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Attentional bias towards threat in sexually victimized Hispanic women: A dot probe study

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Abstract

Objective: The current study examined attention bias toward threat in Hispanic college women exposed to lifetime sexual victimization in childhood, adulthood, and both childhood and adulthood. Response latencies and attention bias scores were compared between victimized and non-victimized individuals. **Design:** Participants were 20 women exposed to adulthood sexual victimization (AS group), 15 exposed to childhood sexual victimization (CS group), 8 exposed to both childhood and adulthood sexual assault (revictimization: RV group), and 20 not endorsing sexual victimization (NS group). They were asked to complete the dot-probe task. **Results:** The CS group and RV group were combined to create the CS-RV group. Among the AS and CS-RV groups, response latencies were faster when attention was engaged to threat than when attention was engaged to non-threat. The NS group did not demonstrate such differences. When response latencies were compared among the three groups, the CS-RV group had slower response latencies than the NS group. The CS-RV and AS groups revealed similarly significantly elevated bias scores towards threat words than the NS group. **Conclusion:** Hispanic college women exposed to lifetime sexual victimization display elevated levels of attention bias compared to non-victimized women. Further, the current findings align with an integrative cognitive model for explaining maladaptive informational processing in trauma victims.

Keywords: Cognitive processes; sexual assault; attentional bias; Hispanic women

Attentional bias towards threat in sexually victimized Hispanic women: A dot-probe study

Research suggests that between 6.6% and 51.1% of college women have experienced some type of sexual victimization (e.g., Bagwell-Gray et al., 2015; Carey et al., 2015; Conley et al., 2017; Hines et al., 2012; Howard et al., 2018; Mellins et al., 2017). Sexual victimization was endorsed as the most distressing traumatic event among women in a recent survey (Smith et al., 2016) and has been identified as a strong risk factor in the development of psychological impairment or dysfunction, including posttraumatic stress disorder (PTSD) (e.g., Dworkin et al., 2017; Scott et al., 2015; Smith et al., 2016).

Cognitive approaches have investigated an attentional bias to threat as a possible causal and/or maintenance factor of posttraumatic stress symptoms (Bar-Haim et al., 2007; Kruijt et al., 2019; Van Bockstaele et al., 2014). An integrative cognitive model (Bar-Haim et al., 2007) proposes four systems as the underlying mechanisms of biased information processing in anxiety and fear: a preattentive threat evaluation system (PTES), a resource allocation system (RAS), a guided threat evaluation system (GTES), and a goal engagement system (GES). According to this model, the maladaptive processing of information within each of the four systems, or combinations of the systems, contribute to posttraumatic stress and impairments found in trauma survivors. Specifically, survivors of trauma may perceive slightly threatening stimuli as high threat (PTES) and allocate resources (e.g., attentional resources) to even slightly threatening stimuli (RAS). Consequently, individuals with trauma history may fail to use past experiences and adaptive coping mechanisms when evaluating the level of threat of varying stimuli (GTES) and continue orienting to threat, resulting in experiencing trauma symptoms (GES). Based on this theory, those exposed to sexual victimization perceive very mildly threatening information as threatening (via the PTES) and readily allocate their attention to such information (via the

RAS). When these individuals evaluate the attended threat as high (GTES), traumatic stress symptoms are more likely to continue surfacing. If the threat was evaluated as being low, this could potentially override excessive attentional resource allocation to mildly threatening stimuli. Attention bias is likely due to non-normal operations of the PTES and RAS before the operations are activated at the GTES.

An established way to assess attention bias to threat is the dot-probe task, developed by MacLeod et al. (1986). The dot-probe task is considered a useful measure of attentional bias (Van Bockstaele et al., 2014). According to Macleod et al. (1986), the dot-probe task has several advantages over other methods such as the Stroop paradigm when assessing attention bias. A dot-probe task uses button-pressing as a response to neutral information (a dot probe) so that responses are likely free from emotion-related or semantic interpretation bias, purely assessing attention bias. By contrast, color-naming Stroop tasks may be confounded by measuring attention slowness associated with emotional arousal that impairs response time. Further, the dot-probe task can likely determine whether attention to threat is facilitated or impaired.

Evidence supports the presence of attention bias in individuals exposed to lifetime sexual victimization. A recent meta-analytic study of 13 investigations exploring attention bias among victims of lifetime sexual victimization found elevations in selective attention toward threat over non-threat stimuli in individuals exposed to this type of trauma (Latack et al., 2017). This meta-analytic study reported that the effect sizes when comparing victims and non-victims ranged from 0.0 to 0.86 with an aggregate effect size of 0.31, indicating a small effect. However, the results of the study should be interpreted with caution because an elevated attention bias was found only in studies using the Stroop paradigm. Neither the dot-probe study nor the visual search study showed significantly elevated attention bias in victims. By contrast, several other

dot-probe studies targeting interpersonal violence, including lifetime sexual victimization, reported some attention bias in trauma survivors (DePierro et al., 2013; Fani et al., 2011; Herzog, et al., 2019). However, the lack of healthy controls in these studies makes it impossible to address levels of attention bias in victims relative to those in non-victims. Further, the inclusion of participants who may have experienced non-sexual interpersonal violence as traumatic events in some of these studies makes it difficult to attribute results to lifetime sexual victimization. Overall, accumulating knowledge about attention bias in those exposed to lifetime sexual victimization when compared to non-victims in a solid experimental method, such as the dot-probe task, seems necessary.

One unresolved question is whether differential sexual victimization pathways might produce varying effects on attention bias. Past research has suggested that childhood adverse experiences set long-term alterations in cognitive, physiological, and behavioral responses (e.g., Heim et al., 1997; Repetti et al., 2002). Consistent with this, an elevated attention bias in adults with a history of childhood maltreatment, including childhood sexual abuse, has been reported (e.g., Fani et al., 2011; Gibb et al., 2009). Further, Fani et al., (2011) reported that attention bias levels among survivors of childhood victimization were unrelated to the frequencies of childhood and adulthood revictimization experienced, which seems to emphasize a strong impact of even only one adverse experience in childhood on attention bias. In other words, individuals who have experienced childhood sexual victimization only and those who have experienced sexual victimization both in childhood and adulthood may exhibit similar levels of attention bias. Yet, it is unknown whether attention bias might differ between individuals exposed to childhood sexual victimization with or without adulthood sexual victimization and those with adulthood sexual victimization only. To summarize, research involving attention bias among individuals exposed

to different types of lifetime sexual victimization is an important area of study. Such efforts are likely to advance our understanding of cognitive mechanisms underlying posttraumatic stress symptoms within sexually victimized individuals and may aid the development of treatment strategies, such as attention modification approaches (e.g., MacLeod & Mathews, 2012).

Hispanic individuals are at a similar or higher risk than non-Hispanic Whites for sexual victimization (Basile et al., 2015; Howard et al., 2018; Yeater et al., 2016). And yet, attention bias studies targeting Hispanic individuals are lacking. The proportion of Hispanic individuals included in recent attention bias studies conducted in the US and targeting PTSD ranged from 0% to 9% (Bardeen et al., 2011; Bardeen et al., 2016; DePierro et al., 2013; Pineles et al., 2009; Reichert et al., 2015), highlighting the need of investigating attention bias in Hispanic women exposed to sexual victimization.

The current study attempted to examine response latencies to threat stimuli and attention bias in Hispanic college women who experienced lifetime sexual victimization in childhood, adulthood, and both childhood and adulthood. Response latencies and attention bias were compared to those of non-victimized Hispanic college women. The goal of the current study was to examine the hypothesis that Hispanic women exposed to lifetime sexual victimization would demonstrate significant attention bias toward threat-related stimuli when compared to Hispanic women without sexual victimization experiences.

Method

Participants

The current study was part of a larger assessment study targeting attention issues associated with lifetime sexual victimization. A total of 63 Hispanic female undergraduate students were selected from the subject pool of a Psychology department of a state university in

South Texas, where 89.4% of students are Hispanic. Of the 63 participants, 20 reported sexual victimization in adulthood (AS group), 15 reported childhood sexual victimization (CS group), 8 reported both childhood and adulthood sexual assault (revictimization: RV group), and 20 reported no sexual victimization (NS group). All participants were Hispanic with Mexican or partial Mexican descent (e.g., Mexican and Irish, Mexican and Canadian, Mexican and mixed ethnic origin). Participants were fluent in English with 53 participants reporting English as their primary language, 8 reporting Spanish as their primary language, and 2 reporting being equally fluent in English and Spanish. The mean age was 23.5 years ($SD = 4.88$). There was no age difference across the four groups: ($F(3, 59) = 2.098, ns$).

Materials

The following questionnaires were administered online.

The Demographic information questionnaire asked participants' demographics, including age, gender, ethnic background, ancestral descent, and primary language.

Stressful Experiences Checklist (SEC; Hirai et al., 2012): The SEC asked participants to select all traumatic events they experienced from the checklist. Examples of the events on the checklist include: physical assault as an adult, sexual assault as an adult, natural disaster (e.g., hurricane, tornado), accident (e.g., automobile), history of life-threatening illness or medical conditions, childhood physical abuse, childhood sexual abuse, and war-related experience. To allow for endorsement of other stressful experiences, events not listed in the checklist could be reported in an open-ended manner.

Rating Scale for Word Stimuli: Word stimuli (threat words) for the dot-probe task were adapted from previous attention bias studies (Fleurkens et al., 2011; MacLeod et al., 2002; Pineles et al., 2007). In addition, negative experiences and emotions commonly reported among

victims of sexual assault were included (e.g., guilt, ashamed, mistrust, terrified). A total of 32 words were selected. Participants rated each word on a 10-point Likert scale ranging from 0 (Not at all feel threatened/negative) to 9 (severely feel negative/threatened). The list of the words is shown in the Appendix.

Procedure

The study was part of a larger study approved by the institutional review board of the university. Sexual victimization was described in the recruitment information as the target of the study. Female undergraduate students were eligible for the study, regardless of presence or absence of lifetime sexual victimization. Female undergraduate students who had signed up for the larger study were invited to a consent session held in a lab room. Initially, 488 female students who agreed to participate in the study signed the consent form and were then asked to complete demographic items, the stressful events checklist, the word rating task, and a symptom measure¹ at home or in a private setting. Individuals who reported lifetime sexual victimization but no other stressful life event and those who reported no stressful life event were then contacted and invited to a subsequent individual lab session scheduled for another day to complete a dot-probe task. Among the 488 participants, a total of 88 individuals met the above inclusion criteria and were invited to a dot-probe experiment session. Among those 88, a total of 63 participants completed a dot-probe session. The remaining 25 individuals did not respond to the invitation. The dot-probe sessions were scheduled approximately two weeks after the completion of the demographics and word ratings. Research credit was given to participants as compensation.

Dot-probe task

The current study employed word stimuli (see Appendix). Words are considered potent

for assessing threat-related attention bias (Bar-Haim et al., 2007). The current dot-probe task was created with the software E-Prime, Version 2 (Psychology Software Tools, Inc.). Initially, a fixation cross appeared in the middle of the computer display for 500ms and then disappeared. A threat-related word and a neutral word then appeared, one above the location of the former fixation cross and the other below the location of the fixation cross. After the two words were displayed for 500ms and disappeared, a dot-probe replaced one of the two words. The participant pressed a key of a wired keyboard as quickly and accurately as possible. If the probe was detected in place of the top word the participant would press the “1” key. If the probe was detected in place of the word on the bottom the participant would press the “4” key. The threat words were located on top about 50% of the trials and on the bottom 50% of the trials. The probe appeared following either a threat word or a non-threat word with equal frequency. Trials in which the probe appeared following a threat word were labelled congruent trials (attention was engaged to threat), and trials in which the probe appeared following a non-threat word were labelled incongruent trials (attention was disengaged from threat). Stimulus pairs (threat and non-threat) were randomly created at each trial. Faster response latencies to the probe when it appears in the previous location of a threat stimulus compared to a neutral stimulus are interpreted as vigilance to threat. Having slower response latencies to the probe that replaces the previous neutral stimulus than to the previous threat stimulus indicate a difficulty disengaging from threat.

A total of 320 dot-probe trials were programmed. Before starting the actual task, the participant attempted 10 practice trials (5 threat and 5 non-threat) supervised by a research assistant who gave instructions and answered any questions. Then, the actual dot-probe task was completed by each participant privately. The 320 trials were divided into two blocks of 160 trials

each. The participant was able to take a short break between the two blocks. The location of the keyboard was adjusted for participant handedness.

Results

Because of the relatively smaller sample sizes of the CS group ($n = 8$) and RV group ($n = 15$), these two groups were aggregated to comprise the CS-RV group. This aggregation was justified based on the following: 1) both groups shared the factor of childhood sexual victimization and 2) the empirical finding that levels of attention bias in survivors of childhood victimization was unrelated to the frequency of adulthood revictimization (Fani et al., 2011). Comparisons were made between the AS group ($n = 20$), CS-RV group ($n = 23$), and the NS group ($n = 20$).

Word ratings

Ratings on the word stimuli conducted approximately two weeks prior to the dot-probe task were compared between sexual victimized individuals ($n = 43$) and non-victims ($n = 20$). A series of t-tests were performed with the false discovery rate (FDR) at 0.05.² Sexually victimized women rated 27 words out of the 32 words more threatening than non-victimized women (Appendix).

Data deduction and missing data

For each segment (block, probe location, threat vs. non-threat), participant response latencies 2 standard deviations above or below their mean response latency were eliminated from the analysis as done in recent studies (e.g., Amir et al., 2009; Najmi & Amir, 2010; Price et al., 2015). Incorrect trials were also eliminated from analysis. Overall, approximately 5.2%³ of the total trials (2.4% as outliers and 2.8% as incorrect responses) were removed from the final analysis. There was no missing data in the word rating task.

Response latencies

A 3 (group) x 2 (block: first/second) x 2 (location: upper/lower) x 2 (probe: congruence/incongruence) mixed ANOVA was performed on response latencies. The block and location variables were included in the analysis to address variances related to these procedural variables. A significant main effect of congruence/incongruence was found, showing that the congruent trials showed faster response latencies than the incongruent trials ($F(1, 60) = 19.09, p < 0.01$). No other significant main effects were found and the procedural variables had no effect. A significant interaction effect of group x congruence/incongruence ($F(2, 60) = 4.97, p < 0.05$) was found. Because no procedural effects (block or location effects) were found, subsequent post-hoc analyses were performed for mean response latencies across the blocks and locations. Results are presented in Table 1. Post-hoc analyses found that response latencies were significantly faster for congruent trials than for non-congruent trials in the AS group and also in the CS-RV group (p 's < 0.001). The NS group demonstrated similar response latencies for the two types of trials. When response latencies were compared among the three groups, the CS-RV group had significantly slower response latencies for incongruence trials ($p < 0.05$) and marginally significantly slower response latencies for congruent trials ($p = 0.07$) than the NS group. No other significant group differences were found.

Attention bias scores

Attention bias scores were calculated by applying a modified form of MacLeod et al.'s original formula (1986). As noted above, the ANOVA results found no location (upper/lower) or block (first/second) effects, and thus, a bias score was calculated as: a bias score = response latencies for trials where the probe replaced a threat word – response latencies for trials where the probe replaced a non-threat word⁴. Results are presented in Table 1. The negative values

indicated bias toward threat stimuli (vigilance and faster attention to threat words than non-threat words) and positive values indicated bias away from these stimuli (attention away from threat words, faster attention to non-threat words than threat words). The CS-RV and AS groups yielded negative values. A one-way ANOVA was performed to compare the groups on bias scores. A significant group effect was found ($F(2, 60) = 4.97, p < 0.05$). Post hoc analyses revealed that the CS-RV and AS groups had significantly elevated bias toward threat words than the NS group (p 's < 0.05). There was no difference between the CS-RV group and the AS group bias levels.

Discussion

The current study applied a dot-probe task to examine attention bias toward threat stimuli in Hispanic college women exposed to lifetime sexual victimization in three groups: the adulthood sexual victimization only group (AS), the childhood sexual victimization and revictimization group (CS-RV), and the no sexual victimization group (NS). Hispanic individuals with lifetime sexual victimization experiences have rarely been targeted in attention bias research. Groups were compared on response latencies for word stimuli and levels of attention bias.

The hypothesis that women with lifetime sexual victimization would demonstrate a significant attention bias toward threat-related stimuli compared to women without lifetime sexual victimization was supported. Both AS and CS-RV groups had significantly faster response latencies for congruent trials than for incongruent trials, revealing a significantly negatively elevated attention bias in the groups, compared to the NS group. The NS group demonstrated no notable attention bias. These findings are consistent with the theoretical formulation and some empirical evidence supporting the presence of elevated attention bias in

victims of interpersonal violence including sexual trauma victims (DePierro et al., 2013; Fani et al., 2011; Herzog et al., 2019). As Bar-Haim et al.'s model (2007) suggests, sexually victimized individuals may erroneously perceive slightly threatening information as high threat (PTES) and allocate attentional resources to slightly threatening stimuli (RAS). Non-trauma victims unlikely engage in this maladaptive information processing. Yet, some other reviews reported only limited evidence for different levels of attention bias between trauma victims and non-victims (e.g., Latack et al., 2017; Van Bocksaete et al., 2014). The inconsistency between these review results and the current findings might be attributed to methodological differences across studies (e.g., target traumas, characteristics of samples, assessment methods of bias).

The current study aggregated the CS group and RV group to form a relatively larger group. Both groups had childhood sexual victimization experiences, which are expected to play a significant role in altering cognitive responses including attention bias in the long-term (e.g., Fani et al., 2011; Gibb et al., 2009). The elevated attention bias found in the CS-RV group supports the potentially strong effect of childhood sexual victimization on vigilance to threat associated with sexual traumas, an effect that can be long-lasting. The current design allowed the comparison between individuals with childhood sexual victimization (CS-RV group) and those with adulthood sexual victimization only (AS group) in attention bias, producing no group differences. This result seems to suggest that sexual victimization might have a high negative impact on an individual's cognitive responses, such as attention to threat, regardless of when it was experienced in her lifetime.

An interesting finding of the current study is that the CS-RV group demonstrated significantly or marginally significantly slower response latencies for stimuli than the NS group. The response latencies for the AS group did not differ from those of the CS-RV group or those of

the NS group. These results suggest two possibilities: that slow attention was developed because of childhood sexual victimization and that the slowness preceded the victimization event.

Although the current design does not allow for a causal relationship between response latencies and risk for sexual victimization, future research might pursue investigations into the possibility that slow attention and/or slow responses to environmental stimuli might prove to be risk factors for certain types of victimization, such as childhood victimization. Understanding potential cognitive risk factors of sexual victimization may contribute to developing preventive programs that protect women from sexual victimization.

An unresolved issue is the relationship between levels of attention bias and severity of traumatic stress symptoms. The current study was not able to address the relationship. Previous dot-probe based attention bias research targeting interpersonal trauma, including sexual victimization, has produced contradicting findings. Specifically, Herzog et al. (2019) found a significant relationship between severity of traumatic stress symptoms and attention bias to mild threat but not to high threat in an ethnically diverse sample. DePierro et al., (2013) found that attention bias toward threat relevant to interpersonal violence was negatively correlated with the severity of traumatic stress symptoms in a predominantly Euro-American sample. Fani et al., (2011) found no association between attention bias toward threat and severity of posttraumatic stress symptoms in primarily African American women (90% African American). While targeting posttraumatic stress and anxiety symptoms, Bar-Haim et al.'s meta-analytic study (2007) reported similar bias levels between studies with clinical samples and those with highly anxious samples and suggested a lower threshold of anxiety that can trigger full attention bias. Further examination on potential effects of posttraumatic stress symptoms to levels of attention bias among culturally diverse individuals with various symptom levels is warranted.

It should be noted that this study has several limitations. The relatively small sample size per group is a significant limitation of the study that increased both Type I and Type II error. The small sample sizes of the CS ($n = 8$) and RV ($n = 15$) groups resulted in aggregating these groups, making it impossible to compare attention bias between these groups. As noted above, this grouping was justified based on the past research suggesting that childhood victimization may set significant and long-term cognitive biases. However, effects of the presence or absence of adulthood victimization in addition to childhood victimization to current attention remains to be investigated. Another limitation of the study is that the current findings were from Hispanic female college students with subclinical symptom levels of posttraumatic stress, and thus, have limited generalizability to individuals with different cultural backgrounds and those from community and clinical settings who have a diagnosis of PTSD or more severe posttraumatic stress symptoms. At the same time, targeting Hispanic women who have been underrepresented in research in general and in attention bias research in particular is believed to be a strength of the current study. It should also be mentioned that participants had been aware of sexual victimization as the topic of the study prior to the experiment. Pre-existing expectations toward the experiment might have increased vigilance to information related to sexual victimization particularly among victimized participants, potentially affecting their response latencies. In addition, although the dot-probe task has been considered a useful measure of attention bias (e.g., Van Bocksaele et al., 2014), its reliability has been questioned by past psychometric studies of dot-probe tasks with anxious and healthy samples (Schmukle, 2005; Staugaard, 2009). Dennis-Tiwary et al. (2019) suggested that using personally relevant stimuli may improve reliability of a dot-probe task, and the use of word stimuli designed specifically for sexually victimized individuals in the current study is consistent with that notion. Future research into the

psychometrics of dot-probe tasks for specific targets such as sexual victimizations is needed. Overall, any interpretations of the current findings should be made with caution and with consideration of these limitations.

Despite the above limitations, the current study investigated attention bias targeting lifetime sexual victimization, an experience found to be the most distressing traumatic event among women and a possible causal factor of PTSD (e.g., Smith et al., 2016). Further, Hispanic women have been underrepresented in attention bias research and this study attempts to better represent that population. Unlike other attention bias studies that included lifetime sexual victimization along with other types of traumas, the current study targeted only participants who endorsed lifetime sexual victimization without other traumatic experiences and those without any trauma history. Because of this design, the significant attention bias differences found in the current study can be attributable to sexual trauma specifically. Also, the word rating results support the conclusion that attention bias found in the victimized women were specific to their trauma-relevant information which they perceived as threat. The current results are expected to contribute to a deeper understanding of attention bias among Hispanic women with lifetime sexual victimization, a sparsely focused area of research. Replication efforts should be made with a larger number of participants and in those with clinical levels of posttraumatic stress.

Footnotes

1. There were errors in the symptom measure and thus the current study did not include the measure for the analysis.
2. The concept of the false discovery rate (FDR) was developed by Benjamini and Hochberg (1995). The FDR is considered more powerful than the Bonferroni correction and is less prone to committing Type I errors than making no corrections (Maxwell & Delaney, 2004)
3. Compared to Bardeen et al.'s dot-probe study in PTSD (2016), this proportion was high. This was due likely to the fact that the current study applied a stricter outlier cut off (2 SD) compared to Bardeens' study using 3 SD, as one of the outlier criteria.
4. The original formula is below:
$$\text{A bias score} = ((\text{upper probe following upper threat} - \text{upper probe following lower threat}) + (\text{lower probe following lower threat} - \text{lower probe following upper threat}))/2.$$

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Table 1. Mean response latencies and bias scores

Group	Congruent:	Incongruent:	Bias
	Probe following a threat word	Probe following a non-threat word	
	M (SD)	M (SD)	
NS (n = 20)	491.59 (62.78) ^a	491.30 (67.30) ^a	0.29 ^a
AS (n = 20)	506.48 (81.34) ¹	526.68 (82.47) ²	-20.20 ^b
CS + RV (n = 23)	546.91 (93.19) ^{1, b}	569.94 (104.40) ^{2, b}	-23.04 ^b

Note. AS = adulthood sexual victimization; CS = childhood sexual victimization; RV = revictimization (childhood and adulthood); NS = no sexual victimization; M = mean; SD = standard deviation. Different alphabetical superscripts (a, b) within a column denote group differences: $p < 0.05$ for incongruent response latencies and bias scores; $p = 0.08$ for incongruent response latencies. Different numbers (1, 2) within a row denote within-group differences in congruent and incongruent response latencies: p 's < 0.01 for the AS and CS-RV groups.

Appendix

Threat word list

Rape*	Assault
Anger	Abuse
Incest*	Fondle
Fear	Hurt
Threatened	Dirty
Violence*	Bleeding
Molest	Humiliated
Stalker*	Ashamed
Scream*	Embarrassed
Penis	Helpless
Terrified	Danger
Penetrate	Darkness
Nightmare	Blamed
Guilt	Worthless
Mistrust	Panic
Victim	Violated

* threat levels of these words were similarly rated by sexually victimized women and non-victimized women.