mixed ANOVA on moral permissibility indicated significant effects of sample type, F (1, 1082) = 19.82, $P < 0.001$, partial $\eta^2 = 0.018$, harm type, F (2, 1081) = 1008.68, $P < 0.001$, partial $\eta^2 = 0.651$, and the interaction between them, F (2, 1081) = 19.07, $P < 0.001$, partial $\eta^2 = 0.034$. Specifically, prisoners rated higher moral permissibility than students in attempted but failed harm (mean ± SE: 2.95 ± 0.07 *vs* 2.41 ± 0.04), t (1082) = 6.88, $P < 0.001$, Cohen's $d = 0.42$, and intentionally committed harm (1.56 ± 0.03 *vs* 1.38 ± 0.02), t (1082) = 4.40, $P < 0.001$, Cohen's $d = 0.27$ (Figure 1). To control for sexual differences, the analysis for male students and prisoners showed that prisoners also rated higher permissibility than male students in attempted but failed harm (2.95 ± 0.07 *vs* 2.45 ± 0.07), t (721) = 4.13, $P < 0.001$, Cohen's $d = 0.39$, and intentionally committed harm (1.56 ± 0.03 *vs* 1. 45 ± 0.04), t (721) = 2.07, $P = 0.039$, Cohen's $d = 0.16$.

Due to a great variance in educational level among prisoners, we included this variable in a 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) × 3 (educational level: below middle school *vs* middle school *vs* above middle school) mixed ANOVA on moral permissibility. The analysis demonstrated significant effects of educational level, F (2, 537) = 5.02, $P = 0.007$, partial $\eta^2 = 0.018$, harm type, F (2, 536) = 190.14, $P < 0.001$, partial $\eta^2 = 0.415$, and the interaction between them, F (4, 1074) = 6.50, $P < 0.001$, partial $\eta^2 = 0.024$. Specifically, post-hoc independent t-tests revealed that higher educational level was associated with less permissibility for attempted but failed harm (1.96 ± 0.17 *vs* 2.93 ± 0.08 *vs* 3.28 ± 0.12, all $Ps < 0.020$) and intentionally committed harm (1.19 ± 0.06 *vs* 1.54 ± 0.04 *vs* 1.73 ± 0.07, all $Ps < 0.023$), but not for accidentally committed harm (3.17 ± 0.26 *vs* 2.88 ± 0.08 *vs* 2.75 ± 0.12, all $Ps > 0.100$).

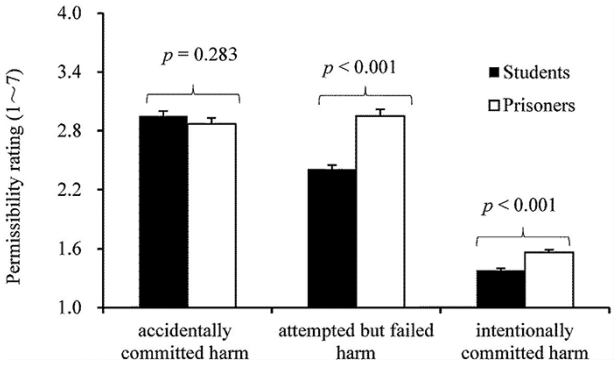

Fig. 1. Permissibility of moral judgment in students and prisoners. Students rated attempted but failed harm and intentionally committed harm as less permissible than prisoners. Error bars represent SEM.

Considering the different crime types among prisoners, we tested whether their moral permissibility was co-varied with crime types in a 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) × 4 (crime type: violent crime *vs* property crime *vs* drug-related crime *vs* sex crime) mixed ANOVA. Thirty-five prisoners who committed other types of crimes were excluded from this analysis because their crimes could not be classified into any of the first four types. The results indicated no significant effect of crime type, F (3, 501) = 2.17, $P = 0.091$, partial $\eta^2 = 0.013$, nor the interaction between crime type and harm type, F (6, 1002) = 0.88, $P = 0.513$, partial $\eta^2 = 0.005$.

Association between the OXTR rs53576 and moral permissibility in students

The genotypes of *OXTR* rs53576 did not deviate from Hardy–Weinberg equilibrium in students (GG = 47, AG = 228, AA = 269, $\chi^2 = 0.02$, $P = 0.893$). Multivariate analysis indicated that the *OXTR* rs53576 was significantly related to the moral permissibility of attempted but failed harm (mean ± SE: GG *vs* AG *vs* AA = 2.10 ± 0.12 *vs* 2.37 ± 0.07 *vs* 2.50 ± 0.07), F (2, 541) = 3.36, $P = 0.036$, partial $\eta^2 = 0.012$ (Figure 2). Post hoc pairwise comparisons indicated a significant difference between the GG and AA groups, t (314) = −2.42, $P = 0.016$, Cohen's $d = -0.41$, a non-significant difference between the GG and AG groups, t (273) = −1.73, $P = 0.085$, Cohen's $d = -0.29$, and a non-significant difference between the AG and AA groups, t (495) = −1.39, $P = 0.164$, Cohen's $d = -0.13$. Moreover, multivariate analysis indicated that the *OXTR* rs53576 was not associated with moral permissibility of accidentally committed harm, F (2, 541) = 0.22, $P = 0.800$, partial $\eta^2 = 0.001$, nor intentionally committed harm, F (2, 541) = 1.75, $P = 0.175$, partial $\eta^2 = 0.006$ (Figure 2). A 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) × 3 (genotype: GG *vs* AG *vs* AA) mixed ANOVA indicated that harm type did not significantly interact with genotype in the moral permissibility, F (4, 535) = 1.60, $P = 0.173$, partial $\eta^2 = 0.006$.

Considering that separate analyses with small subgroups of 361 females and 182 males would lead to lower statistical power, we further examined the associations by controlling for sex as a covariate in the sex-mixed sample. The multivariate analysis with

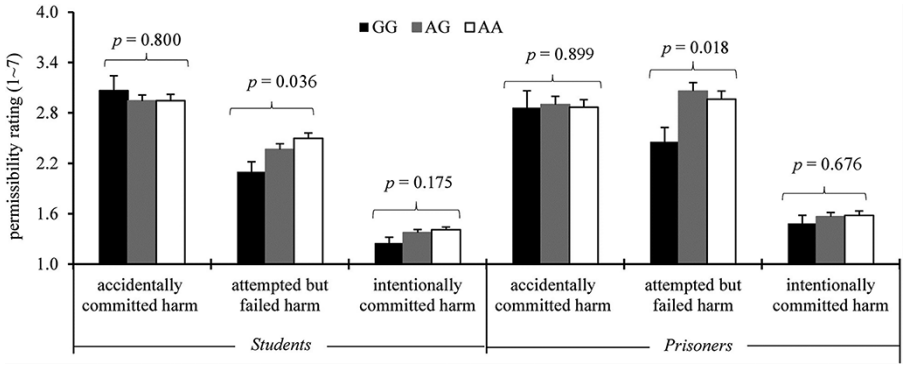

Fig. 2. Effects of the *OXTR* rs53576 on moral judgment. Both students and prisoners with the GG genotype rated attempted but failed harm as less permissible than ones with AA/AG genotype. Error bar represents SEM.

sex as a covariate indicated that the *OXTR* rs53576 was still significantly associated with the moral permissibility of attempted but failed harm, F (2, 540) = 3.24, P = 0.040, partial η^2 = 0.012, but not with accidentally committed harm, F (2, 540) = 0.39, P = 0.680, partial η^2 = 0.001, nor intentionally committed harm, F (2, 540) = 1.50, P = 0.22, partial η^2 = 0.006. Moreover, the 2 (sex: male *vs* female) × 3 (genotype: GG *vs* AG *vs* AA) ANOVAs on the moral permissibility of the three types of harms indicated that genotype did not interact with sex, all Ps > 0.425. Of note, due to the similar educational experiences and academic performance of the students, educational level was not considered in the analysis.

Association between the OXTR rs53576 and moral permissibility in prisoners

The genotypes of *OXTR* rs53576 did not deviate from Hardy–Weinberg equilibrium in prisoners (GG = 63, AG = 237, AA = 240, χ^2 = 0.15, P = 0.700). Similar to the student sample, multivariate analysis showed that the *OXTR* rs53576 was significantly associated with moral permissibility rating of attempted but failed harm in the prisoner sample (mean ± SE: GG *vs* AG *vs* AA = 2.46 ± 0.17 *vs* 3.07 ± 0.10 *vs* 2.96 ± 0.10), F (2, 537) = 4.06, P = 0.018, partial η^2 = 0.015. Post hoc pairwise comparisons indicated significant differences in the permissibility between the GG and AA groups, t (301) = −2.41, P = 0.017, Cohen's d = −0.35, and the permissibility between the GG and AG groups, t (298) = −2.85, P = 0.005, Cohen's d = −0.42. The difference between the AG and AA groups was not significant, t (475) = 0.74, P = 0.461, Cohen's d = 0.07. This polymorphism was not related to the permissibility ratings of accidentally committed harm, F (2, 537) = 0.11, P = 0.899, partial η^2 < 0.001, nor intentionally committed harm, F (2, 537) = 0.39, P = 0.676, partial η^2 = 0.001 (Figure 2). Moreover, a 3 (harm type: accidentally committed harm *vs* attempted but failed harm *vs* intentionally committed harm) × 3 (genotype: GG *vs* AG *vs* AA) mixed ANOVA indicated that harm type did not significantly interact with genotype in moral permissibility, F (4, 1074) = 1.71, P = 0.145, partial η^2 = 0.006. After controlling for educational level, the analysis showed that the *OXTR* rs53576 was again associated with the permissibility of attempted but failed harm, F (2, 536) = 4.40, P = 0.013, partial η^2 = 0.016, and again not with accidentally committed harm, F (2, 536) = 0.08, P = 0.923, partial η^2 < 0.001, nor intentionally committed harm, F (2, 536) = 0.40, P = 0.674, partial η^2 = 0.001.

Discussion

To extend previous findings on the roles of *OXTR* rs53576 in empathy and sensitivity to intentional harms, we investigated the links between this polymorphism and intent-based moral judgment in college students and prisoners. We found that students with the GG genotype of *OXTR* rs53576 rated attempted but failed harms as less permissible than those with the AA genotype. Similarly, prisoners with the GG genotype rated this type of harm as less permissible than those with the AG or AA genotypes.

Unlike the findings that the *OXTR* rs2268498 is associated with the moral permissibility of accidentally committed harm (Walter *et al.*, 2012), we found that the *OXTR* rs53576 is related to the moral permissibility of attempted but failed harm. For intent-based moral judgment, individuals take into account the consequence of action and the actor's intention. According to previous findings (Young and Saxe, 2009; Walter *et al.*, 2012), moral judgment of attempted but failed harm is greatly governed by one's belief in the wrongness of the actor's intention, while judgment of accidentally committed harm is governed by one's empathic response to the victim. Thus, the G allele carriers, with higher theory of mind ability (Wu and Su, 2015) and greater sensitivity to intentional harm (Smith *et al.*, 2014; Kushner *et al.*, 2018), are more capable to detect malicious intention and evaluate the wrongness of intention, and consequently rate attempted but failed harm as less permissible. As for intentionally committed harm, however, the social salience (i.e. a mechanism of attention orienting to salient stimuli) of this type of harm is governed both by the wrongness of intention and the harmful consequence. Given the fact that intentionally committed harm can elicit much stronger emotional aversion than attempted but failed harm (Quan *et al.*, 2021), all individuals judge this kind of harm as impermissible, regardless of which allele they carry.

Previous studies have indicated that other *OXTR* polymorphisms (e.g. rs237889) are associated with moral judgment of utilitarian dilemmas (Bernhard *et al.*, 2016; Palumbo *et al.*, 2020). In contrast to utilitarian moral dilemmas measuring the permissibility of preserving a greater number of people's well-being at the cost of a few persons' welfare (Greene *et al.*, 2001), moral transgression tasks measure the permissibility of the actor's malicious intention (Young and Saxe, 2009; Walter *et al.*, 2012). According to previous studies (Smearman *et al.*, 2015; McDonald *et al.*, 2016; Palumbo *et al.*, 2020), we propose that the impacts of the

OXTR polymorphisms both on utilitarian moral judgment and intent-based moral judgment are governed by the social salience of moral harms. In the case of moral dilemmas, harm to a greater number of people's well-being elicits more social salience than killing one person. Individuals with higher functional *OXTR* alleles (e.g. the C allele of rs237889) are more sensitive to the harm and consequently show higher utilitarian bias, choosing to preserve the well-being of a greater number of people (Bernhard *et al.*, 2016; Palumbo *et al.*, 2020). On the contrary, in the case of intent-based moral judgment, since a harm with malicious intention has greater social salience than an accidental harm, individuals with the GG genotype of *OXTR* rs53576 pay more attention to the wrongness of the actor's intention and the victim's pain and consequently consider the intentional harm as less permissible, even if the harm failed to be committed. These findings indicate that the role of *OXTR* rs53576 in moral judgment depends on the contexts of moral harms (Smearman *et al.*, 2015).

This study revealed that prisoners rated attempted but failed harm and intentionally committed harm as more permissible than students. These findings further suggest a deficit in intent-based moral judgment among prisoners. As compared with accidentally committed harm, both attempted but failed harm and intentionally committed harm bear obvious malicious intention. Prisoners' higher permissibility of intent-based harm may result from their impaired empathy (Rodriguez and Perez, 2015; van Zonneveld *et al.*, 2017) and higher callous-unemotional traits (Garcia *et al.*, 2019). Thus, these findings suggest that prisoners have more difficulties in perceiving the wrongness of the actor's intention and imagining the victim's pain than normal adults.

Consistent with previous findings showing that moral judgments of classic dilemmas are influenced by demographic characteristics (Maeda *et al.*, 2009; Fumagalli *et al.*, 2010), we found that prisoners with high educational level endorsed less moral permissibility than ones with low educational level, suggesting that educational experiences promote moral standards. In this study, the significant association between the *OXTR* rs53576 and moral permissibility of attempted but failed harm emerged both in students and in prisoners, two populations with different demographic characteristics. After controlling for educational level or sex, the genetic association remained significant, suggesting that the role of *OXTR* rs53576 in moral permissibility is independent of the effects of such demographic variables. Specifically, the *OXTR* rs53576 modulates moral judgment through regulating social cognitive abilities of autonomic arousal, attention orientation, empathy and theory of mind (Smith *et al.*, 2014; Wu and Su, 2015; Gong *et al.*, 2017a; Fowler *et al.*, 2018; Luo *et al.*, 2019), while education impacts moral judgment mainly through cultivating individual's social norms and moral rules (Brown *et al.*, 2021). Taken together, our findings further highlight the importance of genes (e.g. *OXTR*) and environment (e.g. education) in the development of social norms and pro-social behaviors.

Some limitations should be mentioned. First, the hypothetical scenarios in this study have advantages in manipulating the actor's intention and action consequence. However, this design reduces the ecological validity of moral harms (Redcay and Schilbach, 2019). Second, although the theme of death for moral scenarios can effectively elicit emotional response for the greater wrongness of malicious intention and the severity of the outcome, these scenarios reduce the generalization of our findings in life events. Third, although the hypothetic scenarios assessed in prisoners were selected from the long version assessed in students, the different versions possibly compromised the comparison of moral judgment between groups.

Conclusion

This study demonstrated that students and prisoners with the GG genotype of *OXTR* rs53576 judged attempted but failed harm as less permissible than those with AA and AG genotypes. These findings highlight the importance of the *OXTR* gene in intent-based moral judgment.

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Conflict of interest

The authors declared that they had no conflict of interest with respect to their authorship or the publication of this article.

Supplementary data

Supplementary data is available at *SCAN* online.

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