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Attentional biases in older adults with generalized anxiety disorder

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Abstract

Cognitive theories of anxiety propose that selective attention to negative information plays a central role in the development and maintenance of anxiety. The presence of such attentional bias has been confirmed in younger adults. Nevertheless, there are few studies that have explored anxiety-linked attentional bias in older adults, and the available results are inconclusive. Conversely, the socioemotional selectivity theory posits that there are age-related changes in emotional information processing and, consistent with this account, it has been found that older adults preferentially pay more attention to positive stimuli compared with younger adults ("positivity effect"). The present study aimed to explore attentional bias towards negative and positive information in a sample of older adults with generalized anxiety disorder (GAD) compared with a control group. The results showed that older adults with GAD displayed an attentional preference for negative information and attentional avoidance for positive information, whereas healthy older adults showed the reverse pattern of attentional deployment. These results suggest that selective attention toward negative information and selective avoidance of positive information may be a relevant factor in clinically anxious older adults.

Keywords: Generalized anxiety disorder; attentional bias; older adults; dot-probe; aging; positivity effect

1. Introduction

Anxiety disorders and subclinical anxiety have a high prevalence in elderly people (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010). In fact, a recent study has found that anxiety disorders are among the most prevalent psychiatric disorders in this population, even more so than depression (Andreas et al., 2017). Furthermore, anxiety disorders and anxiety symptoms are related to increased disability, poor well-being, and cognitive impairment (Bower, Wetherell, Mon, & Lenze, 2015), and their impacts are equal to those of depression (Schuurmans & van Balkom, 2011).

Cognitive theories of anxiety point out that biased attention plays a central role in the development and maintenance of anxiety (Van Bockstaele et al., 2014). Specifically, individuals with clinical anxiety or high levels of trait anxiety are likely to pay relatively more attention to negative information. Despite the evidence regarding attentional biases associated with anxiety in the general population (e.g., Bar-Haim, Lamy, Pargamin, Bakermans-Kranenburg, & van IJzendoorn, 2007), there is a clear lack of research on this topic in older adults. To the best of our knowledge, only 10 studies have explored attentional bias in older adults with clinical anxiety, anxiety symptoms, or trait anxiety, and the available results are inconclusive (see Table 1). Whereas some have observed a relation between anxiety and selective attention to negative information (Price, Eldreth, & Mohlman, 2011; Price, Siegle, & Mohlman, 2012; Wittekind, Muhtz, Moritz, Jelinek, 2017), others have found no clear attentional bias towards negative information (Burgess, Cabeleira, Cabrera, Bucks, & MacLeod, 2014; Fox & Knight, 2005; Lee & Knight, 2009; Namaky et al., 2017), have found null results (Herrera, Montorio, & Cabrera, 2017; Mohlman, Price, & Vietri, 2013), or have even found an avoidance of negative information (Demeyer & De Raedt, 2013).

A possible reason for these inconsistent findings in the studies aimed to explore anxiety-linked attentional bias in older adults is age-related changes in emotional information processing. When selective attentional processing has been studied in older adults, and clinical or trait anxiety has not been specifically assessed, it has been observed that older adults preferentially pay more attention to positive stimuli compared with younger adults (Reed, Chan, & Mikels, 2014). Socioemotional selectivity theory (Carstensen, 2006) attributes this "positivity effect" to age-related changes in motivation. Specifically, it has been argued that, when individuals age and perceive their time horizon to be constrained, goals shift from a focus on long-term outcomes to short-term outcomes, such as current emotional well-being. Favoring the processing of positive information and paying less attention to negative information is one of the emotional regulation strategies adopted to achieve this goal. However, this "positivity effect" may be moderated by individual differences in emotional variables like anxiety (e.g., Herrera et al., 2017).

Besides the inconclusive results from previous studies that have explored anxiety-linked attentional bias in older adults, another limitation is that only two studies employed clinical samples (Mohlman et al., 2013; Price et al., 2011). Differences between subclinical analogue samples and clinical samples have been observed in anxiety-linked attentional bias (e.g., Yiend et al., 2015). These differences point out that caution is necessary before generalizing from subclinical samples to clinical populations.

In the first study that explored anxiety-linked attentional bias in older clinical adults, Price et al. (2011) compared a sample of older adults with generalized anxiety disorder (GAD) to non-anxious controls, using the emotional Stroop task with negative and neutral words. In the emotional Stroop task, participants are asked to name the ink

color of emotional words (Williams, Mathews, & MacLeod, 1996). Anxious participants typically show disproportionately long color-naming latencies to negative words in the emotional Stroop task, and this has been interpreted as an attentional bias toward negative information (Bar-Haim et al., 2007). Price et al. (2011) found that older adult GAD patients took longer to name the color of negative words and concluded that late-life GAD is related to a similar attentional bias observed in younger GAD samples. However, the longer color-naming latencies to negative words could also be explained by hypothesizing that anxious individuals have an overall delayed response to negative stimuli ("behavioral freezing", Clarke, Macleod, & Guastella, 2013). Therefore, the methodological limitation of the task does not allow reaching Price et al.'s conclusion.

In the second study, Mohlman et al. (2013) analyzed attentional bias in a sample of older adults with GAD compared to non-anxious controls, using the dot-probe task (MacLeod, Mathews, & Tata, 1986). In the dot-probe task, two stimuli appear, one emotional and one neutral, at different locations on the screen for a brief time, followed by a probe in the same spatial location as one of the previous stimuli. Participants have to identify the probe (e.g., ":" vs. ".."). Responses are faster on trials in which the probe appears in the spatial location to which the participants had been paying attention. Anxious participants are disproportionately faster to respond to probes in the spatial location of negative stimuli, suggesting an attentional bias for negative stimuli (Bar-Haim et al., 2007). In their study, Mohlman et al. (2013) employed negative (threatening and depressive), positive, and neutral words and the pair of stimuli was presented for 500 ms. In their results, the authors did not find any anxiety-linked attentional biases and suggested that future studies should use: a) different presentation times and b) more compelling stimuli.

Regarding the presentation time, the vigilance-avoidance hypothesis indicates that anxious individuals show an initial automatic hypervigilance to threat information, followed by an attentional avoidance of threat in an attempt to reduce their anxious mood (Mogg & Bradley, 1998). Several studies have confirmed this hypothesis, finding that high-anxious (non-clinical) young adults, at brief presentations (100 ms), showed an initial attentional bias, but at longer stimulus duration (500 ms), they showed an attentional avoidance (Koster, Verschuere, Crombez, & Van Damme, 2005; Mogg & Bradely, 2006). Regarding the use of more compelling stimuli, pictorial stimuli have a greater ecological value compared to words and, consequently, have greater emotional salience (e.g., McBride & Dosher, 2002).

Therefore, due to the previous inconsistent results and methodological limitations, further research is required to determine whether anxiety is associated with attentional bias towards negative information in older adults. Following Mohlman et al.'s (2013) suggestions, the present study explored anxiety-linked attentional biases in a sample of older adults with GAD using the dot-probe task with negative, positive, and neutral pictorial stimuli and two presentation times: 100 and 500 ms. We have focused on GAD due to its being the most prevalent anxiety disorder in older adults (Bryant, Jackson, & Ames, 2008). Based on selective attention research with younger adults (e.g., Bar-Haim et al., 2007), it is expected that older adults with GAD would show attentional bias towards negative information. By contrast, based on the positivity effect research with older adults (e.g., Reed et al., 2014), it is expected that healthy older adults would show attentional bias towards positive information and bias away from negative information.

2. Method

2.1. Participants

Participants were 32 GAD patients and 28 controls aged 60 or more. This age threshold was used due to the fact that most of the studies that have explored anxiety-related bias in older adults have used it (Burgess et al., 2014; Herrera et al., 2017; Mohlman et al., 2013; Namaky et al., 2017; Price et al., 2011; Price et al., 2012). Clinical participants were recruited from primary health care centers if they had a diagnosis of GAD identified by the primary care physician and had at least five medical visits during the last year. A previous study has found that individuals who visit a primary health care center five or more times per year were almost four times as likely to have a diagnosis of GAD (Bélanger, Ladouceur, & Morin, 2005). Before participating in the study, all clinical participants were diagnosed according to Diagnostic and Statistical Manual of Mental Disorders-IV-TR criteria (American Psychiatric Association, 2000) and met these criteria as their primary diagnosis. The diagnosis was determined using the Spanish version (Valiente, Sandín, & Chorot, 2003) of the Anxiety Disorders Interview Schedule-Revised (ADIS-R; Brown, Di Nardo, & Barlow, 1994) by a clinical psychologist with a clinical experience of 10 years. Many GAD patients had additional current Axis I diagnoses, including co-morbid anxiety disorders (34%) and major depressive disorder (40%). Control participants were also recruited from primary health care centers if they did not present a diagnosis of GAD identified by the primary care physician and had less than five medical visits during the last year. Control group was also assessed with the ADIS-R to ensure they did not meet the DSM-IV criteria for GAD or any other anxiety disorder. Participants were excluded if they reported being diagnosed with visual problems (e.g., cataracts), dementia, or had suspected cognitive impairment. The study was approved by the Ethics Committee at the Universidad Autónoma de Madrid.

2.2. Materials

2.2.1. Cognitive status

Two cognitive measures were used as a dementia screen and to control cognitive differences between groups.

Mini Examen Cognoscitivo (MEC; Lobo, Ezquerra, Burgada, Sala, & Seva, 1979): The MEC is a brief screening test to measure cognitive functioning and suspected cognitive impairment. It is the Spanish version of the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) that scores from 0 to 35.

Digit Span Backward of the Wechsler Adult Intelligence Scale III Revision-Revised (DSB-WAIS-III; Wechsler, 2001): Each participant was presented with progressively longer strings of digits and asked to repeat them in reverse order. The score was the longest string of digits correctly recalled in reverse order (maximum score = 8).

2.2.2. GAD symptomatology severity

To measure GAD symptomatology severity the Worry and Anxiety Questionnaire was employed (WAQ; Dugas et al., 2001). The WAQ assesses specific GAD symptoms, as defined by the Diagnostic and Statistical Manual of Mental Disorders (4th Edition). The WAQ consists of 10 items scored from 0 (Not at all) to 8 (Very severely). The internal consistency for the WAQ was .89 (Cronbach´s alpha) in this study.

2.2.3. Dot-probe task

The attentional task consisted of 20 practice trials and 108 experimental trials, 36 with negative-neutral, 36 with positive-neutral, and 36 with neutral-neutral picture pairs. Each trial began with a fixation cross in the middle of the screen for 500 ms. This was followed by two pictures, one shown on each side of the preceding fixation cross. One of the pictures was negative, positive, or neutral and the other one was always

neutral. The stimulus presentation time was 100 or 500 ms. Immediately following the termination of the picture display, a probe appeared in the same spatial location as one of the previous pictures. The probe was two small vertical (:) or horizontal dots (..). Participants were asked to press as quickly and accurately as possible one of two mouse buttons to indicate the type of probe. The right computer mouse key was used for one probe (..) and the left key for the other (:). The inter-trial interval was 1,000 ms. Experimental trials were balanced for the position of the emotional picture and the target to be detected, for the exposure time, and for the type of probe, and all conditions were presented in a different random order for each participant. The speed and accuracy of the probe discrimination responses were recorded. Split-half reliabilities were calculated by correlating the first half of the trials of each type with the latter half. The split-half correlations ranged from -.17 to -.10, and none was significant.

2.2.4. Stimuli

Candidate pictures subsets (negative, positive, and neutral) were created, with 72 pictures for each emotion. Pictures were selected both from the International Affective Picture System (Lang, Bradley, & Cuthbert, 1999) and others from various internet sources. Twelve independent older adults (aged 61-80, M = 70.7, 75% women) were asked to rate the emotional valence using a 7-point Likert scale (-3 = very negative, +3 = very positive). The 36 most negative, positive, and neutral pictures were selected. The mean rating of negative pictures was -2.2 (SD = 0.2), the mean rating of positive pictures was 2.4 (SD = 1.8), and the mean rating for neutral pictures was 0.2 (SD = 0.3). The difference among the ratings of the three picture subsets was statistically significant ($p < .01$). Furthermore, there was no significant difference in the absolute value of emotional intensity ratings between negative and positive pictures ($p > .05$).

2.3. Procedure

Participants were assessed individually over two days. In the first day, participants read and signed an informed consent form, answered some demographic and health questions, completed the MEC (Lobo et al., 1979), the DSB-WAIS-III (Wechsler, 2001), and the WAQ (Dugas et al., 2001), and answered the ADIS-R (Valiente et al., 2003). If participants fulfilled the inclusion criteria they were asked to return another day. On the second day, participants were seated at a comfortable viewing distance from the computer screen (approximately 60 cm) and completed the dot-probe task.

2.4. Data analysis

The differences between the GAD and control groups in age, MEC, DSB-WAIS-III, and WAQ were examined with independent *t*-tests. Gender differences between groups were examined with the chi-square test.

Reaction time (RT) data from the dot-probe task were analyzed after excluding trials with incorrect probe identification. In order to reduce the influence of outliers, we used the median RTs (e.g., Williams, Mathews, & Hirsch, 2014). Attentional bias index for each emotional valence (negative and positive) at both exposure times (100 and 500 ms) were calculated for each participant by subtracting the median RT when probes appeared in the same location as the emotional picture (congruent trials) from the median RT when probes occurred in the opposite location (incongruent trials) (e.g., Mogg, Millar, & Bradley, 2000). Positive values of attentional bias scores indicate vigilance for the emotional picture and negative values reflect attentional avoidance.

To explore the attentional bias differences between the GAD and control groups, a 2 x 2 x 2 mixed design ANOVA was used. The between-subjects variable was the Anxiety Group (GAD/control). The within-subject variables were Emotional Valence of pictures (negative/positive) and Exposure Time (100/500 ms).

3. Results

3.1. Participant characteristics

None of the participants had diagnosed or suspected cognitive impairment using a cut-off of more than 23 in the MEC (Lobo et al., 1979). The two groups did not differ significantly in terms of gender, $\chi^2(1) = 1.40$, $p = .235$, $r = .15$, but there was a significant difference in age, $t(58) = -2.5$, $p = .013$, $d = 0.66$. However, there were no differences between groups in cognitive functioning as measured with the MEC, $t(58) = .091$, $p = .365$, $d = 0.23$, and the DSB-WAIS-III, $t(58) = 1.09$, $p = .279$, $d = 0.28$. As expected there was a significant difference between groups in the WAQ, $t(58) = -6.494$, $p < .001$, $d = 1.70$ (Table 2).

3.2. Attentional biases

There is no clear recommendation regarding a standard percentage of errors made on the dot-probe task. Some studies used an error rate of 10% as exclusion criterion (e.g., Johansson, Ghaderi, & Andersson, 2004), whereas others used 20% (e.g., Fani, Bradley-Davino, Ressler, & McClure-Tone, 2011), 25% (e.g., Demeyer & De Readt, 2013) or even 50% (e.g., Roy et al., 2008; Salum et al., 2013). The studies that used higher error rates were those conducted with children or older adults (Demeyer & De Readt, 2013; Roy et al., 2008; Salum et al., 2013). Thus, in the present study, participants with an error rate above 30% in the dot-probe task (n = 9, 1 from the control group and 8 from the GAD group) were excluded from the analyses. The mean RTs in each condition for the dot-probe task are displayed for each group in Table 3.

The analysis of the attentional bias differences between the anxiety groups did not reveal any significant main effects (Anxiety Group, $F(1, 49) = 0.05$, $p = .814$, partial $\eta^2 = .001$, Emotional Valence, $F(1, 49) = 0.006$, $p = .94$, $\eta^2 = .000$, Exposure Time, $F(1, 49) = 0.01$, $p = .895$, $\eta^2 = .000$). Nor were there any significant interactions between

Anxiety Group and Exposure Time, $F(1, 49) = 3.7$, $p = .058$, partial $\eta^2 = .071$, Emotional Valence and Exposure Time, $F(1, 49) = 1.03$, $p = .313$, partial $\eta^2 = .021$, or in the three-way interaction between Anxiety Group, Emotional Valence and Exposure Time, $F(1, 49) = 0.321$, $p = .574$, partial $\eta^2 = .007$. However, there was a significant interaction between Anxiety Group and Emotional Valence, $F(1, 49) = 8.5$, $p = .005$, partial $\eta^2 = .148$. Irrespective of exposure duration, participants with GAD paid more attention to negative information ($M = 31.8$, $SD = 15.6$) and avoided the positive information ($M = -5.3$, $SD = 14.7$), whereas participants in the control group paid more attention to positive information ($M = 27.3$, $SD = 11.4$) and avoided the negative information ($M = -2.5$, $SD = 12.1$). Therefore, the Anxiety Group (GAD/control) moderated the attentional biases. Specifically, in the GAD group the difference between the negative and the positive bias was 37.1 [31.8 – (-5.3)] and in the control group was -29.8 (-2.5 – 27.3). This difference or effect was significantly different between both groups ($p = .005$) (Figure 1)[1].

4. Discussion

Previous research with young adult populations has demonstrated that anxiety is characterized by an attentional bias to negative information. However, studies with older adults have shown inconclusive results, consequently, the issue of whether anxiety-linked attentional biases are present in older adults has not yet been adequately resolved. The purpose of the present study was to determine whether this is evident in clinically anxious older adults.

[1] After excluded 9 participants due to their error rate in the dot-probe task, the age difference between groups was still significant, $t(49) = -2.12$, $p = .04$, $d = 0.58$. Therefore, we repeated the 2 x 2 x 2 mixed design ANOVA with age as a covariant and the results were not modified.

The results of the present study support the hypothesis that older adults with clinical anxiety do indeed display an attentional preference for negative information and attentional avoidance for positive information, whereas healthy older adults showed the reverse pattern of attentional deployment. Thus, in older adults, as in younger samples (e.g., Bar-Haim et al., 2007), clinical anxiety appears to be characterized by an attentional bias to negative information. In addition, the effect size found for these attentional biases is large, compared with the medium effect size found with younger GAD samples (Bar-Haim et al., 2007).

Only one previous study explored anxiety-linked attentional bias with clinical anxiety in older adult samples with a dot-probe task similar to the one we used with emotional words and a stimulus presentation of 500 ms (Mohlman et al., 2013). However, these authors did not find either an attentional preference for negative information in the older GAD adult group or an attentional preference for positive information in the control group.

Compared with Mohlman et al.'s (2013) work, in the present study, we employed pictures instead of words. It is likely that emotional pictures are more ecologically relevant stimuli and have greater emotional salience than words to capture attentional bias (e.g., McBride & Dosher, 2002). Besides, this might be more relevant in older adults, due to the lower educational level of older adults compared to young samples (e.g., Eurostat, 2017). It is also possible that older adults process emotional pictures and words differently, with pictures associated with a bottom-up or more automatic processing, and words associated with a top-down or conceptual processing (Leclerc & Kensinger, 2011). Our results lead to the recommendation that future studies explore anxiety-linked attentional bias in older adults by comparing verbal and pictorial formats in the dot-probe task.

A second difference with Mohlman et al.'s (2013) work was the use of two presentation times: 100 and 500 ms. Our findings showed that there was no significant effect of stimulus duration on attentional biases, and the vigilance-avoidance pattern found in others studies was not observed (e.g., Koster et al., 2005). It seems that older adults with clinical anxiety directed their attention towards negative information and maintained it, at least within the time course explored in this study (100 and 500 ms), whereas healthy older adults showed the same pattern but towards positive information. These results are congruent with a previous meta-analysis carried out with young populations, finding a significant threat-related bias across all exposure times, from subliminal exposures to exposures longer than 1,000 ms (Bar-Haim et al., 2007). Nevertheless, it is still unclear whether anxiety-linked attentional bias reflects a tendency to rapidly engage attention with negative information or a difficulty in disengaging attention from such stimuli (Mogg & Bradley, 2016). Burgess et al. (2014) employed a novel lexical decision task using negative, positive, and neutral stimuli to measure attentional engagement and disengagement in a sample of young and older adults with high and low levels of trait anxiety. They found that heightened anxiety may be associated with a deficit in engaging with positive information. This result is consistent with our results; however, futures studies should further explore the engagement and disengagement components of anxiety-linked biases.

Regarding the dot-probe task, a relevant issue is that the validity of the task has been called into question during the last years (Rodebaugh et al., 2016). In the scarce studies that have explored the reliability of the dot probe-task, a low internal consistency has been found (for a review, see Chapman, Devue, & Grimshaw, 2019), a result that was also been found in the present study. However, it has been observed that highly anxious individuals do not present a stable attention bias but instead, it varies

based on different moderating variables like time, level of state anxiety, or stimuli. Therefore, within-individual attentional bias may be conceptualized as probabilistic in nature, and the low internal consistency of the dot-probe task may reflect this variability (MacLeod, Gratfon, & Notebaert, 2019). In this sense, some researches have explored the dynamic expression of attentional bias across time and have found that attentional bias fluctuates between threat vigilance and avoidance (Zvielli, Bernstein, & Koster, 2015).

A consequence of this high within-individual variability is that attentional-linked bias and the instruments to measure it are not very suitable for individual classification and limit its diagnostic utility. However, when this variability is averaged to contrast groups with high and low levels of anxiety, it consistently reveals group differences despite the low internal consistency of the task. When these group differences are conducted, there is substantial evidence that individuals with clinical anxiety or high levels of trait anxiety are characterized as paying relatively more attention to negative information (Cisler & Koster 2010, Mathews & MacLeod 2005). Therefore, "attentional bias assessment may best reveal characteristics of groups rather than individuals" (MacLeod, Gratfon, & Notebaert, 2019, p. 14). These group differences have been found in this study and are coherent with cognitive theories of anxiety, due to the fact that GAD participants showed an attentional bias to negative information, but also with the socioemotional selectivity theory, as the control group showed an attentional bias to positive information.

Despite that the low reliability of the dot probe-task may show the high within-individual variability in the attentional bias, there may be also a measurement error, and therefore, it is important to continue improving the procedure and measure to explore attentional bias. MacLeod, Gratfon, and Notebaert (2019) proposed using different

measures of attentional bias or using the same measure on multiple occasions and developing novel dot-probe tasks.

Our findings may have clinical implications. Anxiety disorders are among the most prevalent psychiatric problems in older adults (Andreas et al., 2017), and GAD seems to be among the most common of these (Bryant et al., 2008). The studies that explore the efficacy of cognitive behavioral therapy (CBT) in older people have found small to moderate effect sizes when compared with those of younger adult clinical samples (e.g., Gould, Coulson, & Howard, 2012; Kishita & Laidlaw, 2017), perhaps because older adults find it more difficult to follow CBT procedures (Beck, 2008). Our findings show that attentional bias to negative information may be a characteristic of older adults with GAD similar to the effects found in younger adults. Therefore, new emerging therapeutic interventions used in younger cohorts, designed to reduce anxiety by decreasing attentional preferences for negative information, may also be employed in older adults with clinical anxiety. Cognitive bias modification (CBM) techniques utilize computer-based attention training protocols to implicitly modify biased attentional patterns in anxious patients by extended exposure to task contingencies that favor predetermined patterns of processing selectivity and seem to significantly alter emotional vulnerability (Grafton et al., 2017). CBM techniques could supplement CBT and might be more relevant in older adults due to their performance ease and the lower efficacy of CBT. Future studies should assess the capacity of CBM techniques, designed to reduce the attentional bias to negative information, to decrease anxiety symptomatology in older clinical adults, alone or together with CBT.

Regarding the positivity effect, the current findings show that older adults with GAD avoided positive pictures, whereas healthy older adults showed an attentional preference for this information and avoidance of the negative. This result suggests that

the positivity effect that seems to characterize older adults (Reed et al., 2014) may be moderated by clinical anxiety by limiting the use of attention as an emotional regulation strategy. In consequence, studies aimed at exploring the positivity effect should take anxiety levels into account.

Our results support the relevance of examining positive aspects of functioning in clinical psychology and considering the processing of both negative and positive information (Vazquez, 2017). Thus, future researchers could explore not only the anxiety-linked attentional bias to negative information, but also bias to positive information. If clinical anxiety is also related to less attention towards positive information, and this could maintain the symptomatology, CBM should not only be aimed at decreasing attentional bias towards negative information, but also at increasing attention to positive information.

Some limitations should be acknowledged. First is the age difference found in the GAD and control groups, although there were no differences in cognitive functioning between both groups. No younger adult group was included, as the study was aimed at exploring the effects of anxiety rather than the effect of aging. Therefore, age should be further explored. Finally, the small samples sizes of the study.

5. Conclusion

In summary, the results of the current investigation suggest that older adults with GAD present an attentional preference for negative information and avoidance of positive information. Improving our understanding of the etiology and maintenance of anxiety, such as selective information processing biases, may promote the development of more effective psychological interventions in older adults (MacLeod & Bucks, 2011).

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Declarations of interest

None

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Table 1. A summary of research exploring anxiety-linked attentional bias in older adults

Study	Anxiety problem	Sample	Attentional task	Stimuli	Evidence[a]	Detail
Fox & Knight (2005)	TA IA	Older adults (n = 37)	Emotional Stroop	Negative, positive, and neutral words	–	Large AB for negative words in IA group with low TA.
			Dot-probe task Exposure time: 500 ms	Negative and neutral words	±	No differences between high and low TA groups. Large AB for negative words in IA group.
Lee & Knight (2009)	TA	Older adults (n = 44) and younger adults (n = 103)	Dot-probe task Exposure time: subliminal (20 ms for young and 50 ms for older adults) and	Negative and neutral faces, pictures, and words	±	Attentional avoidance followed by large AB in high TA older adults for negative words. Large AB followed by an attentional avoidance in moderate

			1,500 ms			TA older adults for negative faces.
Price at al. (2011)	GAD	Older adults (n = 28)	Emotional Stroop	Negative and neutral words	+	Large AB for negative words in GAD group.
Price at al. (2012)	Worry	Older adults (n = 60)	Emotional Stroop	Negative, positive, and neutral words	+	Large AB for negative words in high worry group.
Demeyer & De Raedt (2013)	TA	Older adults (n =37) and middle-aged adults (n = 25)	Exogenous cueing task	Negative, positive, and neutral facial expression	–	Attentional avoidance for negative words related to high levels of TA in older adults.
Mohlman et al. (2013)	GAD	Older adults (n = 62)	Dot-probe identification task. Exposure time: 500 ms	Negative, positive, and neutral words	–	No differences between GAD and control groups.

Burgess et al. (2014)	TA	Older adults (n = 32) and younger adults (n = 32)	Lexical decision task	Negative, positive, and neutral words	±	Deficit in engaging with positive words in high TA group.
Herrera et al. (2017)	TA	Older adults (n = 102)	Interference task	Negative, positive, and neutral pictures	–	No differences between high and low TA groups.
Namaky et al. (2017)	TA	Older adults (n = 38) and younger adults (n = 38)	Dot-probe task Exposure time: 2,000 ms	Negative and neutral faces and pictures	±	Large AB for negative information related to high levels of TA in older and younger adults with low cognitive control.
Wittekind et al. (2017)	Subclinical PTSD	Older adults (n = 50)	Emotional Stroop	Trauma, anxiety, depression, and neutral words	+	Large AB for trauma and depression words in high PTSD group.

Note: AB = attentional bias; GAD = generalized anxiety disorder; IA = induced anxiety; PTSD = post-traumatic stress disorder; TA = trait anxiety.

[a] Plus (+) indicates evidence relating attentional bias to anxiety; plus/minus (±) indicates mixed findings, and minus (–) indicates null findings or reversed effects.

Table 2. Sample characteristics

	Control (n = 28)	GAD (n = 32)
Gender (% female)	64.3%	78.7%
Age	68.71 (5.24)	72.93 (7.21)
MEC	31.75 (3.16)	31.00 (3.17)
DSB-WAIS-III	3.71 (1.08)	3.46 (0.62)
WAQ	29.85 (14.85)	51.62 (11.03)

Note: DSB-WAIS-III = Digit Span Backward subtest of the Wechsler Adult Intelligence Scale-Third Revision; MEC = Mini Examen Cognoscitivo; WAQ = Worry and Anxiety Questionnaire.

Table 3. Mean RTs in ms (SDs in parentheses) for each condition in dot-probe task

		Control		GAD	
Picture valence	Exposure time	Congruent	Incongruent	Congruent	Incongruent
Negative	100	797.5 (149.1)	778.6 (164.6)	868.5 (256.8)	900.9 (274)
	500	865.1 (195.9)	873.6 (168.1)	958.4 (268.8)	989.8 (259.3)
Positive	100	775.5 (138.2)	795.7 (159.3)	870.4 (257)	891.4 (238.9)
	500	866.9 (159.1)	901.5 (181.1)	1003.6 (281.5)	977.7 (253.3)

Figure 1. Attentional bias index (ms) for negative and positive pictures in GAD and control groups.