

## The impact of patients' hostile attribution bias on aggression in doctor-patient interactions

Jie Liu <sup>a,1</sup>, Hong Zheng <sup>b,1</sup>, Lu Lu <sup>a</sup>, Hongying Liu <sup>c,\*</sup>, Xiongwei Xu <sup>d,\*\*</sup>, Wen He <sup>a,\*\*\*</sup>

<sup>a</sup> School of Psychology, Shanghai Normal University, Shanghai, 200234, China

<sup>b</sup> Changning Mental Health Center Affiliated with East China Normal University, Shanghai, China

<sup>c</sup> Hangzhou Kang Sheng Health Consulting Co., Ltd. Hangzhou 310023, China

<sup>d</sup> School of Education, Shanghai Normal University, Shanghai, 200234, China

### ARTICLE INFO

#### Keywords:

Hostile attribution bias  
Anger  
Implicit aggression  
Explicit aggression  
Doctor-patient interaction

### ABSTRACT

**Background:** Doctor-patient conflict is trending in social attention research. However, the existing literature rarely explores whether a patient's hostile attribution bias (HAB) in the doctor-patient interaction affects the aggression level against doctors.

**Objective:** This study aimed to explore the relationship and mechanism between different types of HAB and aggression in patients.

**Method:** In Study 1, 80 patients completed the word sentence association paradigm for hostility (WSAP-Hostility), and their explicit and implicit aggression levels were measured using the hot sauce paradigm and the single-category implicit association test (SC-IAT), respectively. In Study 2, 63 patients were randomly divided into an experimental (rejection) and a control group. Their state hostile attribution bias (SHAB) was activated through social rejection materials. They completed the SHAB questionnaire and anger expression inventory, and their explicit and implicit aggression levels were measured as in Study 1.

**Results:** In both studies, results indicated that patients' trait and state HAB were significantly related to explicit aggression but not implicit aggression. Hostile interpretation positively predicted explicit aggression, whereas benign interpretation had a negative predictive effect on explicit aggression. Patients' anger played a mediating role between SHAB and explicit aggression.

**Conclusions:** These findings suggest that patients' HAB affects explicit aggression toward doctors and anger plays a mediating role.

\* Corresponding author.

\*\* Corresponding author.

\*\*\* Corresponding author.

E-mail addresses: [liujiie@163.com](mailto:liujiie@163.com) (J. Liu), [zhmm2@163.com](mailto:zhmm2@163.com) (H. Zheng), [1317405064@qq.com](mailto:1317405064@qq.com) (L. Lu), [hongyingliu@91jkys.com](mailto:hongyingliu@91jkys.com) (H. Liu), [xuxw@shnu.edu.cn](mailto:xuxw@shnu.edu.cn) (X. Xu), [hewen@shnu.edu.cn](mailto:hewen@shnu.edu.cn) (W. He).

<sup>1</sup> Jie Liu and Hong Zheng are co-first authors who contribute equally to this work.

<https://doi.org/10.1016/j.heliyon.2024.e23971>

Received 27 April 2023; Received in revised form 6 December 2023; Accepted 1 January 2024

Available online 2 January 2024

2405-8440/© 2024 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

### 1.1. Background of patient aggression toward doctors

The doctor-patient interaction is a complex interpersonal bond that emerges between doctors and patients during medical treatment. However, the issue of doctor-patient conflict has garnered significant social attention recently, with aggressive behavior toward physicians becoming a global public health concern [1]. According to a survey conducted in China, more than 30 % of doctors have experienced violence from patients [2]. Similarly, a study conducted in Iran shows that medical workers are 16 times more likely to be attacked at their workplace compared to workers in other professions [3]. However, such incidents are not limited to middle-income countries, they also occur in high-income countries such as Germany, Australia, and the United Kingdom [1]. The incidence of aggression displayed by patients is on the rise, and hospitals worldwide are facing significant challenges in this regard [4–6].

Aggression in the doctor-patient interaction refers to intentional aggression of patients toward medical staff and damage to hospital facilities during treatment or while waiting in medical institutions. This behavior can manifest in various forms, including verbal abuse, accusations, and violent destructive actions [7]. Such behavior can contribute to multiple hazards. For instance, doctors who reported experiencing a physical attack were 6.7 times more likely to report PTSD symptoms and experience anxiety and depression [6]. Moreover, these behaviors have wide-ranging implications, affecting not only the aggressors and medical staff but also patients' families, other patients, and bystanders [8,9]. Furthermore, the quality of care provided can deteriorate in an unsafe hospital working environment [9,10]. In response to patients' aggressive behavior, healthcare institutions have initiated structured team responses, such as "Code Grey" [11]. This approach aims to manage aggression incidents within healthcare settings. Researchers in China have explored ways to alleviate the tension between doctors and patients by adopting an inter-group perspective, with a common in-group identity [12]. This approach promotes a sense of shared identity and understanding between doctors and patients, ultimately fostering better communication and reducing conflict.

### 1.2. Hostile attribution bias in healthcare

As doctor-patient interactions occur in various specific contexts, aggression toward doctors can be attributed to various external environmental factors. For example, research has indicated that physical aggression by patients toward healthcare personnel correlates with a heightened probability of medication errors or delays in medication administration by medical professionals [10]. Additionally, other precipitating factors for aggressive behaviors include sex [13], age [5], substance abuse, and organic diseases, such as metabolic disorders and dementia [4,14]. Furthermore, internal psychological and cognitive factors may contribute to aggression. The social information processing (SIP) theory suggests that aggressive behavior can be influenced by hostile attribution bias (HAB), which is characterized by interpreting ambiguous situations as threatening and can contribute to heightened hostility [15]. Individuals who have a predisposition toward distrustfulness or feeling threatened are more likely to respond to situations with opposition or aggression [16]. Furthermore, certain traits cause individuals to frequently display aggression against others, often due to a susceptibility toward HAB and having expectation biases [15,17].

### 1.3. Influence of HAB on aggression

Aggression toward doctors may be attributed to a lack of effective communication [1]. In medical treatment, patients and their relatives may exhibit aggressive behavior due to mistakenly attributing vague situational information in the doctor-patient interaction as hostile and unfriendly. HAB refers to one such cognitive bias and occurs when individuals interpret ambiguous information about the environment or others' actions as indicative of hostile intentions [18,19], and it can be categorized into trait hostile attribution bias (THAB) and state hostile attribution bias (SHAB) based on stability across time and consistency across situations [18]. THAB is a stable and unchangeable general tendency in individuals to perceive hostility, which can affect social cognition [20]. It is typically measured through self-report questionnaires on the interpretation of ambiguous scenarios [21–23]. However, SHAB is more susceptible to environmental influence and can be assessed by creating specific situations where participants judge the hostility of others' behavioral intentions [24,25]. Furthermore, social rejection increases the tendency to perceive neutral information as hostile, thus triggering SHAB in participants [26]. Therefore, the social rejection paradigm can trigger patients' SHAB [27]. Additionally, HAB has been shown to be a risk factor for adolescent aggression development [28]. Meta-analyses have consistently revealed a significant association between HAB and aggressive behaviors in children [29] and adults [30]. However, few studies have explored the relationship between HAB and aggression within the doctor-patient interaction, and its underlying mechanism, whereas HAB in patients may significantly predict aggression toward doctors.

Explicit aggression involves conscious acts of harm directed toward others, such as shouting, making threats, or engaging in physical altercations [31,32], whereas implicit aggression involves automatic processes that affect the perceptual, attitudinal, judgmental, and reactive aspects of aggression [33,34]. In a healthcare context, a patient displaying implicit aggression might purposefully ignore medical professionals or actively evade communication, thereby subtly expressing their discontent or animosity. Conversely, a patient exhibiting explicit aggression might elevate their voice, employ offensive language, or engage in physical confrontations with medical personnel during moments of disagreement. Studies have demonstrated that patients display both explicit [35] and implicit aggression toward doctors [36]. Explicit aggression can directly undermine the harmony of doctor-patient interactions, while implicit aggression poses a latent threat to the relationship [36]. Although some research has found that individuals with a pronounced THAB exhibit higher levels of both explicit and implicit aggression [37,38], other studies have shown a limited correlation between explicit

and implicit aggression, indicating different psychological processing mechanisms [39]. Besides, individuals with high levels of explicit and implicit aggression display similar attentional biases, such as toward negative facial stimuli and aggressive words [40,41]. Therefore, considering the impact of HAB on both explicit and implicit aggression is crucial in the context of doctor-patient interactions.

#### 1.4. The role of anger in SHAB and explicit aggression

The computations of the hostile biases model indicate that emotional factors, such as anger, play a significant role in encoding hostility [42,43]. Anger has been found to interfere with higher-level cognitive processes, including moral reasoning and judgment, as well as the reappraisal process [44]. HAB may trigger anger, especially in ambiguous social environments. Research has demonstrated that individuals with high HAB levels tend to perceive hostility, leading to feelings of anger and subsequent engagement in retaliatory or defensive aggressive behavior [19]. According to the “hot system” of emotional motivation, individuals with HAB activate the underlying basis of anger [45]. This activation of anger may increase aggression as individuals seek to alleviate their anger and protect themselves [43]. The integrative cognitive model posits that HAB can contribute to aggression by inducing anger [46]. Within doctor-patient interactions, induced SHAB may further amplify feelings of anger, subsequently increasing explicit aggression toward healthcare providers. Therefore, we hypothesize that anger may mediate the connection between SHAB and explicit aggression.

#### 1.5. Objectives and hypotheses of the current study

Previous studies on the relationship between HAB and aggression have primarily focused on children, teenagers [47], and college students [48]. However, there is a limited exploration of whether patient’s HAB in the doctor-patient interaction affects the aggression level against doctors. Additionally, studies have revealed that patients exhibit explicit [35] and implicit aggression [36] toward medical staff. Since implicit and explicit aggression operate within different cognitive processing systems [39] while demonstrating similar attribution biases toward aggressive words [41], they should be considered simultaneously. Therefore, what sets this study apart from previous research is that it focuses on patients as the investigation topic, specifically examining the impact of patients’ HAB on both explicit and implicit aggression directed toward doctors within the context of doctor-patient interactions. Furthermore, anger serves as a direct driver of aggression [44] and individuals are likely to externalize anger in the form of language or physical actions toward their surrounding environment [49]. Despite the crucial role of anger in aggression and its trigger susceptibility in an ambiguous social situation through hostile interpretations, few studies have investigated its potential effect on the doctor-patient relationship, by using doctor-patient interaction scenarios to induce a patient’s SHAB. Thus, from the doctor-patient interaction’s perspective, this study aims to examine the influence and mechanism of both trait and state HAB on explicit and implicit aggression using questionnaires and experimental methods. We make the following hypotheses:

**Hypothesis 1.** The THABs of patients are positively correlated with explicit aggression toward doctors.

**Hypothesis 2.** The THABs of patients are positively correlated with implicit aggression toward doctors.

**Hypothesis 3.** The SHABs of patients are positively correlated with explicit aggression toward doctors.

**Hypothesis 4.** The SHABs of patients are positively correlated with implicit aggression toward doctors.

**Hypothesis 5.** Anger mediates between SHAB and explicit aggression.

## 2. Study 1

### 2.1. Method

Study 1 examined the influence of patients’ THAB on both explicit and implicit aggression toward doctors. We utilized the word sentence association paradigm for hostility (WSAP-Hostility) to measure THAB in patients. Subsequently, we employed the hot sauce paradigm to assess patients’ explicit aggression, while SC-IAT measured their implicit aggression.

#### 2.1.1. Materials and procedure

Patient participants were recruited using a convenience sampling method from a tertiary hospital outpatient department, considering the computer-based nature of the SC-IAT and potential challenges faced by older individuals in operating computers, as well as possible comprehension biases, participants from older age groups were excluded from the study and this age exclusion criterion was not predetermined in advance. Moreover, sex balance was managed by adapting to the availability of participants. For instance, when a surplus of male participants existed, extra efforts were made to approach female patients for inclusion in the study. For Study 1, the sample size was estimated using G\*Power 3.1 software. A sample size of 75 was determined with a significance level ( $\alpha$ ) of 0.05, a statistical power ( $1 - \beta$ ) of 0.85, and a moderate effect size (Cohen’s  $d$ ) of 0.3. This calculation allowed us to ensure that our study had a reasonable chance of detecting significant effects while minimizing biases. Ultimately, 80 patients from the general outpatient service of two Grade-A tertiary hospitals and a university health center in Shanghai participated in this study. The sample comprised 38 men (47.5 %) and 42 women (52.5 %), with ages ranging from 20 to 33 years and an average age of 25.35 (SD = 3.09). All participants had normal or corrected vision and normal taste, and they signed voluntary consent forms. Normal taste refers to

participants possessing regular taste sensitivity and perceptual ability, thereby safeguarding the reliability of the experimental outcomes. The study was conducted following the ethical guidelines and approved by the institutional review board and all collected data were kept confidential and personal identifiers were removed. During the experiment, participants first completed demographic information, including sex, age, and education level, followed by the WSAP-Hostility questionnaire. Subsequently, the levels of implicit and explicit aggression were measured using the SC-IAT and hot sauce paradigm. To balance potential order effects, half of participants underwent hot sauce paradigm first, while the other half started with SC-IAT. After completing the experiment, participants received compensation.

**The Word Sentence Association Paradigm for Hostility (WSAP-Hostility).** We measured THAB using the WSAP-Hostility questionnaire [21], which has been widely used in previous studies in China with normal populations and has demonstrated strong psychometric properties [50]. This questionnaire comprises ambiguous sentences describing various events or scenarios (e.g., “Someone slammed the door in front of you”) followed by a hostility-related word (e.g., “Insulting”) or (“Your friend refused your dinner invitation”) followed by a benign word (“Busy”). There were 16 sentences paired with hostility-related words and another 16 paired with benign words. Participants were asked to rate the sentences and the words on a scale ranging from 1 (*not at all similar*) to 6 (*extremely similar*), indicating the perceived relatedness of the sentences and words. The THAB index was calculated as the difference between the average scores of hostile interpretations and benign interpretations. The internal consistency for both the hostile interpretation and benign interpretation subscales was 0.74 and 0.86, respectively.

**The single-category implicit association test (SC-IAT).** This study employed the SC-IAT [51] to assess implicit social cognition and the strength of evaluative associations with a single attitude object to examine patients’ implicit aggression toward doctors [52]. In contrast to some questionnaires that directly measure attitudes toward specific entities, this method astutely utilizes reaction times between conceptual words and attribute words as a measurement indicator, rendering it more accessible for participants to engage with. The SC-IAT consists of two stages: the compatible task and the incompatible task. Each stage begins with 24 practice trials, followed by 48 test trials [53]. In each stage, participants are required to provide rapid and accurate responses to words displayed on the screen. The vocabulary is divided into two categories: conceptual words representing “doctor” (such as physician, practitioner, healthcare personnel), and the other consists of attribute words (such as aggressive, non-aggressive). In the compatible task, participants press the “F” key if the presented target word is related to the doctor or an aggressive word, and the “J” key if it is a non-aggressive word. In the incompatible task, participants press the “F” key if the presented target word is an aggressive word and the “J” key if it is related to the doctor or non-aggressive word. For a detailed procedure, please refer to Fig. 1. To balance the experiment, some participants first performed the compatible task, while others first completed the incompatible task.

The selection of conceptual and attribute words was made by psychology graduate students according to standard procedures. Each target word appeared at the center of the screen, and feedback was provided to participants regarding the accuracy of their responses. To ensure balanced probabilities for left and right key press, in the compatible task, words representing “doctor,” “aggressive,” and “non-aggressive” were presented at a ratio of 1:1:2, ensuring a 50 % occurrence for both left and right key presses. In the incompatible task, words representing “aggressive,” “doctor,” and “non-aggressive” were presented at a ratio of 2:1:1, also resulting in a 50 % occurrence for both left and right key presses (Table 1 shows the specific process). Data from the formal experiment with reaction times exceeding 10,000 ms or falling below 350 ms were excluded. IAT scores were calculated using the more recent D-score method, which entails subtracting the mean of the incompatible task from the mean of the compatible task and then dividing this difference by the standard deviation of all response latencies (correct reactions) in both tasks [51]. The D-score represents the patient’s implicit aggression toward the doctor, with higher scores indicating a higher implicit aggression level.

**The hot sauce paradigm.** This study adopted a hot sauce paradigm to assess patients’ aggressive tendencies toward a target, allowing them to express explicit aggression by choosing the amount of extremely spicy hot sauce allocated to a doctor who was perceived as hostile [54]. It is valid as spicy food has been used in real-world assaults [55] and some child abuse cases [54]. Moreover, this paradigm offers the advantage of easy quantification, making it a valid and practical measure of laboratory aggression. Participants were initially asked to rate their perceived spiciness of the prepared hot sauce on a scale from 1 (*extremely hot*) to 7 (*not hot at all*) as well as their level

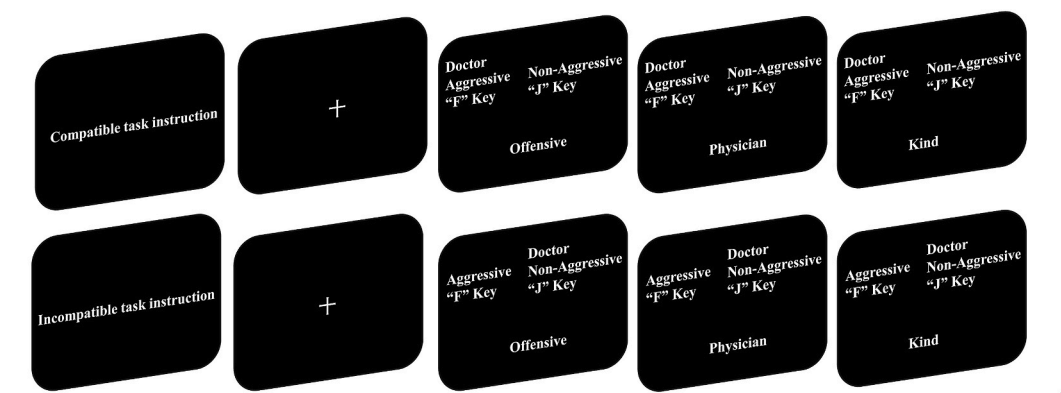


Fig. 1. Flowchart for the single-category implicit association test.

**Table 1**  
The procedural model of the single-category implicit association test.

Block	Trials	Function	Response	
			F-key response	J-key response
1	24	Practice	assault + doctor	Friendly
2	48	Test	assault + doctor	Friendly
3	24	Practice	assault	Friendly + doctor
4	48	Test	assault	Friendly + doctor

of preference for the hot sauce, ranging from 1 (*like it extremely*) to 7 (*do not like it at all*), ensuring that they did not like the spicy food. Researchers then explained to the patients that a taste preference experiment would be conducted later. Patients were given the freedom to decide the amount of hot sauce to allocate to the participating doctors, being aware that the doctor disliked spicy foods and would be required to consume the entire sample. The procedure involved using disposable spoons to scoop the hot sauce into a paper cup with a lid. Once the allocation was completed, the cup was sealed with the lid. Patients were informed that the experiment would be conducted anonymously, and aggression was measured as the weight in grams of hot sauce allocated to the doctor; the more sauce allocated, the higher the level of explicit aggression [54].

## 2.2. Results

We employed the Pearson correlation to compute the correlation coefficients between the continuous variables. Table 2 shows basic descriptive data for THAB, hostile interpretation, benign interpretation, implicit aggression, and explicit aggression. As expected, explicit aggression showed a significant positive correlation with both THAB and hostile interpretation ( $r = 0.36, p < 0.01$ ; and  $r = 0.25, p < 0.01$ , respectively), which support Hypothesis 1. However, there was no significant correlation between implicit aggression and THAB, which does not support Hypothesis 2. Additionally, hostile and benign interpretations significantly correlated with THAB ( $r = 0.83, p < 0.01$ ;  $r = -0.51, p < 0.01$ , respectively). Therefore, we used explicit aggression as the dependent variable and hostile and benign interpretations as predictive variables for linear regression. The results revealed that patient's hostile interpretation positively predicted explicit aggression ( $\beta = 0.25, p < 0.05$ , 95%CI [0.11, 1.77]), while benign interpretation had a significant negative predictive effect ( $\beta = -0.36, p < 0.01$ , 95%CI [-1.67, -0.43]), see Table 3 for specific results.

## 2.3. Discussion

The results of Study 1 revealed a significant positive correlation between patients' THAB and their explicit aggression toward doctors. Specifically, hostile interpretation positively predicted aggression, while benign interpretation showed a negative relationship. These findings aligned with our hypothesis 1 and previous research, indicating that individuals who interpreted ambiguous situations as hostile were more likely to display higher explicit aggression levels [19,20]. Longitudinal studies have supported the predictive nature of HAB in future aggression, particularly among adolescents [28,56]. However, no significant correlation was found between THAB and implicit aggression. This outcome implies that THAB reflects an inherent disposition toward aggression [15]. Individuals with higher THAB levels are often more prone to engaging in explicit aggression because of their increased likelihood of interpreting environmental cues or others' behavior as hostile [19]. However, implicit aggression toward doctors is a less observable attitude and may be influenced more by patients' individual medical experiences [57]. Prior research has demonstrated that patients' implicit aggression toward doctors increases after recalling medical setbacks [36]. In other words, the development of implicit aggression toward doctors appears to rely more on personal experiences, such as frustrating medical encounters. Therefore, Study 1 suggests that in the absence of direct doctor-patient interaction, THAB may not directly influence patients' implicit aggression toward doctors. However, explicit aggression toward doctors often manifests the inherent tendency to behave aggressively in patients with high levels of THAB. Hence, Study 2 investigates the impact of SHAB induced by doctor-patient interactions on both explicit and implicit aggression toward doctors.

**Table 2**  
Descriptive statistics and Pearson correlations between measures of trait hostile attribution bias, interpretation, and aggression.

Variables	M	SD	1	2	3	4
1 THAB	-16.46	18.62				
2 Hostile Interpretation	47.90	9.29	0.83**			
3 Benign Interpretation	64.36	12.05	-0.90**	-0.51**		
4 Implicit Aggression	-0.16	0.49	0.08	0.04	-0.09	
5 Explicit Aggression	2.35	2.21	0.36**	0.25**	-0.36**	0.19

Note: THAB = trait hostile attribution bias, \*\* $p < 0.01$ .  $N = 80$ . All tests were two-tailed. This table shows the general means, standard deviations, and correlations of the four major variables.

**Table 3**  
Linear regression analysis of trait hostile attribution bias and explicit aggression.

Dependent variable	Predictor variable	$R^2$	$F$	Beta	$t$	95 % CI
Explicit aggression	Benign interpretation	0.13	11.48	-0.36	-3.39**	[-1.67, -0.43]
	Hostile interpretation	0.06	5.11	0.25	2.26*	[0.11, 1.77]

\* $p < 0.05$ , \*\* $p < 0.01$ .  $N = 80$ .

### 3. Study 2

#### 3.1. Method

As mentioned above, HAB can be categorized into THAB and SHAB [18]. Differing from THAB, SHAB refers to a cognitive interpretation bias stimulated by external environmental factors more situational and temporary. Study 1 focused on individuals' trait-based propensity for aggression, whereas Study 2 aimed to investigate how situation-induced SHAB influences explicit and implicit aggression by inducing certain situations through the social rejection paradigm. Participants' anger was measured to explore the influence of SHAB and aggression in doctor-patient interaction.

##### 3.1.1. Materials and procedure

Study 2 employed a between-subjects experimental design. Initially, a sample size of 26 participants per group was determined based on specific parameters, including a significance ( $\alpha$ ) of 0.05, a statistical power ( $1 - \beta$ ) of 0.8, and a large effect size (Cohen's  $d$ ) of 0.7. However, the actual participant recruitment exceeded this calculated size. In total, 63 patients from two Grade-A tertiary hospitals and a university health center in Shanghai participated in this study and provided voluntary consent. Participants were randomly assigned to either an experimental group (the rejection group) or a control group. The experimental group consisted of 32 participants (18 men and 14 women), with an average age of 26.25 years ( $SD = 3.83$ ). The control group comprised 31 participants (16 men and 15 women), with an average of 25.74 years ( $SD = 3.78$ ). All participants had normal or corrected vision and normal taste. The participants first completed the WSAP-Hostility questionnaire and thereafter their SHAB were activated through social rejection materials. Subsequently, they completed the SHAB questionnaire and anger expression inventory to assess their SHAB and anger levels after being rejected by the doctor. Implicit and explicit aggression levels were measured thereafter, using the SC-IAT and hot sauce paradigm as in Study 1. To mitigate the potential influence of order effects, half of participants began with hot sauce paradigm, while the other half started with the SC-IAT.

*Activating materials of SHAB.* In Study 2, we utilized social rejection [26] to induce SHAB in patients. Participants were informed that they would be engaging in a task with a doctor. Before the task, the parties introduced themselves and decided whether to proceed with the task together. Participants in both groups received a prepared letter of introduction from the doctor, but the feedback after reading it was different. The experimenter stated the following:

The experimental group: "I don't know what happened, but your doctor partner is unwilling (refused) to continue to complete the next task with you after reading your introduction."

The control group: "I'm sorry, your doctor partner will not be able to complete the next task with you. I guess he had to leave early because of an emergency in the hospital."

*The SHAB questionnaire.* To measure participants' SHAB, we used five items developed by Barlett et al. [24]. Items included: "In the previous task, the doctor was offensive to me," and "In the previous task, the doctor was hostile to me." Participants rated items ranging from 1 ("not consistent at all") to 5 ("very consistent") to indicate their agreement with the engagement items. High scores, also an indicator of operational effectiveness, indicated high levels of SHAB ( $\alpha = 0.84$ ).

*Anger Expression Inventory.* Spielberger's State-Trait Anger Expression Inventory (STAXI) was used to evaluate anger experience and expression [58,59]. We used the subscale of the STAXI adapted by Tao [60] to evaluate anger. It comprises 15 items on a 4-point scale. Some items were as follows: "I feel irritated," "I feel like swearing," and "I am burned up." High scores indicated high levels of anger ( $\alpha = 0.76$ ).

#### 3.2. Results

*Manipulation check.* To test the effect of SHAB manipulation, we recruited an additional 30 patients in advance, enrolled in the general outpatient service of Grade-A tertiary hospitals who had participated in the pre-experiment. These patients volunteered to participate in this study. They were randomly divided into an experimental group and a control group; 15 participants were in the experimental group (7 men and 8 women), and the average age was 26.27 years ( $SD = 4.39$ ). The control group consisted of 15 participants (6 men and 9 women), aged 27.53 years ( $SD = 3.98$ ). We employed an independent sample  $t$ -test to conduct the analysis, and the data conformed to the assumptions of homogeneity of variances and normal distribution. For THAB, the result revealed that there is no significant difference between the experimental and control groups,  $t(28) = 0.17, p = 0.87$ . As expected, the experimental group was manipulated to feel social rejection from doctors and displayed significantly more SHAB than the control group [ $M = 4.19$ ;  $M = 3.11, t(28) = 3.35, p < 0.01, d = 1.22, r = 0.52$ ]. This indicated the effectiveness of manipulation.

*Control of two groups in THAB and hot sauce paradigm.* For THAB: consistent with the pre-experiment results, there was no significant difference between the experimental ( $M = -0.77, SD = 1.13$ ) and control groups [ $M = -0.70, SD = 0.68, t(61) = -0.34, p > 0.05$ ] in

the THAB score. However, there was a significant difference between the two groups regarding SHAB [ $M = 4.22$ ,  $M = 3.17$ ,  $t(61) = 5.96$ ,  $p < 0.001$ ,  $d = 1.49$ ,  $r = 0.60$ ]. For the hot sauce experiment: there was no significant difference between the experimental ( $M = 6.03$ ,  $SD = 1.03$ ) and control groups [ $M = 6.00$ ,  $SD = 0.89$ ,  $t(61) = 0.13$ ,  $p > 0.05$ ] in the “spicy” score. The same result was reflected in the “like” degree score [ $M = 5.25$ ,  $SD = 1.59$ ;  $M = 5.03$ ,  $SD = 1.72$ ,  $t(61) = 0.52$ ,  $p > 0.05$ ]. This result indicated that it was reliable to use the hot sauce as the explicit aggression criterion.

**Explicit and implicit aggression.** An independent samples *t*-test of the hot sauce revealed significant differences between the experimental ( $M = 2.99$ ,  $SD = 1.84$ ) and control groups [ $(M = 1.24$ ,  $SD = 0.91)$ ,  $t(61) = 4.75$ ,  $p < 0.001$ ,  $d = 1.21$ ]. There was no significant difference in the D-score between the experimental ( $M = -0.04$ ,  $SD = 0.45$ ) and control groups [ $(M = 0.03$ ,  $SD = 0.40)$ ,  $t(61) = -0.56$ ,  $p > 0.05$ ]. Additionally, the anger level in the experimental group ( $M = 24.50$ ,  $SD = 2.74$ ) was significantly higher than that in the control group [ $M = 19.03$ ,  $SD = 2.01$ ;  $t(61) = 9.02$ ,  $p < 0.001$ ,  $d = 2.28$ ].

**The mediating effects of anger.** Our results showed a significant correlation between SHAB, anger, and explicit aggression, but the correlation with implicit aggression was nonsignificant (see Table 4). This finding supports Hypothesis 3 and does not support Hypothesis 4. Furthermore, this study examined the influence of SHAB on explicit aggression and the mediating role of anger. Model 4 in PROCESS of SPSS was used to analyze the mediating effect of anger, and the bootstrap method was used to estimate the 95 % confidence interval of 5000 samples for the mediating effect test. Table 5 presents the regression analysis results for each variable. The results showed that SHAB positively predicted explicit aggression ( $\beta = 1.03$ ,  $F = 22.5$ ,  $p < 0.001$ ) and anger ( $\beta = 1.50$ ,  $F = 81.35$ ,  $p < 0.001$ ). Using SHAB and anger as predictive variables and explicit aggression as the outcome variable, the regression equation was not significant ( $\beta = 0.33$ ,  $F = 17.16$ ,  $p > 0.05$ ). The mediating effect test results are shown in Table 6 and Fig. 2 shows the path of the mediating effect. The indirect effect of anger was significant (IE = 0.70, 95 % CI = [0.26, 1.27]), whereas the direct effect of SHAB on explicit aggression was not significant (DE = 0.56, 95%CI = [-0.50, 1.61]). This finding support Hypothesis 5 and implied that anger fully explained the association between SHAB and explicit aggression.

### 3.3. Discussion

In Study 2, we explored the influence of SHAB on explicit and implicit aggression and the mediating role of anger. These results are consistent with prior research indicating that SHAB significantly positively predicted explicit aggression [19,61]. Furthermore, this study demonstrated that anger played a crucial mediating role between SHAB and explicit aggression, fully mediating the relationship. The mediation analysis helps us understand how SHAB influences explicit aggression, that is, when individuals have SHAB, they are more likely to experience increased feelings of anger, which, in turn, leads to higher explicit aggression levels. These results align with previous studies [62], indicating that when patients attribute hostility to a doctor's rejection, it can trigger feelings of anger and repetitive thoughts about the perceived injustice, ultimately contributing to aggressive behavior [19,63]. These findings provide valuable insights into the complex interplay between SHAB, anger, and aggressive behavior in the context of doctor-patient interactions. Understanding these relationships can inform interventions aimed at reducing aggression and improving the quality of doctor-patient interactions.

## 4. General discussion

This study investigated the relationship between HAB and aggression, and the results support our hypotheses 1 and 3, indicating that patients' HAB is positively and significantly correlated with their explicit aggression toward doctors, regardless of whether it is THAB or SHAB. This finding supports previous research suggesting that a crucial aspect of aggressive behavior involves interpreting ambiguous behaviors of others as hostile or threatening [30]. Additionally, our results further demonstrated the mediating role of anger in the relationship between SHAB and explicit aggression, which is consistent with previous studies that individuals who experience heightened anger in response to provoking situations are more likely to engage in aggressive behavior [64]. According to SIP theory, social cognition plays an important role in determining an individual's aggressive behavior [15]. The theory highlights two stages of information processing relevant to hostile reactivity. The first stage is attending to and encoding hostile cues, while the second stage is forming a global interpretation of the context [15,65]. Biases in either stage can predispose individuals to heightened anger and reactive aggression [46]. Our findings align with and lend support to this theory in several ways.

First, our findings established a significant link between patients' HAB and explicit aggression. They highlighted the role of cognitive biases in shaping aggressive behavior within doctor-patient interactions. Thus, addressing and modifying patients' HAB could potentially reduce instances of explicit aggression toward healthcare providers. Second, our study provides new evidence that SHAB can be experimentally manipulated, consistent with the SIP theory view of HAB as a cognitive-processing factor subject to

**Table 4**

Person correlations between Measures of State hostile attribution bias, Anger, and Aggression ( $N = 63$ ).

	1	2	3	4
1 SHAB	1			
2 Anger	0.76**	1		
3 Implicit Aggression	-0.07	0.04	1	
4 Explicit Aggression	0.52**	0.59**	-0.01	1

Note: SHAB = state hostile attribution bias, \*\* $p < 0.01$ .

**Table 5**  
Multiple linear regression analysis of variables' relationships in the model.

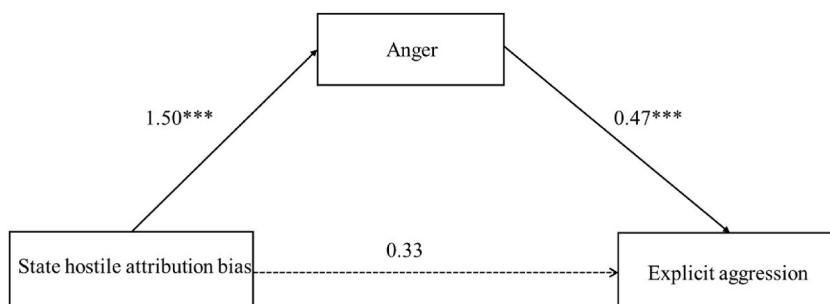
Regression equation		Fitting index			Significance	
Outcome variable	Predictive variable	R	R <sup>2</sup>	F	β	t
Explicit Aggression	SHAB	0.52	0.27	22.55	1.03	4.75***
Anger	SHAB	0.76	0.57	81.35	1.50	9.02***
Explicit Aggression	SHAB	0.60	0.36	17.16	0.33	1.05
	Anger				0.47	2.98**

Note: SHAB = state hostile interpretation bias, N = 63, \*\*p < 0.01, \*\*\*p < 0.001. All variables in the model have been standardized.

**Table 6**  
The direct, indirect, and total effect of the mediation model.

	Effect	SE	95 % CI
Direct effect	0.56	0.53	[-0.50, 1.61]
Indirect effect	0.70	0.25	[0.26, 1.27]
Total effect	1.74	0.37	[1.01, 2.48]

Note. Outcome variable: Explicit aggression; Predictive variable: State hostile attributional bias; Mediator variable: Anger.



**Fig. 2.** The mediation model, N = 63. \*\*p < 0.01, \*\*\*p < 0.001.

situational influences [15]. Third, the mediating effect of anger between SHAB and explicit aggression corroborates the role of anger as an emotional reaction within the SIP framework that links biased cognitions to aggressive behavior [15,46]. Therefore, patients with a higher SHAB level tend to interpret ambiguous situations as hostile, and this biased interpretation amplifies negative emotions, such as anger [44], ultimately leading to increased aggression [66,67]. Further, the multiple systems model of angry rumination [64] proposes that becoming deeply immersed in anger is a risk factor for aggression. In the context of patients with SHAB, their tendency to interpret situations as hostile may trigger feelings of anger, leading to retaliatory or defensive aggressive behavior [68]. Therefore, incorporating anger management strategies into healthcare settings may help patients cope with negative emotions and reduce aggressive responses.

Moreover, in considering the generalizability of our findings, it is crucial to acknowledge the potential impact of cultural and healthcare context variations. The relationships identified between HAB and aggression in our study may vary across diverse cultural norms and healthcare systems with distinct patient-doctor power dynamics. Existing research indicates that people from different cultures hold different beliefs about health, illness and communication [69]. These factors influence establishing an effective and satisfying doctor-patient relationship. Notably, communication styles diverge in individualism-collectivism cultures. Asians, characterized by a collectivistic orientation, often exhibit a communication style that is less assertive and direct compared to Americans, who lean towards individualism [69]. Moreover, collectivists focus more on situational and paralinguistic cues while individualists emphasize message content [69,70]. Such differences can increase risks of miscommunication and patients' HAB. Additionally, the relationship between HAB and aggression may depend on patient-doctor power dynamics. In some models, doctors make decisions while patients passively comply, leading to few fulfilled patient requests. Other model promotes patient-centered care through collaboration, understanding patients' perspectives, and continuity [71]. This patient-doctor partnership through collaboration and trust may mitigate HAB by facilitating more satisfying patient-doctor relationships. Therefore, the relationships we identified between HAB and aggression may manifest differently across healthcare systems and cultures. Future research should further investigate these critical contextual factors.

Contrary to our initial predictions, our study found a nonsignificant relationship between patients' HAB (trait and state) and implicit aggression. These results, which diverge from the results on explicit aggression, suggest the independence of implicit and explicit processing [72,73], which is also consistent with our finding of a nonsignificant correlation between implicit and explicit



aggression. Implicit aggression is a deeper cognitive process and operates at an unconscious level and forms implicit attitudes and cognitions toward the stimulus object [57,74]. These findings are inconsistent with one previous study that shows that recalling one's medical setbacks can intensify patients' implicit aggression toward doctors [36]. Several possible explanations may account for this discrepancy. First, the rejection and provocation induced by the social rejection paradigm may indeed induce patients' SHAB, which subsequently activates anger and leads to explicit aggression [30,44,75]. However, this rejection scenario may not adequately replicate patients' frustration in real healthcare settings. Consequently, it might not genuinely activate patients' implicit aggression toward doctors. Moreover, in the healthcare context in China, doctors hold a relatively high social status, and patients often respect and value their individual capabilities. Research has shown that compared to nurses, patients hold more positive implicit attitudes toward doctors [76]. As a result, patients' implicit aggression toward doctors may be less observable in such a context. Methodologically, although the SC-IAT can measure attitudes toward specific objects, these may reveal more about an individual's associations regarding the environment rather than their absolute attitudes. Therefore, SC-IAT results should be interpreted cautiously [77]. Consequently, compared to the SC-IAT, physiological indicators may be a more sensitive measure of changes in patients' implicit aggression toward doctors following frustrating experiences during doctor-patient interactions [78]. Considering that implicit aggression remains an unconscious tendency and can influence HAB and subsequent explicit aggression [79], it is essential to reduce setbacks in medical experiences and improve doctor-patient interactions. Enhancing the quality of doctor-patient interactions and fostering positive interpretations to facilitate a favorable healthcare experience for patients can help reduce the formation of implicit aggression toward doctors and prevent violence against healthcare professionals.

The relationship between HAB and aggression was influenced by various factors, including personality, sex, and socioeconomic status [19]. Notably, individuals with lower socioeconomic status exhibit greater aggression [80,81] and a stronger association between HAB and aggressive behavior compared to those with higher socioeconomic status [82]. The model of relative deprivation [83] further explains that lower socioeconomic status is often linked to higher levels of perceived disadvantage and insecurity. Therefore, individuals facing economic hardships or social disadvantages may perceive the world as more hostile and resort to defensive behaviors, including aggression, as a means of self-protection [80]. Moreover, patients' mental health status and healthcare providers' communication style are important factors to consider when examining aggression in the doctor-patient interaction. Patients with mental health conditions such as anxiety, depression, or personality disorders may be more vulnerable to aggressive behaviors or have difficulties regulating their emotions. On the healthcare providers' side, factors such as empathetic communication, active listening, and respect for patient autonomy are pivotal in shaping positive interactions and reducing the likelihood of aggression. Therefore, when investigating the impact of HAB on aggression in the doctor-patient interaction, future research should consider these and other influencing factors to develop a more comprehensive understanding and create an optimal doctor-patient interaction environment.

## 5. Conclusion and limitations

This study examined the effects of THAB on patients' explicit and implicit aggression (Study 1) and the effects of SHAB on patients' explicit and implicit aggression (Study 2). Additionally, we assessed the role of anger in SHAB and aggression. Our results showed that both the patient's THAB and SHAB were significantly related to explicit aggression but not implicit aggression. This suggests that patients with high THAB interpreted ambiguous situations as hostile, resulting in the manifestation of aggression toward doctors. Furthermore, inducing patients' SHAB toward doctors through the social rejection paradigm can evoke increased anger, subsequently leading to aggressive behaviors. While patients' implicit aggression toward doctors may not be influenced by THAB. Nevertheless, setbacks or conflicts experienced during medical interactions have undeniable potential to increase implicit aggression, thereby jeopardizing the harmony of doctor-patient relationships [36,84].

In conclusion, our findings enrich the literature by highlighting the importance of considering patients' cognitive biases, specifically HAB, in understanding and managing doctor-patient conflict. Additionally, our study suggests that managing anger can reduce explicit aggression within the doctor-patient relationship. Creating a positive healthcare experience is also essential in preventing patients from developing implicit aggression toward healthcare providers. Given our findings, healthcare providers can incorporate observations of patients' behavior and verbal cues during medical process, which may indicate signs of HAB. In addition, healthcare staff can engage in role-playing exercises and receive training recommendations to assist them in learning and enhancing their skills in identifying both types of HAB and effectively de-escalating potential conflicts. Furthermore, effective communication between healthcare providers and patients can play a crucial role in preventing HAB and subsequently reducing doctor-patient conflicts. Healthcare providers can adopt various communication strategies, such as active listening, clear explanation of diagnosis and treatment plans, and empathetic engagement, to foster trust and collaboration with patients.

This study had several limitations. First, participants were predominantly from regions with relatively developed medical resources in China, and the narrow age range of our sample may limit the generalizability of the findings to older or younger populations. Future studies that include a wider age range and patients from regions with relatively scarce medical resources would provide a more comprehensive understanding of the relationship between HAB and aggression in patients. Second, the social rejection employed in our study may not fully capture the complexity of interactions in real clinical settings. Future studies should utilize more immersive social rejection scenarios through virtual reality technology to enhance ecological validity or conduct observational research in clinical contexts to directly study doctor-patient interactions. Additionally, Future research should employ longitudinal designs to track the evolution of HAB and aggression in patients over time, especially in response to different types of doctor-patient interactions. Third, the lack of a significant impact of SHAB on implicit aggression in this study may be attributed to limitations of methodology. For instance, the SC-IAT might not be sufficiently sensitive to patients' absolute implicit aggressive attitudes toward doctors. Research has already shown that the latest frontier in implicit attitude measurement involves sophisticated physiological measures [78]. Future

research could explore the use of physiological indicators to assess the presence of implicit aggressive emotions in patients within medical contexts. As the autonomic nervous system controls these processes unconsciously, measures of heart rate, respiration, skin conductance, and electrodermal activity may detect implicit aggression that the self-report measures in our study could not [85]. Moreover, patients' previous healthcare experiences and baseline aggression levels play a significant role in shaping individuals' responses and behaviors within the doctor-patient relationship. Considering these factors in future studies would enhance our understanding of the dynamics between HAB and aggression in medical settings. Furthermore, various factors influence the relationship between HAB and aggression, including personality, sex, socioeconomic status, patients' mental health status, and healthcare providers' communication styles. Exploring the impact of these factors on the relationship between the two variables could lead to valuable insights, helping to promote better doctor-patient interactions and reduce occurrences of patient aggression toward healthcare professionals.

## Funding

This research was funded by Shanghai Philosophy and Social Science Planning Project (2022BSH002) and the Medical Master's and Doctoral Innovation Talent Base Project of Changning District (RCJD2022S07).

## Institutional review board statement

The study was approved by the local Ethics Committee of Shanghai Normal University (protocol code 202249, 3 July 2022).

## Informed consent statement

Informed consent was obtained from all participants involved in the study.

## Data availability statement

Data Availability in <https://osf.io/zcv3t/>

## CRedit authorship contribution statement

**Jie Liu:** Writing – original draft, Formal analysis, Conceptualization. **Hong Zheng:** Investigation, Formal analysis, Data curation, Conceptualization. **Lu Lu:** Methodology, Investigation, Data curation. **Hongying Liu:** Writing – review & editing, Supervision. **Xiongwei Xu:** Supervision, Writing – review & editing. **Wen He:** Writing – review & editing, Supervision.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Wen He reports financial support was provided by Shanghai Philosophy and Social Science Planning Project. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

We express our gratitude to all patients who participate in this study. We also would like to express our gratitude to Rui Wan and Wenjun Jiang for their valuable assistance in the early stages of this manuscript.

## References

- [1] S. Chakraborty, S.R. Mashreky, K. Dalal, Violence against physicians and nurses: a systematic literature review, *J. Publ. Health* 30 (8) (2022) 1837–1855, <https://doi.org/10.1007/s10389-021-01689-6>.
- [2] X. Ding, J. Zou, Media performance in doctor-patient conflict and its improvement strategies, *Youth Journalist* (17) (2020) 41–42.
- [3] F. Najafi, M. Fallahi-khoshknab, A. Dalvandi, F. Ahmadi, M. Rahgozar, Workplace violence against Iranian nurses: a systematic review, *J. Healthc. Protect. Manag.* 3 (2) (2014) 72–85.
- [4] S.M. Hopper, F.E. Babl, C.E. Stewart, J.W. Woo, Aggression management in a children's hospital setting, *Med. J. Aust.* 196 (3) (2012) 198–201, <https://doi.org/10.5694/mja11.10257>.
- [5] R. Williamson, K. Lauricella, A. Browning, E. Tierney, J. Chen, S. Joseph, et al., Patient factors associated with incidents of aggression in a general inpatient setting, *J. Clin. Nurs.* 23 (7) (2013) 1144–1152, <https://doi.org/10.1111/jocn.12294>.
- [6] W. Zafar, U.R. Khan, S.A. Siddiqui, S. Jamali, J.A. Razzak, Workplace violence and self-reported psychological health: Coping with post-traumatic stress, mental distress, and burnout among physicians working in the emergency departments compared to other specialties in Pakistan, *J. Emerg. Med.* 2 (49) (2015) 1–10, <https://doi.org/10.1016/j.jemermed.2015.02.049>.
- [7] X. Bao, J. Min, Y. He, The causes of aggressive behavior of waiting patients and its prevention and treatment, *Journal of Youjiang Medical University for Nationalities* 22 (4) (2000) 475–477.
- [8] V. Browne, J. Knott, J. Dakis, J. Fielding, D. Lyle, C. Daniel, et al., Improving the care of mentally ill patients in a tertiary emergency department: development of a psychiatric assessment and planning unit, *Australas. Psychiatr.* 19 (4) (2011) 350–353, <https://doi.org/10.3109/10398562.2011.579612>.

- [9] J.B. Lau, J. Magarey, H. McCutcheon, Violence in the emergency department: a literature review, *Aust. Emerg. Nurs. J.* 7 (2) (2004) 27–37, [https://doi.org/10.1016/S1328-2743\(05\)80028-8](https://doi.org/10.1016/S1328-2743(05)80028-8).
- [10] M. Roche, D. Diers, C. Duffield, C. Catling-Paull, Violence toward nurses, the work environment, and patient outcomes, *J. Nurs. Scholarsh.* 42 (1) (2010) 13–22, <https://doi.org/10.1111/j.1547-5069.2009.01321.x>.
- [11] J. Considine, D. Berry, R. Johnson, N. Sands, Vital signs as predictors of aggression in hospital patients, *J. Clin. Nurs.* 26 (18) (2017) 2593–2604, <https://doi.org/10.1111/jocn.13646>.
- [12] X. Deng, S. Long, Y. Shen, H. Zhao, W. He, Influence and mechanisms of common ingroup identity on competitive victimhood in doctor-patient relationships, *Acta Psychol. Sin.* 55 (5) (2023) 752–765, <https://doi.org/10.3724/SP.J.1041.2023.00752>.
- [13] M. Knutzen, N.H. Mjosund, G. Eidhammer, S. Lorentzen, S. Opjordsmoen, L. Sandvik, et al., Characteristics of psychiatric inpatients who experienced restraint and those who did not: a case-control study, *Psychiatr. Serv.* 65 (5) (2011) 492–497, <https://doi.org/10.1176/ps.62.5.pss6205.0492>.
- [14] A.N. Hodge, A.P. Marshall, Violence and aggression in the emergency department: a critical care perspective, *Aust. Crit. Care* 20 (2) (2007) 61–67, <https://doi.org/10.1016/j.aucc.2007.03.001>.
- [15] N.R. Crick, K.A. Dodge, A review and reformulation of social information-processing mechanisms in children's social adjustment, *Psychol. Bull.* 115 (1) (1994) 74–101, <https://doi.org/10.1037/0033-2909.115.1.74>.
- [16] J.K. Moreno, A. Fuhrman, M.J. Selby, Measurement of hostility, anger, and depression in depressed and nondepressed subjects, *J. Pers. Assess.* 61 (3) (1993) 511–523, [https://doi.org/10.1207/s15327752jpa6103\\_7](https://doi.org/10.1207/s15327752jpa6103_7).
- [17] K.E. Dill, C.A. Anderson, K.B. Anderson, W.E. Deuser, Effects of aggressive personality on social expectations and social perceptions, *J. Res. Pers.* 31 (2) (1997) 272–292, <https://doi.org/10.1006/jrpe.1997.2183>.
- [18] K.A. Dodge, Translational science in action: hostile attributional style and the development of aggressive behavior problems, *Dev. Psychopathol.* 18 (3) (2006) 791–814, <https://doi.org/10.1017/S0954579406060391>.
- [19] L. Zhang, L. Miao, Hostile interpretation bias and aggression, *Adv. Psychol. Sci.* 27 (12) (2019) 2097–2108, <https://doi.org/10.3724/SP.J.1042.2019.02097>.
- [20] K.A. Dodge, P.S. Malone, J.E. Lansford, E. Sorbring, A.T. Skinner, S. Tapanya, et al., Hostile attributional bias and aggressive behavior in global context, *Proc. Natl. Acad. Sci. U.S.A.* 112 (30) (2015) 9310–9315, <https://doi.org/10.1073/pnas.1418572112>.
- [21] K.H. Dillon, N.P. Allan, J.R. Cogle, F.D. Fincham, Measuring hostile interpretation bias: the WSAP-Hostility scale, *Assessment* 23 (6) (2016) 707–719, <https://doi.org/10.1177/1073191115599052>.
- [22] J. Gagnon, M. Aubin, F. Carrier Emond, S. Derguy, A.F. Brochu, M. Bessette, et al., An ERP study on hostile attribution bias in aggressive and nonaggressive individuals, *Aggress. Behav.* 43 (3) (2017) 217–229, <https://doi.org/10.1002/ab.21676>.
- [23] M. Schöenberg, A. Jusyte, Investigation of the hostile attribution bias toward ambiguous facial cues in antisocial violent offenders, *Eur. Arch. Psychiatr. Clin. Neurosci.* 264 (1) (2014) 61–69, <https://doi.org/10.1007/s00406-013-0440-1>.
- [24] C.P. Barlett, K.M. Helmstetter, D.A. Kowalewski, L. Pezzillo, Piecing together the aggression puzzle: testing the mediating variables linking early to later aggression, *Aggress. Behav.* 43 (6) (2017) 523–530, <https://doi.org/10.1002/ab.21710>.
- [25] I. Roskam, M. Stievenart, E. Brassart, M. Houssa, L. Loop, B. Mouton, et al., The Unfair Card Game: a promising tool to assess externalizing behavior in preschoolers, *Prat. Psychol.* 22 (1) (2016) 61–73, <https://doi.org/10.1016/j.prps.2015.09.004>.
- [26] C.N. DeWall, J.M. Twenge, S.A. Gitter, R.F. Baumeister, It's the thought that counts: the role of hostile cognition in shaping aggressive responses to social exclusion, *J. Pers. Soc. Psychol.* 96 (1) (2009) 45–59, <https://doi.org/10.1037/a0013196>.
- [27] X. Huang, *The Influence and Intervention of Hostility Attribution Bias and Aggression Behavior*, Beijing Sport University, 2018.
- [28] A. Yaros, J.E. Lochman, K.C. Wells, Parental aggression as a predictor of boys' hostile attribution across the transition to middle school, *IJBD (Int. J. Behav. Dev.)* 40 (5) (2016) 452–458, <https://doi.org/10.1177/0165025415607085>.
- [29] R.E. Verhoef, S.C. Alsem, E.E. Verhulp, B.O. De Castro, Hostile intent attribution and aggressive behavior in children revisited: a meta-analysis, *Child Dev.* 90 (5) (2019) 525–547, <https://doi.org/10.1111/cdev.13255>.
- [30] S.K. Tuentse, S. Bogaerts, W. Veling, Hostile attribution bias and aggression in adults—a systematic review, *Aggress. Violent Behav.* 46 (2019) 66–81, <https://doi.org/10.1016/j.avb.2019.01.009>.
- [31] D.J. Harris, R. Reiter-Palmon, Fast and furious: the influence of implicit aggression, Premeditation, and provoking situations on malevolent creativity, *Psychology of Aesthetics, Creativity, and the Arts* 9 (1) (2015) 54–64, <https://doi.org/10.1037/a0038499>.
- [32] Z. Galic, M. Ružojčić, Interaction between implicit aggression and dispositional self-control in explaining counterproductive work behaviors, *Pers. Individ. Differ.* 104 (2017) 111–117, <https://doi.org/10.1016/j.paid.2016.07.046>.
- [33] F. Wang, The implicit aggression of adolescents and its influencing factors, *Journal of Hubei University of Economics (Humanities and Social Sciences)* 6 (1) (2009) 16–17.
- [34] A. Todorov, J.A. Bargh, Automatic sources of aggression, *Aggress. Violent Behav.* 7 (1) (2002) 53–68, [https://doi.org/10.1016/S1359-1789\(00\)00036-7](https://doi.org/10.1016/S1359-1789(00)00036-7).
- [35] K.A. Rhoades, R.E. Heyman, J.M. Eddy, N.C. Haydt, J.E. Glazman, Z.F. Dispirito, et al., Patient aggression toward dentists, *The Journal of the American Dental Association* 151 (10) (2020) 764–769, <https://doi.org/10.1016/j.adaj.2020.06.041>.
- [36] M. Li, W. Li, W. He, Effects of medical frustration on Patients' Emotions and implicit aggression, *Chin. J. Clin. Psychol.* 28 (4) (2020) 670–674, <https://doi.org/10.3724/SP.J.1042.2019.02097>.
- [37] Y.J. Wang, L.X. Xia, The longitudinal relationships of interpersonal openness trait, hostility, and hostile attribution bias, *Aggress. Behav.* 45 (6) (2019) 682–690, <https://doi.org/10.1002/ab.21862>.
- [38] D.S. Yeager, A.S. Miu, J. Powers, C.S. Dweck, Implicit theories of personality and attributions of hostile intent: a meta-analysis, an experiment, and a longitudinal intervention, *Child Dev.* 84 (5) (2013) 1651–1667, <https://doi.org/10.1111/cdev.12062>.
- [39] T. Li, X. Huang, Y. Zhang, H. Ge, C. Meng, The relationship between implicit and explicit aggression: is the same or separated? *Journal of Leshan Normal University* 34 (12) (2019) 100–106, <https://doi.org/10.16069/j.cnki.51-1610/g4.2019.12.017>.
- [40] K. Bertsch, R. Böhnke, M.R. Kruk, E. Naumann, Influence of aggression on information processing in the emotional stroop task—an event-related potential study, *Front. Behav. Neurosci.* 3 (2009) 1–10, <https://doi.org/10.3389/neuro.08.028.2009>.
- [41] F. Yu, Y. Guo, On the relationship between attributional bias and attribution bias of aggressors, *Adv. Psychol. Sci.* 17 (4) (2009) 821–828.
- [42] D. Smeijers, E.B.H. Bulten, I.A. Brazil, The Computations of hostile biases (CHB) model: grounding hostility biases in a unified cognitive framework, *Clin. Psychol. Rev.* 73 (2019) 1–18, <https://doi.org/10.1016/j.cpr.2019.101775>.
- [43] T.F. Denson, W.C. Pedersen, M. Friese, A. Hahm, L. Roberts, Understanding impulsive aggression: angry rumination and reduced self-control capacity are mechanisms underlying the provocation-aggression relationship, *Pers. Soc. Psychol. Bull.* 37 (6) (2011) 850–862, <https://doi.org/10.1177/0146167211401420>.
- [44] C.A. Anderson, B.J. Bushman, Human aggression, *Annu. Rev. Psychol.* 53 (19) (2002) 27–46, <https://doi.org/10.1146/annurev.psych.53.100901.135231>.
- [45] V. Topalli, E.C. O'Neal, Retaliatory motivation enhances attributions of hostility when people process ambiguous social stimuli, *Aggress. Behav.* 29 (2) (2003) 155–172, <https://doi.org/10.1002/ab.10068>.
- [46] B.M. Wilkowski, M.D. Robinson, The cognitive basis of trait anger and reactive aggression: an integrative analysis, *Pers. Soc. Psychol. Rev.* 12 (1) (2008) 3–21, <https://doi.org/10.1177/1088868307309874>.
- [47] Y. Du, Research on the relationship between explicit and implicit aggression tendencies and hostile attribution bias in adolescents, *Mod. Commun.* 24 (2021) 142–144.
- [48] N. Liu, J. Wang, L. Yang, The effect of social exclusion on reactive aggression: chain mediating effects of hostile attribution bias and trait anger, *Chin. J. Clin. Psychol.* 30 (6) (2022) 1446–1454, <https://doi.org/10.16128/j.cnki.1005-3611.2022.06.037>.
- [49] Y. Shao, B. Xie, Y. Qiao, L. Huang, A correlation study of state-trait anger to parental rearing styles of young male violent offenders, *Chin. J. Clin. Psychol.* 17 (4) (2009) 481–483.

- [50] K. Zeng, F. Cao, Y. Wu, M. Zhang, X. Ding, Effects of interpretation bias modification on hostile attribution bias and reactive cyber-aggression in Chinese adolescents: a randomized controlled trial, *Curr. Psychol.* (2023) 1–14, <https://doi.org/10.1007/s12144-023-04433-3>.
- [51] A.G. Greenwald, B.A. Nosek, M.R. Banaji, Understanding and using the Implicit Association Test: I. An improved scoring algorithm, *J. Pers. Soc. Psychol.* 85 (2) (2003) 197–216, <https://doi.org/10.1037/0022-3514.85.2.197>.
- [52] A. Karpinski, R.B. Steinman, The single category implicit association test as a measure of implicit social cognition, *J. Pers. Soc. Psychol.* 9 (1) (2006) 16–32, <https://doi.org/10.1037/0022-3514.91.1.16>.
- [53] C. Ai, B. Zuo, Application of single category implicit association test in group identification, *Chin. J. Clin. Psychol.* 19 (4) (2011) 476–478, <https://doi.org/10.16128/j.cnki.1005-3611.2011.04.010>.
- [54] J.D. Lieberman, S. Solomon, J. Greenberg, H.A. McGregor, A hot new way to measure aggression: hot sauce allocation, *Aggress. Behav.* 25 (1999) 331–348, [https://doi.org/10.1002/\(SICI\)1098-2337\(1999\)25:5<331::AID-AB2>3.0.CO;2-1](https://doi.org/10.1002/(SICI)1098-2337(1999)25:5<331::AID-AB2>3.0.CO;2-1).
- [55] D. Ritter, M. Eslea, Hot sauce, toy guns, and graffiti: a critical account of current laboratory aggression paradigms, *Aggress. Behav.* 31 (5) (2005) 407–419, <https://doi.org/10.1002/ab.20066>.
- [56] E. Calvete, M. Gamez-Guadix, S. Garcia-Salvador, Social information processing in child-to-parent aggression: bidirectional associations in a 1-year prospective study, *J. Child Fam. Stud.* 24 (8) (2015) 2204–2216, <https://doi.org/10.1007/s10826-014-0023-4>.
- [57] A.G. Greenwald, M.R. Banaji, Implicit social cognition: attitudes, self-esteem, and stereotypes, *Psychol. Rev.* 102 (1) (1995) 24–27, <https://doi.org/10.1037/0033-295x.102.1.4>.
- [58] F.B.D. Azevedo, Y.P. Wang, A.C. Goulart, P.A. Lotufo, I.M. Benseñor, Application of the spielberger's state-trait anger expression inventory in clinical patients, *Arquivos de neuro-psiquiatria.* 68 (2) (2010) 231–234, <https://doi.org/10.1590/s0004-282x2010000200015>.
- [59] C.D. Spielberger, S.S. Krasner, E.P. Solomon, *The Experience, Expression, and Control of Anger. Individual Differences, Stress, and Health Psychology*, Springer, New York, 1988.
- [60] H. Tao, *Revise of State-Trait Anger Expression Inventory II and Analyse of the Coping Style Among Anger-Out Group and Anger-In Group*, Shandong University of Traditional Chinese Medicine, 2006.
- [61] D.A. Nelson, C.M. Cramer, S.M. Coyne, J.A. Olsen, Children's hostile intent attributions and emotional distress: what do parents perceive? *Aggress. Behav.* 44 (1) (2018) 98–108, <https://doi.org/10.1002/ab.21734>.
- [62] F. Quan, L. Xia, The prediction of hostile attribution bias on reactive aggression and the mediating role of revenge motivation, *Journal of Psychological Science* 42 (6) (2019) 1434–1440, <https://doi.org/10.16719/j.cnki.1671-6981.20190623>.
- [63] Y. Wang, S. Cao, Y. Dong, L. Xia, Hostile attribution bias and angry rumination: a longitudinal study of undergraduate students, *PLoS One* 14 (5) (2019) 17–25, <https://doi.org/10.1371/journal.pone.0217759>.
- [64] T.F. Denson, The multiple systems model of angry rumination, *Pers. Soc. Psychol. Rev.* 17 (2) (2013) 103–123, <https://doi.org/10.1177/1088868312467086>.
- [65] K.A. Dodge, N.R. Crick, Social information-processing bases of aggressive behavior in children, *Pers. Soc. Psychol. Bull.* 16 (1) (1990) 8–22, <https://doi.org/10.1177/0146167290161002>.
- [66] T.F. Denson, W.C. Pedersen, N. Miller, The displaced aggression questionnaire, *Journal of personality and social psychology* 90 (6) (2006) 1032–1051, <https://doi.org/10.1037/0022-3514.90.6.1032>.
- [67] W. Gerin, K.W. Davidson, N.J.S. Christenfeld, T. Goyal, J.E. Schwartz, The role of angry rumination and distraction in blood pressure recovery from emotional arousal, *Psychosom. Med.* 68 (1) (2006) 64–72, <https://doi.org/10.1097/01.psy.0000195747.12404.aa>.
- [68] K.A. Dodge, J. Price, On the relation between social information processing and socially competent behavior in early school-aged children, *Child Dev.* 65 (5) (1994) 1385–1397, <https://doi.org/10.1111/j.1467-8624.1994.tb00823.x>.
- [69] B.C. Schouten, L. Meeuwesen, Cultural differences in medical communication: a review of the literature, *Patient Educ. Counsel.* 64 (1–3) (2006) 21–34, <https://doi.org/10.1016/j.pec.2005.11.014>.
- [70] T. Holtgraves, Styles of language use : individual and cultural variability in conversational indirectness, *J. Pers. Soc. Psychol.* 73 (3) (1997) 624–637, <https://doi.org/10.1037/0022-3514.73.3.624>.
- [71] M. Khazen, Power dynamics in doctor-patient relationships: a qualitative study examining how cultural and personal relationships facilitate medication requests in a minority with collectivist attributes, *Patient Educ. Counsel.* 105 (7) (2022) 2038–2344, <https://doi.org/10.1016/j.pec.2021.11.023>.
- [72] Y. Zhou, J. Liu, Using eye-movement to study implicit aggressiveness, *Psychol. Sci.* 32 (4) (2009) 858–860, <https://doi.org/10.16719/j.cnki.1671-6981.2009.04.041>.
- [73] G.D. Logan, Automaticity and reading: perspectives from the instance theory of automatization, *Read. Writ. Q.: Overcoming Learning Difficulties* 13 (2) (1997) 123–146, <https://doi.org/10.1080/1057356970130203>.
- [74] J. Richetin, D.S. Richardson, G.D. Mason, Predictive validity of IAT aggressiveness in the context of provocation, *Soc. Psychol.* 44 (1) (2010) 27–34, <https://doi.org/10.1027/1864-9335/a000005>.
- [75] A. Martinelli, K. Ackermann, A. Bernhard, C.M. Freitag, C. Schwenck, Hostile attribution bias and aggression in children and adolescents: a systematic literature review on the influence of aggression subtype and gender, *Aggress. Violent Behav.* 39 (2018) 25–32, <https://doi.org/10.1016/j.avb.2018.01.005>.
- [76] M. Fan, *The Research of Implicit Attitude in Doctor and Patient Relationship*, Northwest University, Xian, 2017.
- [77] K. Zhang, D. Zhang, Progress of study on implicit association test, *Psychological exploration* 29 (4) (2009) 15–18, <https://doi.org/10.3969/j.issn.1003-5184.2009.04.004>.
- [78] G. Mitchell, P. Tetlock, *Implicit attitude measures*, in: R.A. Scott, S.M. Kosslyn (Eds.), *Emerging Trends in the Social and Behavioral Sciences*, Wiley, 2015, pp. 1–14.
- [79] C. Zhu, H. Gong, X. Zheng, *An experimental research on character of implicit aggression among juveniles*, *Psychological Exploration* 26 (2) (2006) 48–50.
- [80] T. Greitemeyer, C. Sagioglou, Subjective socioeconomic status causes aggression: a test of the theory of social deprivation, *J. Pers. Soc. Psychol.* 111 (2) (2016) 178–194, <https://doi.org/10.1037/pspi0000058>.
- [81] B. Chen, Y. Zhao, The relationship between socioeconomic status and aggressive behavior among college students: the mediating effect of sense of control, *Psychology: Techniques and Applications* 5 (5) (2017) 265–273, <https://doi.org/10.16842/j.cnki.issn2095-5588.2017.05.002>.
- [82] A.H.N. Cillessen, T.A.M. Lansu, Y.H.M. Van Den Berg, Aggression, hostile attributions, status, and gender: a continued quest, *Dev. Psychopathol.* 26 (3) (2014) 635–644, <https://doi.org/10.1017/S0954579414000285>.
- [83] H.J. Smith, T.F. Pettigrew, G.M. Pippin, S. Bialosiewicz, Relative deprivation: A theoretical and meta-analytic review *Personality and Social Psychology Review* 16 (2012) 203–232, <https://doi.org/10.1177/1088868311430825>.
- [84] W. He, X. Wang, X. Zhou, L. Xu, Negative expectations and bad relationships: effects of negative metastereotypes on doctor-patient relationships, *Asian J. Soc. Psychol.* 23 (2020) 103–108, <https://doi.org/10.1111/ajsp.12388>.
- [85] C.J. Patrick, Psychophysiological correlates of aggression and violence: an integrative review, *Philosophical transactions of the Royal Society of London Series B, Biological sciences.* 363 (1503) (2008), <https://doi.org/10.1098/rstb.2008.0028>, 2543–1555.