

## Self-affirmation reduces vigilance to mortality threat: An eye-tracking study

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The literature has indicated that self-affirmation attenuates defensive responding (e.g., derogation of an offensive essay's author, accessibility of death-related cognitions) to mortality threat. The current eye-tracking study built on that literature to examine whether self-affirmation influences attentional processing of mortality threat. Participants ( $N = 51$ ), after being randomly assigned to the self-affirmation or control condition, completed a free-viewing task that consisted of death-related (mortality threat) and non-death-related (control) images while their eye movements were being recorded. The results indicated that self-affirmation reduced attentional vigilance toward mortality threat both at the early stage and the whole stage of the free-viewing task. Reduced vigilance to mortality threat may be a precursor to attenuated defensive responding to it.

*Keywords:* attention, defensive responding, eyemovement, mortality threat, self-affirmation.

Psychological threat, in the form of unfavourable social or performance feedback, can challenge people's self-views as socially efficacious or intellectually competent (Sedikides, 2012; vanDellen et al., 2011). The pernicious implications of threat can be thwarted via self-affirmation, which is typically enacted by asking participants to write about their important (vs. unimportant) values (Sherman & Cohen, 2006). This intervention technique capitalises on the flexibility of the self-concept: When one self-aspect is threatened (e.g., social skills), affirmation of another self-aspect (e.g., a core value) re-establishes one's sense of adequacy and worth, thus shielding the individual from the harmful repercussions of threat (Cohen & Sherman, 2014).

Self-affirmation manifests on overt responses to threat (Cohen & Sherman, 2014; Sherman & Hartson, 2011). For example, it weakens the self-serving bias (i.e., the tendency to credit the self for successes more than failures; Sherman et al., 2007) and increases openness to personal health-risk information (e.g., breast cancer, HIV; Sherman et al., 2000) or performance errors (Legault et al., 2012). Further, self-affirmation of individuals struggling with mental health problems weakens their reported intensity of negative emotions (e.g., irritability, upset) that result from exposure to information about their mental

health (Lannin et al., 2017), and self-affirmation of powerless individuals curbs decrements in their executive functions (i.e., inhibitory control; Albalooshi et al., 2020).

Self-affirmation also manifests on subtle psychophysiological responses to threat. For example, in a study assessing facial electromyography, self-affirmation attenuated the startle eyeblink response to threat (Crowell et al., 2015). Moreover, in a study assessing cardiovascular indices, self-affirmation led to lower maximum heart rate and higher respiratory sinus arrhythmia in response to threat (i.e., negative images; Chen et al., 2020). Finally, in a study recording event-related potential, self-affirmation enhanced processing of negative stimuli among threat-prone individuals (Finley et al., 2018).

In this article, we are interested in whether self-affirmation modulates subtle eye movement in response to the most serious of threats, mortality threat (as operationalised by mortality salience). Research inspired by terror management theory (TMT; Burke et al., 2010; Pyszczynski et al., 2015), has documented the wild impact of mortality salience on human psychology, including social cognition (e.g., attentional bias; Finch et al., 2016; Hirschberger et al., 2010; Kappenman et al., 2014), recall (Green et al., 2008), affect (e.g., anxiety, fear; Burke et al., 2010), and defensive behaviour (e.g., aggression; McGregor et al., 1998). The same literature has also indicated that people can cope effectively with death threat by heightening their self-esteem or adhering to the cultural worldview (Greenberg et al., 1992; Harmon-Jones et al., 1997; Routledge et al., 2010).

Previous studies have suggested that self-affirmation modulates overt responses to death threat. For example,

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following mortality salience, self-affirmation allayed participants' defensive responding to a worldview violator (i.e., decreased derogation of them; Schmeichel & Martens, 2005, Study 1) and weakened the accessibility of death-related thoughts (Schmeichel & Martens, 2005, Study 2). In a similar vein, following mortality salience among Chinese participants, self-affirmation attenuated defensiveness, allowing for increased tolerance toward the Chinese birth-control policy (Cai *et al.*, 2012). We note that due to the relatively high familialism of the Chinese culture (Ho, 1998; Li, 2002), self-affirmation in a Chinese context involved requesting participants to write about important values that both they and their family endorsed.

It is not clear, however, whether self-affirmation could modulate subtle eye movements in response to death threat. We addressed this issue via eye-tracking. This technique allows us to observe the allocation of visual attention by recording eye motion and gaze location across time and task (Carter & Luke, 2020). Generally, eye movements comprise a rapid sequence of fixations (i.e., periods of eye immobility) and saccades (i.e., quick jumps between fixation locations) that are influenced by the attention-grabbing nature of the stimuli (Jonides, 1981; Kowler, 1995). Fixating suggests that the stimulus receives attention and that information is being extracted whereas saccades suggest that these processes are suppressed (Rayner, 1998). Thus, the location, number, and duration of fixations are usually implicated as attentional indices to reflect the amount of information extracted from a certain stimulus, with a larger number and longer duration of fixations indicating a higher level of attentional vigilance toward the stimulus (Kessels *et al.*, 2016; Rayner, 1998; Wieser *et al.*, 2009).

We assigned participants to the self-affirmation or control condition. Then, we instructed them to complete a free-viewing task consisting of death-related (mortality threat) and non-death-related (control) images while recording their eye movements. We expected that in line with prior work (Kappenman *et al.*, 2014), participants would show attentional vigilance to death-related images. More importantly, we explored the possibility that as a precursor to attenuated defensiveness against mortality threat, self-affirmed (vs. control) participants would evince decreased attentional vigilance to death-related images.

## Method

### Participants and Design

We determined the sample size via a G\*Power analysis (Faul *et al.*, 2009), using the following parameters: power = .80,  $\alpha$  = .05. We set the expected effect size to

medium in accordance with a related eye-tracking study ( $f = 0.31$ ; Kessels *et al.*, 2016), which required a minimum of 48 participants. We relied on the participant pool of the Institute of Psychology, Chinese Academy of Sciences, to recruit 55 students in total from various Beijing-based universities (e.g., Beijing Forestry University, China Agricultural University, Tsinghua University). Four participants dropped out because they could not pass the standard 9-point calibration and validation procedure, and therefore could not attend the subsequent free-viewing task. Thus, the final sample consisted of 51 students (26 women, 25 men;  $M_{\text{age}} = 22.51$  years,  $SD_{\text{age}} = 2.58$  years). We randomly assigned them to the self-affirmation ( $n = 26$ ) or control ( $n = 25$ ) condition. All participants provided informed consent. The study protocol was approved by the Review Board of the Institute of Psychology, Chinese Academy of Sciences (Approval No. H17019).

### Materials

Informed by a prior study (Chen *et al.*, 2021), we selected 18 death-related images (e.g., “dead body,” “mutilation”) and 54 non-death-related images (e.g., “neutral face,” “factory worker”) from the International Affective Picture System, a standardised set of images (Lang *et al.*, 2008). The images had been validated by collecting participant ratings on valence (i.e., affect) and arousal. Ratings scales ranged from 1 to 9 (graphically rendered), with higher ratings indicating more positive valence and more intense arousal. The 18 selected death-related images ( $M = 1.80$ ,  $SD = 0.38$ ) had lower valence (i.e., more negative affect) than the 54 selected non-death-related images ( $M = 6.28$ ,  $SD = 0.92$ ),  $t(70) = -19.98$ ,  $p < .001$ . In addition, the selected death-related images ( $M = 6.73$ ,  $SD = 0.51$ ) entailed higher arousal than the selected non-death-related images ( $M = 3.96$ ,  $SD = 0.89$ ),  $t(70) = 12.48$ ,  $p < .001$ .

In addition, four student judges (two women, two men;  $M_{\text{age}} = 22$  years,  $SD_{\text{age}} = 2.94$  years) rated on a scale of 1 (*not at all*) to 7 (*very much*) the extent to which each image was threatening (Kendall's  $W = 0.90$ ) and mortality salient (Kendall's  $W = 0.82$ ). The judges rated the selected death-related images as more threatening ( $M = 6.42$ ,  $SD = 0.55$ ) than the selected non-death-related images ( $M = 1.13$ ,  $SD = 0.25$ ),  $t(70) = 55.81$ ,  $p < .001$ . Further, they rated the selected death-related images as more mortality salient ( $M = 6.24$ ,  $SD = 0.45$ ) than the selected non-death-related images ( $M = 1.31$ ,  $SD = 0.31$ ),  $t(70) = 51.56$ ,  $p < .001$ . Finally, we selected an additional 72 non-death-related images (valence:  $M = 5.15$ ,  $SD = 0.45$ ; arousal:  $M = 3.05$ ,  $SD = 0.45$ ) to serve as filler trials to ensure that some experimental trials did not contained a death-related image. We note the

International Affective Picture System numbers for the selected pictures in the Supporting Information.

We displayed the images in a four-image array format (Figure 1). In the mortality threat trials, a four-image array included one death-related image and three non-death-related images. In the filler trials, a four-image array included only non-death-related images.

### Apparatus

We presented the image arrays using Experiment Builder software (SR Research Ltd., Mississauga, Ontario, Canada) on a 17-in. monitor with a resolution of  $1,024 \times 768$  pixels. Each of the images in the array was 10.75 cm wide and 8.1 cm high ( $10.2^\circ$ ,  $7.7^\circ$  visual angle, respectively), with images being separated by 3 cm ( $2.8^\circ$  visual angle). We used an Eyelink 1000 system (SR Research Ltd.) to record participants' right eye movements, with a temporal resolution of 2000 Hz and a spatial resolution of  $0.01^\circ$  root mean square. We asked participants to complete a standard 9-point calibration and validation procedure before the free-viewing task commenced.

### Procedure

Participants received a self-affirmation writing essay task suited to Chinese culture (Cai et al., 2012). In the self-affirmation condition, they (a) chose one value, from a

list of four (financial wealth, art/creativity, social network, knowledge) that they and their family cherished most; (b) recorded why their chosen value was important to them and their family; and (c) described an experience in which they realised how important this value was to them and their family. In the control condition, they followed the same steps, having chosen the least important value and explaining why it was least important to them and their family. We provide, in Table 1, the frequency of values selected as the most and least important.

Next, participants sat in front of the monitor and fixed their head position on a chin-rest. Following completion of standard calibration and validation, they engaged in a free-viewing task in which they only needed to watch the images presented on the screen naturally and freely. This task included 72 trials: 36 mortality threat and 36 filler ones (All images were presented twice.) For each participant, we randomised the sequence of the experimental trials. We also randomised the content of each trial (i.e., the four images in the array) and the location of each image separately for each participant. Each trial began with a fixation cross "+" on the centre of the screen, and participants were instructed to fixate on it. Subsequently, the experimenter pressed a key to present the four-image array when they saw that the participant had fixated on the fixation cross through the calibration and validation screen. Each array was presented for 6 s and then was displaced by the fixation cross of the next trial.

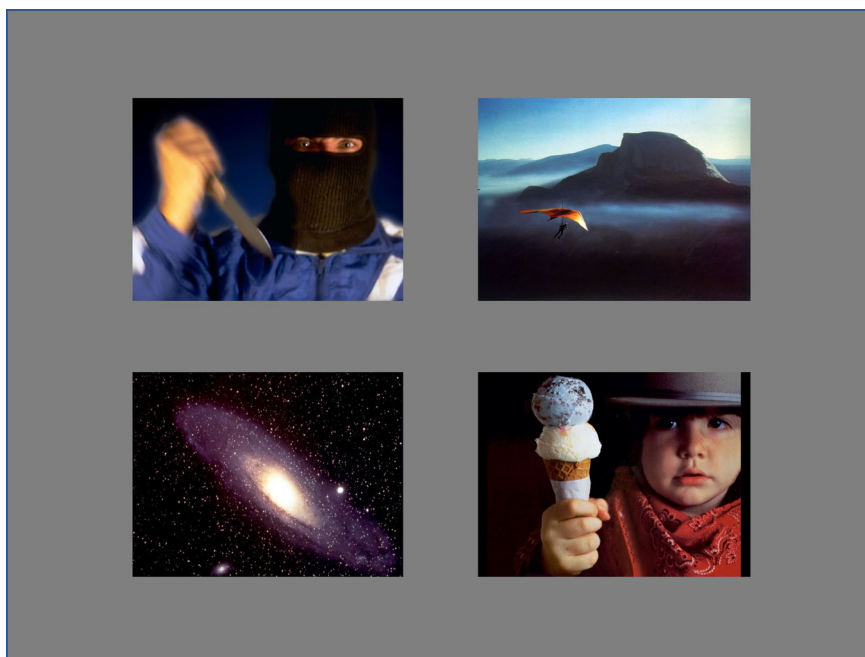


Figure 1 Example of a four-image array: one death-related, three non-death-related images. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

**Table 1**  
*Frequency of Values Selected as the Most (Least) Important*

	Financial Wealth	Art/Creativity	Social Network	Knowledge
Self-affirmation condition (most important value)	11	2	6	7
Control condition (least important value)	0	20	5	0

### Eye-Movement Indicators

We transferred the eye-tracking data into SPSS 23 using Data Viewer (SR Research Ltd.). We only analysed data from the mortality threat trials, given that filler trials did not contain a target (i.e., death-related) image.

In eye-tracking research (as mentioned earlier), the location, number, and duration of fixations are often used as attentional indices demonstrating one's attentional allocation. Thus, we implicated three fixation-related eye movement indices as dependent variables: (a) initial fixation position for each trial, (b) overall fixation percentage for each image, and (c) overall gaze duration percentage for each image. Initial fixation position for each trial is an indicator of initial rapid attention to threat (early stage). As such, if one's initial fixation position is on the death-related image, then they are more vigilant to mortality threat at an early stage. Overall fixation and gaze duration percentage for each image are eye movement indices indicating the extent to which participants are vigilant to mortality threat during the whole time course (whole stage). If participants fixate more and longer on death-related images, then they are more vigilant to threat during the whole stage.

## Results

### Initial Fixation Position (Early Stage)

For each trial, we included four regions of interest (ROIs) corresponding to the four images (i.e., one death-related, three non-death-related). We analysed only those fixations located on the ROIs. We counted the number of trials in which the initial fixation was located on a death-related image and a non-death-related image separately. There were 36 mortality trials in total; thus, the

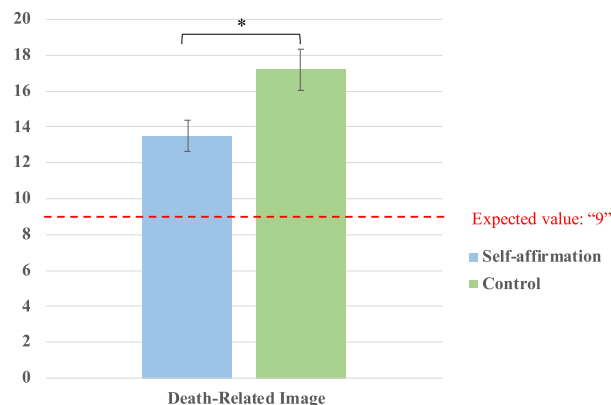
number of initial fixations on the target images and the number of initial fixations on the control images added up to a constant (i.e., 36) for each participant.

First, we tested whether self-affirmed and control participants showed obvious attentional vigilance to death-related images. We used one-sample *t* tests to compare the number of initial fixations on the target images with the expected value "9" (as there were three non-death-related images and only one death-related image in each trial). The results indicated that control participants ( $M = 17.16$ ,  $SD = 5.77$ ) showed an attentional bias toward death-related images,  $t(24) = 7.07$ ,  $p < .001$ , Cohen's  $d = 1.41$ , but so did self-affirmed participants ( $M = 13.50$ ,  $SD = 4.53$ ),  $t(25) = 5.07$ ,  $p < .001$ , Cohen's  $d = 0.99$ . In all, participants did manifest an attentional bias toward mortality threat images at an early stage. Furthermore, we used an independent-samples *t* test to compare the numbers of initial fixations on the target images between the self-affirmation and the control group. The results suggested that self-affirmation significantly reduced participants' vigilance to death-related images,  $t(49) = 2.53$ ,  $p = .015$ , Cohen's  $d = 0.71$  (Figure 2). That is, self-affirmation reduced initial vigilance toward mortality threat.

### Overall Fixation Position (Whole Stage)

We computed the overall fixation position percentage as the sum number of all fixations on a certain ROI (i.e., a certain image) divided by the total number of fixations on the ROIs during the whole 6-s period. Thus, the percentages of overall fixations on death-related images and non-death-related images added up to 100%.

Similarly, we first tested whether participants showed obvious attentional vigilance to death-related images. We used one-sample *t* tests to compare the percentage of fixations on target images with the expected value



**Figure 2** Initial fixation position (number) on death-related images.  $*p < .05$ . [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

“0.25” (as there were three non-death-related images accompanied by one death-related one). Control participants ( $M = 0.34$ ,  $SD = 0.13$ ) exhibited an obvious attentional bias toward death-related images (i.e., more fixations),  $t(24) = 3.66$ ,  $p = .001$ , Cohen’s  $d = 0.73$ , whereas self-affirmed participants ( $M = 0.26$ ,  $SD = 0.09$ ) did not,  $t(25) = 0.84$ ,  $p = .41$ . Furthermore, we used an independent-samples  $t$  test to compare the percentages of overall fixations on the target images between the self-affirmation and the control group. Self-affirmed participants fixated significantly less on death-related images than control participants,  $t(49) = 2.58$ ,  $p = .013$ , Cohen’s  $d = 0.72$  (Figure 3). In summary, control participants did have an attentional bias toward death-related images for the whole stage, but self-affirmation significantly reduced such vigilance.

### Overall Gaze Duration (Whole Stage)

We computed the overall gaze duration percentage as the duration sum of all fixations on a certain image divided by the whole gaze duration on the ROIs. The percentages of overall gaze duration on death-related images and non-death-related images added up to 100%.

As before, we used one-sample  $t$  tests to compare the percentage of gaze duration on target images with the expected value “0.25.” Control participants ( $M = 0.35$ ,  $SD = 0.15$ ) manifested obvious attentional vigilance to death-related images (i.e., longer gaze duration),  $t(24) = 3.23$ ,  $p = .004$ , Cohen’s  $d = 0.65$ , but self-affirmed participants ( $M = 0.25$ ,  $SD = 0.10$ ) did not,  $t(25) = 0.13$ ,  $p = .90$ . Moreover, we conducted an independent-samples  $t$  test to compare the percentages of overall gaze duration on the target images between the self-affirmation and the control group. Self-affirmed participants spent less time gazing at death-related images than control participants,  $t(49) = 2.68$ ,  $p = .010$ , Cohen’s  $d = 0.75$  (Figure 4). To

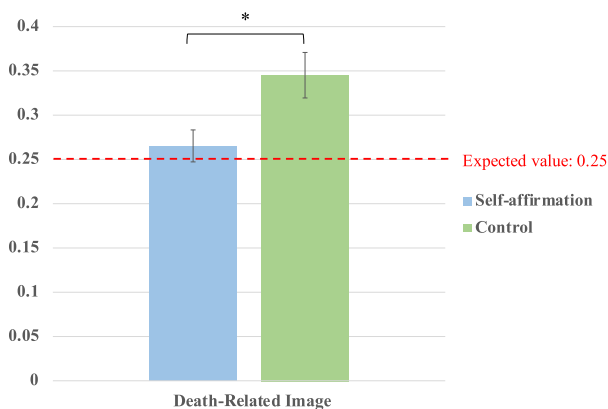


Figure 3 Overall fixation (percentage) on death-related images.  $*p < .05$ . [Colour figure can be viewed at wileyonlinelibrary.com]

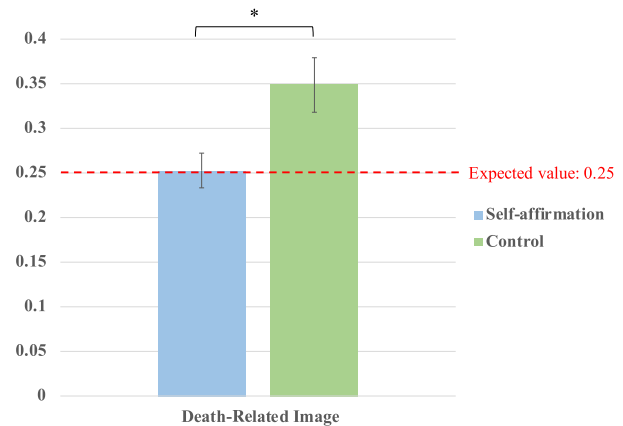


Figure 4 Overall gaze duration (percentage) on death-related images.  $*p < .05$ . [Colour figure can be viewed at wileyonlinelibrary.com]

summarise, the results indicated that control participants manifested an attentional bias to death-related images, but self-affirmation attenuated this defensive responding to mortality threat for the whole stage of processing.

### Discussion

Prior work has indicated that self-affirmation lessens defensive responding to mortality threat (Schmeichel & Martens, 2005). We extended this work by asking, in an eye-tracking study, whether self-affirmation also reduces attentional vigilance to mortality threat. Death-related images (i.e., entailing high mortality threat) evoked increased vigilance across eye movement indices (i.e., initial fixation position, overall fixation position, overall gaze duration). This finding is consistent with that of an event-related potential study, which showed an initial attentional shift to death-related images (Kappenman et al., 2014), perhaps as a marker of death anxiety (Burke et al., 2010). However, self-affirmation soothed this early defensive response that we observed. In other words, self-affirmed participants, across eye movement indices, evinced lower attentional vigilance to death-related images.

Our study adds to a burgeoning literature on how self-affirmation influences subtle responses, such as eye-movements, to death-related stimuli. Given that eye-movements indicate attention or vigilance that predisposes behavioral responses, our findings help clarify the utility of self-affirmation. As a defensive response to threatening stimuli, initial vigilance and maintained attentional bias toward threat have been associated with psychological ill-being (e.g., anxiety disorder; Richards et al., 2014). Hence, the finding that self-affirmation reduces attentional vigilance to mortality threats may explain why self-affirmation is beneficial for

psychological well-being: Self-affirmation decreases the impact of threatening stimuli by reducing people's attention to them, ultimately contributing to psychological well-being. In line with this thinking, a prior study has reported that self-affirmation attenuated the startle eye-blink response to threat, a process that presumably resulted from decreased attention to threatening images (Crowell *et al.*, 2015).

Our findings appear to contrast—at least partially—with another set of findings, showing that self-affirmation increases, rather than decreases, sensitivity to threat. In particular, an eye movement study has indicated that self-affirmed smokers (*vs.* nonsmokers) allocated greater attention (*i.e.*, more fixations) to a personally relevant health message (*e.g.*, containing risk) than a personally irrelevant (*e.g.*, neutral) health message, delivered as information on a cigarette pack (Kessels *et al.*, 2016). The role of personal relevance was further highlighted in a study where self-affirmed coffee drinkers (*vs.* non-coffee drinkers) manifested higher accessibility of threat-related cognitions in a lexical decision task in response to a threatening health message (*i.e.*, linking caffeine consumption to health problems; van Koningsbruggen *et al.*, 2009), although level of threat was not manipulated. The findings of yet another study were more equivocal. Self-affirmed (*vs.* control) moderate drinkers evinced an attention bias to supraliminally presented threatening words; however, self-affirmed (*vs.* control) heavy drinkers did not evince this bias (Klein & Harris, 2009), although arguably they should, and to a great extent than moderate drinkers.

The partial inconsistency between the aforementioned findings and our findings may be due to the differing type of threat involved. The aforementioned studies used health threat whereas we used death threat. Health threat, even when personally relevant, is malleable. Hence, its early detection could conduce to helpful steps to cope with it in the future. However, death threat is fixed and irrevocable. Hence, reduced attention may facilitate coping, thus conducing to psychological well-being (in line with terror management theory; Pyszczynski *et al.*, 2015). This explanation suggests a key moderator; namely, whether the threat is malleable or fixed. Evidence from another literature, the mnemonic neglect effect (Sedikides *et al.*, 2016), is consistent with the proposed moderator. Negative feedback (*i.e.*, self-threat) on ostensibly malleable personality traits is recalled well whereas negative feedback on ostensibly fixed personality traits is recalled poorly (Green *et al.*, 2005).

We manipulated mortality salience in accordance with a prior study (Chen *et al.*, 2021), presenting participants with death-related images. We selected death-related and non-death-related images from the International Affective Picture System based on valence and arousal

ratings. To ensure that the selected death-related images can heighten mortality salience, we asked participants to rate the extent to which the images were mortality salient and threatening. Nevertheless, it is still possible that the effect of death-related images was due, at least partially, to the high arousal level and negativity of those pictures. To rule out this possibility, follow-up research would need to implicate a control group that used non-death-related images of high arousal and negativity. Except for death-related images, follow-up research also could examine whether similar results are obtained when death threat is induced via other triggers such as death-related words, videos, or questionnaires (Greenberg *et al.*, 1997). In addition, our findings would need to be replicated in other cultures and among participants other than university students.

In closing, self-affirmation reduced attentional vigilance toward mortality threat at both the early stage and the whole stage of the viewing task. It is possible that this reduced attentional vigilance is a precursor to the attenuated defensive responding to mortality threat (*e.g.*, target derogation) at the conscious level.

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## Conflict of interest

None.

## Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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