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# Memories of a Death Threat: Negative Consequences of Unconscious Thoughts About a Terrorist Attack on Attitudes Towards Alcohol

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Franziska Pradel<sup>1,2</sup>  and  
Sebastian Sattler<sup>1,3</sup>

## Abstract

Based on the terror management health model (TMHM), we examined the impact of terrorist attacks as reminders of death on implicit alcohol-related attitudes, including the moderating role of conscious death-related thoughts and alcohol-based self-esteem (ABS). With an online experiment ( $N = 487$ ), we analyzed how thoughts and memories about a recent terrorist attack unconsciously (with a delay task) and consciously (without a delay task) affected implicit alcohol-related attitudes. We found that such thoughts increased the death-thought accessibility. While no main effect of the salience of the terrorist attack on alcohol-related attitudes existed, respondents with low ABS had more positive attitudes, when unconsciously thinking about the attack as compared to the control group. Respondents with high ABS in the delay task had lower alcohol-IAT scores. Overall, this study provides evidence that thoughts about terrorism that can be provoked through media affect

<sup>1</sup>Institute for Sociology and Social Psychology, University of Cologne, Cologne, Germany

<sup>2</sup>Cologne Center for Comparative Politics, University of Cologne, Cologne, Germany

<sup>3</sup>Pragmatic Health Ethics Research Unit, Institut de recherches cliniques de Montréal, Montréal, Québec, Canada

## Corresponding Author:

Franziska Pradel, Institute for Sociology and Social Psychology, University of Cologne, Herbert-Lewin-Str. 2, 50931 Cologne, Germany.

Email: [pradel@wiso.uni-koeln.de](mailto:pradel@wiso.uni-koeln.de)

alcohol-related attitudes. Such attitudes may cause negative health consequences through health-related decisions.

### **Keywords**

terror management theory, terror management health model, alcohol, attitudes towards alcohol, death-thought accessibility, implicit association test

## **Introduction**

Terrorism is not a new phenomenon in and outside of western societies, but since the September 11, 2001 attacks we have faced an increase of vivid reports and images broadcasted by the media about terrorist attacks (Neria et al., 2006). Despite the increased reports, it is not sufficiently understood how such attacks affect our thoughts and behavior. Research has shown that events like terrorist attacks can be considered a natural reminder of death (e.g., Landau, 2004; Ullrich & Cohrs, 2007). This is supported by the fact that news about terrorist attacks trigger death-related thoughts, anxiety, and a constant perceived danger of a future attack (e.g., Das et al., 2009). Being confronted with such media reports is not the only cause for death-related anxiety: activating thoughts about terrorist attacks (e.g., Dewa et al., 2014; Yum & Schenck-Hamlin, 2005), priming participants with words related to terrorism (e.g., Landau, 2004), or images of terrorist attacks (e.g., Vail et al., 2012) also provoked death-anxiety.

To cope with their concerns that death can happen at any time, individuals with such anxieties may try to manage them in various ways that may differ from reactions to other disasters. This is because terrorism attacks possibly damage an individual's culture, a natural "shield" that is embedded with one's worldviews and which frequently functions as a buffer for anxiety (Pyszczynski et al., 2003). Thus, if this buffer is under attack, individuals may show specific reactions. To investigate such reactions, most studies focus on the influence of terrorism as a prime in the political context and how it affects different forms of worldview defenses. That is, they examine the effects on not only individuals' stronger identification with their cultural beliefs and ideologies, but also the devaluation of other people's worldviews. For example, research has shown that making thoughts about terrorism salient reinforced racial prejudices, authoritarianism, and conservative attitudes (e.g., Echebarria-Echabe & Fernández-Guede, 2006). Being confronted with terrorism and thoughts about it also had the potential to strengthen support for the president in power (e.g., Landau, 2004) and extreme military actions (e.g., Pyszczynski et al., 2006) in some people. Additionally, terrorism was linked to public opinion leaning towards system-justifying tendencies of greater support

for the system in which they are living (e.g., Ullrich & Cohrs, 2007). Until now, only a few studies focus on the impact of reminding individuals of their own eventual death through a terrorist attack (i.e., terrorism salience, TS) on health and are limited to survey data rather than experimental designs. These studies reveal potential effects on health-related behavior such as alcohol consumption or smoking (DiMaggio et al., 2009; Neria et al., 2006), but little is known about the underlying mechanisms of these effects.

Terror management theory (TMT) (Greenberg et al., 1986; Pyszczynski et al., 2004) and particularly the terror management health model (TMHM) (Arndt & Goldenberg, 2017; Goldenberg & Arndt, 2008), as well as experimental studies on terrorist attacks (Echebarria-Echabe & Fernández-Guede, 2006; Landau, 2004), can help us investigate how processing a terrorist attack impacts health-related attitudes. According to the TMT and the TMHM individuals are assumed to react to unconscious thoughts about terrorist attacks by either strengthening their worldviews or by focusing on behaviors that bolster their self-esteem. Therefore, it should be acknowledged that a conscious processing of information on such attacks can lead to different effects than an unconscious processing.

As of yet, there has not been any research focusing on the link between a terrorist attack and attitudes towards alcohol combined with the role of striving for increased self-esteem. This is surprising, because alcohol is known for its detrimental individual and societal consequences which can include alcohol use disorder, alcoholic cirrhosis, breast cancer, or violence (Graham et al., 2011; Grønbaek, 2009; Room et al., 2005). It would be beneficial to expand the knowledge about whether and under what conditions the activation of death thoughts concerning terrorism occur to prevent such negative outcomes. Specifically, investigating the role of self-control is important in this context, because research has also shown that alcohol can be beneficial for an individual's self-esteem (Banaji & Steele, 1989; Lac & Brack, 2018; Steele & Josephs, 1990). This can be particularly relevant in the response to death threats.

In this study, we take into account both the need for self-esteem-bolstering when having unconscious thoughts about a terrorist attack, and the possible use of alcohol to fulfill this need. We assume that thoughts about a terrorist attack lead to more positive attitudes towards alcohol. We expect this effect to be conditional on the (un-)consciousness of these thoughts and alcohol-based self-esteem (ABS), namely that such thoughts need to be unconscious (rather than conscious), and that the effect occurs with increased ABS.

Using an experimental research design with participants from Germany, we provide insight into the cognitive process causing changes in attitudes towards alcohol provoked by thinking about a terrorist attack. To the best of our knowledge, no research has yet investigated the influence of a particular terrorist attack that happened in Germany on health-related attitudes. A deeper understanding of the consequences of media coverage of terrorist attacks is especially

important to uncover probable future health challenges in a time with frequent and live media reports on terrorism that may cause death-anxiety. In particular, knowing about the effect of media coverage on alcohol-related attitudes can inform public health prevention and interventions to reduce potentially negative individual and societal effects of alcohol as a health-relevant response to death-anxiety.

## **Understanding the Effect of Terrorist Attacks on Health With the Terror Management Theory and the Terror Management Health Model**

We use the conceptual framework of the TMHM (Arndt & Goldenberg, 2017; Goldenberg & Arndt, 2008) to investigate the potential effects of thoughts about terrorist attacks on health-related attitudes. The TMHM applies propositions of the TMT to explain how thoughts about death influence health attitudes and health behavior (Greenberg et al., 1986; Pyszczynski et al., 2004). Building on insights from the TMHM and the TMT, this research was driven by the question of why individuals need to have self-esteem and self-worth in general. The TMT sheds light on the unique psychological threat individuals face when they are confronted with their own mortality. Reminding humans of their own mortality conflicts with the instinctive desire to live and survive, which are inherent traits in themselves. Existential anxiety emerges as humans are faced with the opposing thoughts about the inevitability of death and the will to live. The TMT suggests that humans try to buffer this terror by reinforcing their cultural worldviews and investing in their individual self-esteem and -worth, which replenishes their life with meaning and value.

When adapting this theory into the context of health, we need to consider the dual-process component of TMT (Greenberg et al., 2000; Pyszczynski et al., 1999). The theory introduces two basic defense strategies humans are striving for when they are reminded of their own mortality: proximal or distal defenses. Their choice should be dependent on the level of consciousness of the death thoughts.

It is assumed that explicit reminders of one's own mortality can cause conscious thoughts of death. This initiates proximal defenses. To remove their concerns about their own mortality from focal attention and from consciousness, individuals either deny their own vulnerability and suppress these negative thoughts or pursue health-promoting behaviors that are perceived to be effective in averting the health threat.

Distal defenses are provoked when conscious death-related thoughts enter the unconscious level. In experiments, this is done by reminding subjects of their mortality, followed by delay or distraction tasks. This allows the conscious death-related thoughts to descend to the unconscious, provoking distal defense

strategies (Arndt & Goldenberg, 2017; Pyszczynski et al., 1999). Death-related thoughts can also enter the unconscious level immediately without passing the conscious level if subliminal reminders of death are used (e.g., Ein-Dor et al., 2014; Landau, 2004). In comparison to proximal defenses and unconscious thoughts about death, distal defenses are not directly linked to the death-related problem. Such distal strategies include (health-related) behavior that may help individuals enhance their own self-esteem and worldview defense strategies (Arndt et al., 2003; Arndt & Goldenberg, 2017; Pyszczynski et al., 1999). Worldview defense strategies are described as identifying more strongly with cultural beliefs and ideologies of one's own culture, or the devaluing worldviews that deviate from their own.

Arndt and Goldenberg's (2017; Goldenberg & Arndt, 2008) TMHM refers to these dual-process defense strategies to explain changes in health attitudes and behavior provoked by death-related thoughts. They propose that conscious thoughts about death lead to positive health behavior and attitudes because individuals try to remove and suppress these conscious thoughts by engaging in health-promotion. When death-related thoughts descend to the unconscious, they anticipate either negative or positive health outcomes. Which outcome occurs depends on whether a certain action is considered to promote individual self-esteem or confirm the individual worldview.

Taken altogether, the TMT and the derived TMHM offer explanations for healthy as well as unhealthy behavior and related attitudes. From an outside view, such behavior and attitudes as a reaction to death-related thoughts seem irrational since it expedites rather than delays death – as does alcohol. When such thoughts are active in the unconscious, behavior that helps to improve self-esteem should be more likely (Arndt & Goldenberg, 2017; Pyszczynski et al., 1999). Several studies support the argument that reminding individuals of their own mortality can lead to seemingly irrational, unhealthy, and risky behavior. For instance, some studies showed that unconscious death-thoughts can lead to an increased willingness to suntan (Cooper et al., 2014; Cox et al., 2009). Other studies revealed its dangerous potential for substance use such as consuming alcohol (Ein-Dor et al., 2014; Jessop & Wade, 2008), smoking cigarettes (Arndt et al., 2013; Hansen et al., 2010), or using cannabis (Nagar & Rabinovitz, 2015). Thus, research showing that alcohol can be beneficial for an individual's self-esteem (Banaji & Steele, 1989; Lac & Brack, 2018; Steele & Josephs, 1990) might partially explain increases in alcohol consumption after terrorist attacks (DiMaggio et al., 2009; Neria et al., 2006). In sum, the assumptions of TMT and the TMHM have been supported by several studies on other health-related phenomena (Greenberg & Arndt, 2012).

Moreover, a meta-analysis supports assumptions concerning the dual-process component and showed that task-switching and longer delay between death threat and measuring death-thought accessibility led to larger effect sizes of death-thought accessibility (Steinman & Updegraff, 2015). A review of several

studies in a variety of domains also corroborates the assumption that individuals depend on their self-esteem and worldview defense to manage unconscious concerns about their own mortality (Pyszczynski et al., 2004). For example, Ben-Ari et al. (1999) provided the first evidence that self-esteem derived by certain behaviors moderates the effect of such concerns on whether individuals engage in such behaviors. Particularly, they showed that risky driving intentions and actual behavior in a driving-simulator are moderated by driving-based self-esteem. Similarly, Arndt et al. (2003) investigated the moderating role of action-based self-esteem in the context of fitness intentions. These and other studies (e.g., Ferraro et al., 2005; Hansen et al., 2010) showed that the effect of death-related thoughts on changes in attitudes or actual behavior were moderated by the self-esteem individuals derive from the action. These studies found this moderation effect on the premise that the death-related thoughts were unconscious. This suggests that individuals who are confronted with unconscious thoughts about their own mortality, induced by thinking about a terrorist attack, can lead to changes in health-related attitudes.

We thus assume that thoughts about a terrorist attack result in more positive attitudes towards alcohol with a high ABS. We expect this effect on the premise that thoughts about a terrorist attack are unconscious. This conditional effect is predicted because participants should make efforts to strengthen their individual self-esteem to manage unconscious thoughts about death (Arndt & Goldenberg, 2017; Greenberg & Arndt, 2012). We want to test these assumptions by reminding individuals of a recent terrorist attack and thereby provoking death-related thoughts.

## **Method**

### *Pretesting*

To test the study procedure and the comprehensibility of our questions and instructions, we conducted cognitive pretests ( $N = 4$ ) using the think-aloud technique and a quantitative online pretest with a convenience sample ( $N = 47$ ). Only slight changes were made to improve the experiment, i.e., by using more comprehensible language and by limiting the time in the word completion task to guarantee that all participants spend the same amount of time on this task.

### *Ethics Approval*

The study obtained approval from the ethic commission of the University of Cologne (approval number: 17-317).

### *Pre-registration*

The study has been preregistered at AsPredicted (<http://aspredicted.org/blind.php?x=t4x55g.#5630>).<sup>1</sup>

## Participants

Five-hundred-twenty participants with German citizenship and a minimum age of 18 years started the web-based study. Participants were recruited via the platform Clickworker, which is a crowdsourcing Internet marketplace that facilitates payment for completing surveys and is similar to Amazon Mechanical Turk (Buhrmester et al., 2011). Research showed that experiments using such participant pools produce reliable and valid data (e.g., Lutz, 2016). We offered 1.50 EUR (1.85 USD) as monetary incentive to motivate participation and survey completion (Lavrakas, 2008; Veen et al., 2016). Participation was anonymous and voluntary. To improve data quality, participants were directed to the end of the survey if they failed the attention test (i.e., a question which seemingly asked them about their favorite color (Berinsky et al., 2014)). Participants were also redirected if they did not provide informed consent, if they provided invalid responses in the implicit association test (IAT, see below), or if they were pregnant or lactating. The latter exclusion was made because we expected pregnant or lactating women to abstain from alcohol for health reasons and thus not provide sufficient variance independent of the experimental treatment. Moreover, every respondent who did not have the system requirements for the IAT were forwarded directly to the end of the study (see below). The average age of the remaining 487 (46.4% females) participants was 35.79, ranging from 18 to 60 years.

## Procedure

Individuals were told that they would take part in a scientific study about new survey methods. Participants had to consent to participation and then answer questions concerning their demographics, their ABS, and the attention check (see above). Then, they were randomly assigned to one of four experimental groups (TS: terrorism vs. dental pain, delay task: yes vs. no). They conducted a word completion task and an alcohol-IAT. At the end of the study, participants were debriefed and thanked for their participation.

## Alcohol-Based Self-Esteem (ABS)

Motivated by the TMT and TMHM research (Ben-Ari et al., 1999; Ferraro et al., 2005; Jessop & Wade, 2008), the self-esteem gained by a certain action is considered an important moderator when death-related thoughts are unconscious. Inspired by similar research (Ben-Ari et al., 1999; Hansen et al., 2010), participants indicated on 15 items their perception of their ABS. Nine of the items were adapted from the *Driving as Relevant to Self-Esteem Scale* (Ben-Ari et al., 1999) and translated to German. Four items were adapted from the German version of Rosenberg Self-Esteem Scale (von Collani & Herzberg, 2003), and two items were used from research about functional drinking



(Belitz-Weihmann & Metzler, 1997). Participants answered all items on a six-point-scale, which ranged from 1-*not at all* to 6-*very much*. First, we coded items so that higher values signify a higher benefit to individual self-esteem. Then we used a procedure for summative score construction to produce the benefits of alcohol to the individual self-esteem (see e.g., De Vaus, 2014). Therein, we calculated the item-to-scale coefficients and excluded items with negative and very small ( $<0.3$ ) coefficients. The reason for this is the common assumption that such coefficients do not tap the construct alcohol as beneficial to individual self-esteem. After dropping seven items, we constructed an eight-item “Alcohol-based Self-Esteem” (ABS)-scale to assess the benefits of alcohol on individual self-esteem. A further test with an exploratory factor analysis revealed a single-factor solution (*Eigenvalue* = 4.609, all *factor loadings*  $>0.7$ ), which proves the unidimensionality of the scale (see Appendix Table S1). We calculated participants’ mean ABS score on the eight items (Cronbach’s  $\alpha=0.894$ ) with higher scores indicating participants’ perception of alcohol having more beneficial importance to their self-esteem. These scores were standardized.

### **Terrorism Salience (TS)**

Similar to other TMHM and TMT research (Arndt et al., 2003; Burke et al., 2010), we used a writing task to activate death-related thoughts. We adapted it similarly to other studies investigating the effect of terrorism (Dewa et al., 2014; Landau, 2004; Pyszczynski et al., 2006). While Ullrich and Cohrs (2007) used the 9/11 attack as example in their experiment and could not find higher death-thought accessibility among German participants, we have chosen the Berlin Christmas market attack that happened on December 19, 2016.<sup>2</sup> The choice of this attack was based on the fact that there has not been a terrorist attack comparable to 9/11 in Germany. Further, the attack in Berlin happened more recently, it was geographically closer to participants, it has been the most serious terrorist attack in Germany in recent decades, and thus, to the dismay of individuals living in Germany, is expected to be more likely to occur again. In order to make terrorism salient, half of the interviewees were randomly assigned to a writing task (i.e. the TS group), in which they were asked to describe their feelings and what they think happened on the 2016 Berlin attack: “*Please describe the emotions that the thought of the terrorist attack on December 19, 2016 at the Berlin Christmas market arises in you.*” and “*Write down as specifically as you can what happened during the terrorist attack on December 19, 2016 at the Berlin Christmas market.*” To strengthen the intensity of the TS, the interviewees were asked whether they know a person who was in Berlin at the same time as the attack. The control group, i.e., the other half of the respondents, received similar questions about dental pain. This topic is commonly used for control groups to rule out the alternative explanation that differences between the TS group and the control group only emerged because of the

negative character of the question, rather than the uniqueness of terrorism per se (Burke et al., 2010).

### *Delay Task*

Half of the participants answered the Positive and Negative Affect Schedule (PANAS; see Breyer and Bluemke (2016) for the German translation) which is commonly used as a delay task. A delay task allows death-related thoughts to descend to the unconscious level and continue to affect individuals. Studies have shown that delay tasks like PANAS make death-related thoughts more accessible (Arndt & Goldenberg, 2017; Steinman & Updegraff, 2015). The reason is that individuals try to suppress their thoughts of mortality when they are conscious. When these thoughts are unconscious, it can be expected that individuals have a higher accessibility to death-related thoughts and that they show stronger distal defenses.

### *Death-Thought Accessibility (DTA)*

A widespread procedure in the area of TMT and TMHM is the examination of the experimental manipulation by assessing the availability of death-related thoughts (Greenberg et al., 1994; Hayes et al., 2010). For that reason, all participants performed a word completion task in which they would complete 21 incomplete words, nine of which were death-related or neutral words. German word fragments could be completed with either death-related or neutral words. For example, *S A \_ \_* could be completed with the German word for *coffin* (“SARG”) or *salt* (“SALZ”). Other potential death-related words were the German words for *ash*, *dead*, *grief*, *corpse*, *blood*, *tombstone*, *murder* and *grave*. A similar task has already been used in a study carried out in Germany (Jonas & Fischer, 2006). We calculated a death-thought accessibility score based on the number of completed death-related words. The cognitive pretest and online pretest suggest a time limit for this task. Consequently, the time for this task was limited (150 seconds), after which the participants were automatically forwarded to the next survey page. The reason for that is to guarantee that all participants spend the same amount time on this task and to prevent overly-long deliberation on alternative words.

### *Implicit Attitudes Towards Alcohol (Alcohol-IAT)*

Participants’ implicit attitudes towards alcohol were assessed with an IAT. Generally, the measurement of attitudes towards alcohol can be sensitive due to social desirability, and thus we decided to use a test which is less susceptible to it. Several studies showed that using an IAT is particularly appropriate and beneficial in such a context (Curry et al., 2017; Jajodia & Earleywine, 2003; Lindgren et al., 2013). The IAT considers the average response time of the

participants in allocating concepts. This in turn determines concepts that are related to each other and implicit attitudes (Greenwald et al., 1998). Particularly, a comparable IAT study forecasted the consumption of alcohol and even the danger of addiction (Curry et al., 2017; Friese et al., 2008). This alcohol-IAT was translated to German and only slight changes were made (e.g., the type of beverage was changed if it is less common in Germany). It contained seven blocks and measured the association between the two target-concepts, *alcoholic names* (with words such as “beer”) and *nonalcoholic names* (e.g., “water”), with two attribute categories, *pleasant words* (e.g., “happy”) and *unpleasant words* (e.g., “bad”) (see Table S2 in the Appendix for the wording). While some blocks served as practice in classifying the stimuli (blocks 1, 2, 3, 5, and 6), the others (blocks 4 and 7) functioned as a basis to calculate the *alcohol* and *pleasant* association strength. More precisely, the average response time of the test blocks and subsequently the difference of the blocks’ average response time was calculated. The resulting value was then considered as the strength of the implicit association. The responses on the IAT were noted as invalid if 10% of the responses were too fast (<300 ms) or if they needed more than 10 seconds for one answer (Greenwald et al., 2003). We calculated the final IAT results with higher scores indicating higher implicit positive attitudes towards alcohol. We assessed reliability by calculating the split-half reliability based on test (blocks 4 and 7) and training blocks (blocks 3 and 6). The Spearman-Brown coefficient showed reliability of the IAT ( $\rho = 0.724$ ).

## Results

First, we explored whether TS increased death-thought accessibility significantly, and thus whether our experimental manipulation worked. An independent sample *t*-Test revealed that statistically significantly ( $t = -2.64$ ,  $p = 0.004$ ) more death-related words were reported in the TS group ( $M = 2.138$ , Standard Deviation ( $SD = 1.403$ )) compared to the control group ( $M = 1.823$ ,  $SD = 1.231$ ). This finding suggests that thinking about the Berlin Christmas market attack provoked death-related thoughts.

Exploratory balance tests indicated similar ABS scores for participants in the TS and control group ( $p = 0.739$ ), as well for participants with or without the delay task ( $p = 0.953$ ); the interaction effect of TS and delay was also not significant ( $p = 0.587$ ). All single *t*-tests and joint tests of orthogonality of age, gender, interview time, and ABS indicated that the randomization led to balance ( $p > 0.05$ ).

The mean value of the IAT-score ( $-0.209$  with  $SD = 0.237$ ) was negative, indicating generally negative attitudes towards alcohol. Linear regressions were estimated to further test our assumptions (see Model 1 in Table 1). While the TS treatment ( $p = 0.347$ ) and the delay task ( $p = 0.595$ ) had no statistically significant main effects, higher ABS scores seem to be associated with

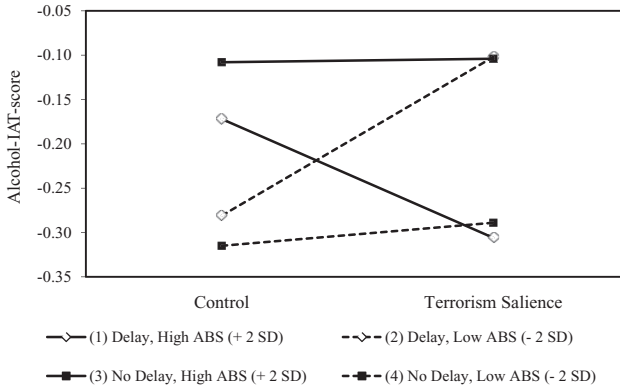
**Table 1.** Predicting Implicit Attitudes Towards Alcohol (Alcohol-IAT Scores) With Multiple Linear Regression Analyses.

	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
TS (Ref. control)	0.020	0.022	0.015	0.030	0.015	0.030
Delay (Ref. control)	-0.011	0.022	-0.016	0.030	-0.016	0.030
ABS	0.018 <sup>†</sup>	0.011	0.068***	0.018	0.052*	0.020
TS × Delay			0.007	0.043	0.007	0.043
TS × ABS			-0.041 <sup>†</sup>	0.021	-0.006	0.030
ABS × Delay			-0.060**	0.021	-0.025	0.030
TS × Delay × ABS					-0.073 <sup>†</sup>	0.043
Constant	-0.214***	0.018	-0.211***	0.020	-0.211***	0.020
F-test	1.37		2.78*		2.81**	
Observations	487		487		487	

Notes: <sup>†</sup> $p < 0.1$ , \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , B = Linear regression coefficients (unstandardized), SE = Standard error.

higher alcohol-IAT score. However, this effect did not reach conventional levels of significance ( $p = 0.086$ ). When adding all two-way interactions (Model 2), we see from the conditional main effect of ABS that increasing ABS led to higher IAT-scores ( $p < 0.001$ ) for respondents in the control group without a delay task. The two-way interaction between ABS and delay shows that this effect was lower among respondents who were assigned to a delay task ( $p = 0.005$ ). Moreover, we found that higher ABS scores seem to be associated with lower IAT-scores in the TS group, although this association just missed traditional levels of statistical significance ( $p = 0.054$ ). The test of a three-way interaction in Model 3 revealed a negative sign, but this interaction also missed traditional levels of significance ( $p = 0.088$ ), which is contrary to our hypothesis.

To better understand the effects and to further explore the interaction effects, we used simple slope tests (Aiken & West, 1991, see Figure 1) and simple slope difference tests (Dawson & Richter, 2006). Following Aiken and West's recommendations, we probed the interaction at two standard deviations above (High ABS) and below the mean of the standardized ABS score (Low ABS). For individuals with low ABS scores and who were exposed to a delay task, alcohol-IAT scores were higher in the TS group as compared to the control group (Slope 2,  $B = 0.179$ ,  $p = 0.009$ ), but not when they had a high ABS score and a delay task (Slope 1,  $B = -0.134$ ,  $p = 0.049$ ). A simple slope difference test indicates that only Slope 1 and Slope 2 differ significantly ( $t = 2.58$ ,  $p = 0.010$ ). For individuals without a delay task, those with a high ABS (Slope 3,  $B = 0.004$ ,  $p = 0.951$ ) and also those with a low ABS (Slope 4,  $B = 0.026$ ,  $p = 0.696$ ) did not



**Figure 1.** Predicted Scores for the Alcohol-IAT as a Function of Standardized Alcohol-Based Self-Esteem (ABS), the Experimental Treatments Terrorism Salience and Delay As Well As All Interactions (Based on Model 3 in Table 1).

have statistically significantly higher alcohol-IAT scores when being in the TS group as compared to the control group.

## Discussion

Prior research around alcohol and TMHM has mainly focused on traditional mortality salience primes (Arndt et al., 2013; Cox et al., 2009) and primes directly related to health risks like alcohol warnings (Jessop & Wade, 2008; Moss et al., 2015). In contrast, the present research investigated whether a recent terrorist attack in Germany provoked death-related thoughts which in turn influenced implicit attitudes towards alcohol. Hence, this research provides insight into the dual-process component of the TMHM by investigating the underlying conscious and unconscious processes related to thoughts about terrorism.

Consistent with related research (Landau, 2004), our study revealed increased death-thought accessibility for participants exposed to thoughts about terrorism by using a word completion task. Ullrich and Cohrs (2007) examined the effect of international terrorism primes and could not find higher death-thought accessibility among German participants. However, here, we showed that thinking about a recent terrorist attack in Berlin activated death-related thoughts among German participants. Our results suggest that this attack may be more influential due to the proximity to the participants. It also suggests that thoughts about the attack had a similar effect like those about 9/11 in studies with participants from the United States. Hence, our research shows that German participants felt threatened and activated death-related thoughts after thinking about such an

attack. Only one year later, a terrorist killed two people and wounded 12 others at a crowded Christmas market in Strasbourg (Peltier & Breeden, 2018), which underlines the salience of the topic.

This study shows a unique effect of TS for individuals with low ABS when death-related thoughts were unconscious, and provides evidence that TS descending to the unconsciousness decreases positive implicit attitudes towards alcohol (alcohol-IAT scores) among individuals for whom alcohol is beneficial to self-esteem. Interestingly, we found more positive implicit attitudes among participants with low ABS when exposed to TS and a delay task.

Our findings contradict those of Jessop and Wade (2008), who found a positive effect of mortality salience related to binge drinking among individuals for whom alcohol is relevant to their self-esteem and willingness to binge drink. However, our findings are similar to other research focusing on global self-esteem (Wisman et al., 2015, Study 5) as well as research focusing on implicit mortality primes and its effects on drinking behavior (Ein-Dor et al., 2014). On the unconscious level, our effects for individuals with low ABS resemble the results of the latter study. This study found that reminding participants implicitly of their mortality led to a higher probability to choose an alcoholic beverage instead of a nonalcoholic one. Similar to our findings, Wisman et al. (2015) found that a mortality salience prime combined with a delay task had a positive effect on drinking behavior among individuals with a low global overall self-esteem. Their simple slope analysis also revealed a negative, but statistically insignificant, effect among participants with high self-esteem, whereas this effect was statistically significant in our study. Importantly, they focused on the global overall self-esteem of individuals and not on ABS. Nevertheless, their results resemble our findings.

Wisman, Heflick and Goldenberg explain the increased alcohol consumption among participants with low self-esteem with the fact that they are incapable to buffer mortality concerns. Thus, alcohol could be seen as an attractive means to cope with death-anxiety, while such demand might be lower or different for people with high self-esteem. Although previous research (Arndt et al., 2003) showed that action-based self-esteem is a specific dimension of self-esteem and rather reflects global self-esteem, it remains to be proven whether this is also true in the context of alcohol.

One concern could be that memories of a terrorist attack affect attitudes towards alcohol similar to any other anxiety-related stimuli, but is less driven by the unique nature of cultural and existential threat. To rule this possibility out, we used dental pain as a control group, which is not an existential health threat, but solely an anxiety-related health threat. The study shows that the effects for dental pain and terrorist attacks are substantially different. For both, alcohol-based self-esteem and the consciousness of thoughts have a substantially different role. This demonstrates that different types of anxiety-related threats can have different effects on individuals. However, our study is insofar

limited that we cannot rule out that the IAT-measure is actually mirroring the knowledge of society's associations with alcohol (i.e. environmental associations) rather than implicit individual attitudes towards alcohol (Karpinski & Hilton, 2001). After all, the IAT-score has been affected differently by the stimuli rather than staying relatively stable, which suggests that we measured personal attitudes towards alcohol. Future research should further investigate this.

One strength of this study is that it provides a first experimental insight into the cognitive processes provoked by the combined effect of a terrorism prime, its produced unconscious and conscious death-related thoughts, and the perceived relevance of alcohol to the individual's self-esteem. Thus, these results indicate that not all health- and mortality-related threats are processed similarly, but instead differently. Further research should help to better understand our findings and try to replicate them, for example, with other terror incidents and with direct attitudinal or behavioral outcome measures. The latter might be interesting since implicit attitudes towards alcohol were less controllable by participants in comparison to direct assessments that tap into more conscious and controllable information. However, such information is also more susceptible to social desirability bias, underlining the usefulness of the IAT measure that we used.

Besides different substantial insights into cognitive processes of the effects of terrorist attacks, this study also offers three methodological contributions: an instrument to assess implicit attitudes towards alcohol which was translated to German and tested regarding its reliability; an new alcohol-based self-esteem scale with good statistical properties was developed; and a new treatment to activate death-related thoughts about a terrorist attack in Germany was proposed and supported by a manipulation check.

## **Conclusion**

Overall, research about information processing of terrorist attacks or other death-related events and their potential health consequences remain a gap in the TMHM literature. Uncovering cognitive processes provoked by death-related events are especially important because they might differ from those typically examined by using more traditional mortality primes. We investigated how conscious death-related thoughts about a terrorist attack that occurred in Germany affect attitudes concerning alcohol, which has not been done before. To our knowledge, it is the first study that experimentally tests the influence of such thoughts about a terrorist attack related to alcohol. Our findings suggest that terrorism leads to increased death-anxiety and to either more positive or more negative implicit attitudes towards a health relevant coping means (i.e. alcohol) and that the direction of the effect depends the self-esteem gained through alcohol and the level of consciousness of thoughts about terrorism. This indicates that different groups react differently to thinking about terrorist attacks and some of these reactions might be associated with negative health



consequences due to alcohol consumption. Thus terrorism not only causes societal challenges like increased prejudices (Das et al., 2009), but might also affect health. Death-related thoughts provoked by TS may have a long-term effect on alcohol attitudes and behavior because such attacks partially affect many individuals at the same time (Gigerenzer, 2006), they are hardly predictable for the public, and are attacks on culture, which functions as natural psychological “shield” against anxieties (Pyszczynski et al., 2003). Clinicians and substance use scientists can build upon the present findings. They can be used to help individuals who are particularly vulnerable to death-thoughts driven by anxiety related to terrorist attacks or the recent threat by COVID-19 (Lee, 2020). The findings suggest that for individuals with low self-esteem an increase in alcohol consumption may be more likely after such death-anxiety threats. Furthermore, our new alcohol-based self-esteem scale could be further explored as a screener of such vulnerable groups who may need special assistance to build psychological “shields” that might help protect from negative consequences of anxieties. Building healthy self-esteem that is not based on negative health behaviors might be one approach (Pyszczynski et al., 2003). Future research should identify cognitive-behavioral approaches and other efficient and sustainable strategies to deal with death-anxiety (Furer & Walker, 2008).

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### **Data Accessibility Statement**

The data that support the findings of this study are available from the first author [FP] upon request.

### **Declaration of Conflicting Interests**

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### **ORCID iD**

Franziska Pradel  <https://orcid.org/0000-0003-4559-0772>



## Notes

1. When pre-registering the study, we intended to have 560 completed cases. Due to budget constraints in the face of increased cost (>10%), we were not able to achieve this number. We pre-registered a second study that we plan to complete and publish later. For this paper, only the protocol for the first study is relevant.
2. In Berlin, twelve individuals died and 56 individuals were injured when a terrorist drove a truck into the market next to the Kaiser Wilhelm Memorial Church (Samaan & Jacobs, 2020). The Islamic State claimed responsibility for the attack. Shortly after the Berlin attack the security precautions were changed and included structural means like bollards and security forces who were partially armed with submachine guns (Tagesspiegel.de, 2017).

## Supplemental Material

Supplemental material for this article is available online.

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### Author Biographies

**Franziska Pradel** is a doctoral researcher at the Cologne Center for Comparative Politics at the University of Cologne (Germany) and member of the research program Digital Society, funded by the Ministry of Culture and Science of the German State of North Rhine-Westphalia. Her research focuses on political psychology, political communication, political behavior, digitization and online platforms.

**Sebastian Sattler** is a lecturer at the Institute of Sociology and Social Psychology at the University of Cologne (Germany) and an associate member of the Pragmatic Health Ethics Research Unit at the Institut de recherches cliniques de Montréal (Canada). He currently is a principal investigator on the project ENHANCE, funded by the German Research Foundation. His research interests include criminology, sociology of health, health ethics, decision-making, and quantitative methods. His work has been published in journals such as the European Sociological Review, Frontiers in Psychology, and PLOS ONE.