

Does the Association between Illness-Related and Religious Searches on the Internet Depend
on the Level of Religiosity?

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All data and analysis codes are accessible at

https://osf.io/52taf/?view_only=a6b24aa8ec4b4c0f8eddd3cf8ad247da

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Abstract

Recent research suggested that illness-related search predicts religious search on Google. In the current research, I aimed to replicate this finding and investigate whether such association depends on the existing level of religiosity. In Study 1, I re-analyze an existing dataset on search behavior for 630 consecutive weeks and show that although illness-related search predicts religious search in 16 different countries, this association does not depend on the religiosity level of the countries. The same finding was replicated in within-nation comparisons of the U.S states (Study 2) and Turkish provinces (Study 3). In all studies, during a period of 235 consecutive weeks, illness-related search predicted religious search but the differences in religiosity among regions did not influence this association, which arguably might not be consistent with the Terror Management Theory. I argue that such finding shows the necessity of considering all alternative theories when interpreting the effects of mortality salience.

Keyword: death, illness, mortality salience, religion, Terror Management Theory

Does the Association between Illness-Related and Religious Searches on the Internet Depend on the Level of Religiosity?

In a recent study (Pelham et al., 2018), it was found that illness-related search volume on Google predicts search volume for religious concepts, such as *God*, *Jesus*, and *prayer*, in 16 nations. In other words, the more people search about illnesses, the more they become likely to search for religious concepts. It was argued that this finding is consistent with the Terror Management Theory (TMT; Pyszczynski, Greenberg, & Solomon, 1999; Pyszczynski, Solomon, & Greenberg, 2015). In this paper, I re-analyze the same data with also considering overall religiosity of the populations and extend the same analyses to other datasets to explore within-country variations in the US and Turkey. Additionally, I argue that alternative theoretical perspectives (e.g., political conservatism as motivated social cognition; Jost, Glaser, Kruglanski, & Sulloway, 2003) might also explain the observed associations between illness-related and religious search on Google. Thus, the aim of the current research is twofold: (1) Replicating the findings of Pelham et al. (2018); and (2) discussing alternative explanations for the findings by highlighting the potentially important role of religiosity of the population.

What Does TMT Propose?

Most animals, including humans, have a strong survival instinct. But, according to TMT (Pyszczynski et al., 2015), humans are unique in understanding their own mortality: They desire to stay alive while they also very well know that they definitely are going to die someday. Such helplessness is expected to result in death anxiety, as any action and choice seem to lead to the same end, death. TMT suggests that we buffer this death anxiety by holding onto our worldviews. Our worldviews attain meaning to our lives and ensure our immortality either in a literal (e.g., belief in an afterlife) or symbolic (e.g., leaving a legacy) sense. Hundreds of experiments suggested that when we are reminded of our own mortality,

we become more likely to endorse our own worldviews since that worldview attains meaning to our lives and buffer our death anxiety (Burke, Martens, & Faucher, 2010; Pyszczynski et al., 2015).

One important point in the TMT perspective is that, in the face of death, people are expected to bolster their own, not any, worldview (Pyszczynski et al., 1999). It is sensible since it is not reasonable to expect mortality salience (MS) to convert a Muslim into a Christian; instead, it would make that person a more devoted Muslim. This is supported by a vast number of studies illustrating that MS leads people to endorse their own worldviews. For example, in a seminal study, the same MS manipulation rendered conservatives more conservative and liberals more liberal (Greenberg, Simon, Pyszczynski, Solomon, & Chatel, 1992). Later research also provided a series of evidences supporting this effect of MS on worldview defense (see Pyszczynski et al., 2015 for a comprehensive review; see Burke et al., 2010 for a meta-analysis).

TMT and Endorsement of Religion among Believers and Non-Believers

According to TMT, endorsement of religious beliefs after MS is one potential expression of a more fundamental process of defending the worldview that offers symbolic and/or literal immortality (Pyszczynski et al., 1999). Thus, it would be plausible to expect people with religious beliefs, but not non-believers, to endorse religious beliefs after MS. For non-believers, the opposite must be true: They should endorse their own worldview which is characterized by disbelief in supernatural entities. Past research has provided some evidence supporting this account: Death reminders increased the belief in supernatural religious entities for Christians but decreased it for atheists (Jong, Halberstadt, & Bluemke, 2012). In other words, atheists did not seek refuge in God as a response to MS; on the contrary, they became even more convinced in their disbelief. Similarly, in other research, MS failed to increase

religious beliefs among atheists and non-religious participants (Norenzayan & Hansen, 2006; Vail et al., 2012).

Some studies suggested that even non-believers become more likely to believe in religion at an implicit level: It was shown that MS increases non-believers' "implicit belief" in religion, as measured by Implicit Association Test, although it decreased belief at an explicit level (Jong et al., 2012). However, a recent meta-analysis has established that the effect of changes in implicit cognition on explicit behaviors is trivial (Forscher et al., 2019). Thus, even if non-believers form implicit positive evaluations of religious beliefs after MS, it would not be reasonable to expect it to manifest itself in explicit behavior, like searching for religious concepts on Google (Pelham et al., 2018).

What Does Recent TMT Research on Google Search Volumes Suggest?

The basic TMT tenet that MS would bolster one's own worldview is important for interpreting recent research on Google search volumes. A recent finding suggested that when people search for illnesses, including *cancer*, *diabetes*, and *hypertension* on Google, they become more likely to search for religious concepts, such as *God*, *Jesus*, and *prayer*; and the same effect was observed in 16 different nations (Pelham et al., 2018). This finding is interpreted as consistent with the TMT perspective, as MS induced by the salience of illnesses seem to lead to a higher level of interest in religion (Pelham et al., 2018). However, such inference does not necessarily follow from the evidence provided: TMT would predict this effect to be observed among people who are already religious (Jong et al., 2012; Norenzayan & Hansen, 2006; Vail et al., 2012). People who believe in God(s), for example, would become even more invested in their worldview (i.e., their religion), and more likely to search for religious concepts on Google after MS. Non-believers (i.e., atheists or agnostics), however, should not be affected in the same way, as they should cling on to their own worldview, not a religious one. If MS has a universal effect of bolstering religiosity,

independent of differences in worldviews, this is not entirely consistent with the TMT.

According to TMT, this association should depend on the level of religiosity and be stronger in highly religious populations as compared to nonreligious ones. Thus, considering such assumptions of the TMT, the current research aims to investigate the potential moderating role of overall religiosity of the population on how illness-related search is associated with religious search. By highlighting the potentially important role of the existing level of religiosity in different populations, I aim to illustrate that there might be different theoretical explanations for why illness-related search predicts religious search on Google.

Alternative Explanations for the Association between Illness- and Religion-Related Search on Google

In addition to replicating past findings suggesting that illness-related and religious search on Google are associated with each other, I argue that there is also a need to investigate whether this association depends on the existing level of religiosity among the population. Such investigation might lead to one of the three potential findings: First, it could be the case that MS (as invoked by illness-related search on the internet) would relatively increase the interest in religious concepts among people who already have religious beliefs. In other words, overall religiosity would be a significant moderator and the positive association between illness- and religion-related searches would be stronger among more religious populations, as compared to less religious ones. This would be consistent with the TMT account, as TMT suggests that MS leads people to bolster their own respective worldviews (Pyszczynski et al., 1999).

The second possibility is that this association would not depend on the overall religiosity, and illness-related search would predict religious search regardless of the existing religiosity among the population. Such result would suggest that MS has a universal effect of rendering people more religious. This would be in line with an alternative line of research

suggesting that conservatism is a form of motivated social cognition: Accordingly, political conservatism and related other attitudes, including religiosity, are motivated by a need to reduce fear, anxiety, and uncertainty (Jost et al., 2003). Later research supported this account: Threat leads to a conservative shift (Bonanno & Jost, 2006; Nail et al., 2009; Wright & Baril, 2013; Van de Vyver et al., 2015; Van Leeuwen & Park, 2009). From this perspective, the sense of threat induced by illness-related search on Google would lead to a general need to reduce threat which would result in a conservative shift and make people more religious, regardless of their existing level of religiosity.

The third possibility is that the association would be stronger among non-religious populations, contrary to what would be expected from the TMT perspective. Despite its contradiction with TMT, it would be expected from the *reactive-liberal hypothesis* account (Nail et al., 2009). According to this perspective, threat has a stronger impact on liberals, since conservatives have a chronic perception of being under threat (Nail et al., 2009). As a result, threatening stimuli would lead to a greater conservative shift among liberals, as opposed to people who are already conservative. Later research provided some support for this account and showed that there was larger conservative shift among liberals after reminders of terrorist attacks (Landau et al., 2004; Nail & McGregor, 2009). From this perspective, then, one might argue that overall religiosity would be a significant moderator but the association between illness-related and religious searches would be stronger among less, not more, religious populations.

The current study aims to explore these three alternative accounts and examine how the existing level of religiosity influences the association between illness-related and religious searches on Google. Support for any of these accounts would provide insights for future research regarding how to explain the association between death reminders and interest in religion. In Study 1, I re-analyze the data used by Pelham et al. (2018) and investigate

whether religiosity of the countries moderated the observed relationships. In Study 2, I investigate whether the relationship between illness-related and religious searches emerges in each state in the US and look into whether the state-level associations in searches depend on the religiosity level of the states. In Study 3, I replicate the same procedure as in Study 2 for analyzing 77 provinces in Turkey.

In all studies, all measures, exclusion criteria, and analysis procedure are openly reported. Sample size (the number of weeks analyzed) was limited by the available data provided by Google (see below for further discussion). Data and analysis codes are available at https://osf.io/52taf/?view_only=cb29561c50f44537a3630435f7a88939. All studies attempted on this line of work are reported in the current manuscript.

Study 1

In Study 1, I re-analyzed the data from Pelham et al. (2018) with the addition of religiosity scores for each country. The aim was to determine whether the overall religiosity of the population moderated the association between MS (as measured by illness-related search on Google) and endorsement of religion (as measured by religious search on Google).

Analysis Procedure

I re-analyzed the data used by Pelham et al. (2018). In the original study, weekly search volumes for 2004-2016 were acquired from Google Trends for 16 countries (see Figure 1 for the list). The main predictor of interest was illness-related search (i.e., search volume for the words *cancer*, *hypertension*, and *diabetes*). There were also five variables to be controlled for: (1) Year (to adjust for yearly trends in religious search); (2) search volume for *sore throat* (to account for search for non-threatening diseases); (3) whether the week coincided with Christmas (to control for variation caused by a religious holiday); (4) whether the week coincided with Easter (same reason); and the preceding week's (Week X-1) search volume for

religious concepts (i.e., search volume for the words *God*, *Jesus*, and *prayer*; to assess changes in religious search). The dependent measure was the current week's (Week X) search volume for the same religious concepts. Simultaneous multiple regression analyses were conducted with six predictors (see Pelham et al., 2018 for further details).

I re-ran the same analyses but included an additional variable: Country-level religiosity. I used the scores for religiosity from Pew Research Center (2018). The scores represented the percentage of the population affiliated with a religion. Using a meta-analysis procedure, I investigated whether the associations between illness-related and religious searches on Google varied based on the country-level religiosity.

Results

All findings for the 16 nations were reproduced as they are reported by Pelham et al., (2018; see Figure 1). A restricted maximum likelihood model was used in the meta-analysis, as there was significant heterogeneity in the associations between illness-related search and religious search, after controlling for the five control variables, $Q(16) = 199.459, p < .001$. The combined association across 16 nations was statistically significant, $b = .150, SE = .018, z = 8.349, p < .001, 95\% \text{ CI } [.115, .185]$. When religiosity was included as a covariate, the combined association across 15 nations¹ remained as significant, $b = .310, SE = .097, z = 3.187, p = .001, 95\% \text{ CI } [.119, .501]$, whereas the observed associations did not co-vary with the religiosity of the country, $b = -.002, SE = .001, z = -1.717, p = .086, 95\% \text{ CI } [-.004, .000]$.²³

¹ Religiosity score for New Zealand was not available (Pew Research Center, 2018) and thus it was removed from the analysis.

² Although it is a widely criticized approach, some might interpret the p value of .086 as marginally significant. Even in the case of such lack of rigour in inference, it should be noted that the observed association was negative. A negative association would mean that the association between illness-related and religious search was weaker in more religious countries, which is not consistent with TMT.

³ One criticism could be that these countries differ in their religion and language, so a comparison disregarding such differences could lead to erroneous interpretations. In order to overcome this limitation, I also conducted

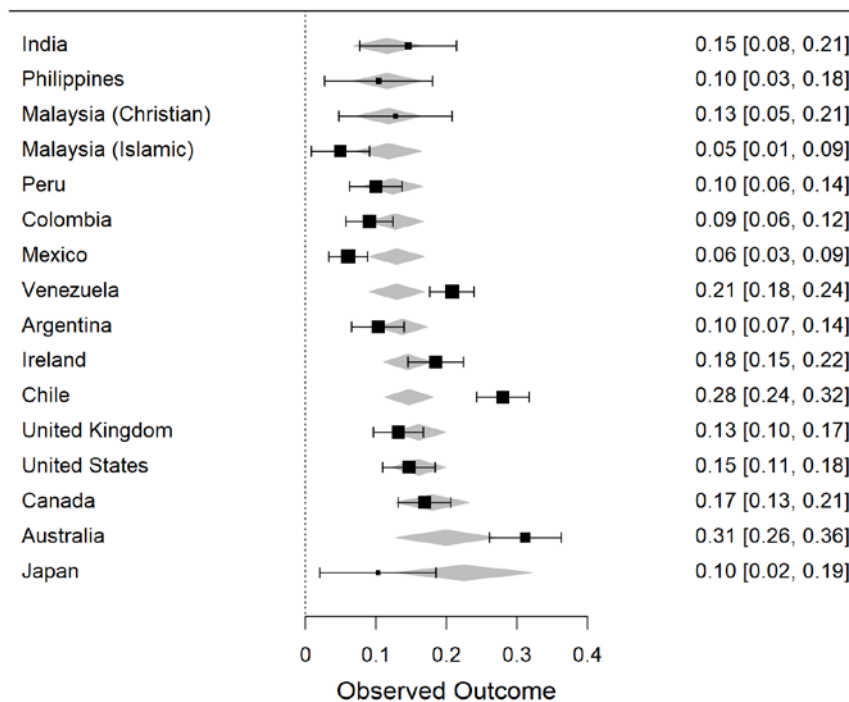


Figure 1. The distribution unstandardized regression coefficients predicting religion-related search on Google from disease-related search (Study 1). Whiskers represent 95% confidence intervals for the coefficients. Grey diamonds represent the predictions from the religiosity of the country. Countries are ranked from the most religious (India) to the least religious (Japan).

In short, the associations between illness-related search and religious search on Google did not depend on the religiosity of the country. In other words, the associations were not significantly different in more and less religious countries.

separate analyses comparing countries with a common language and religion. Among English-speaking and predominantly Christian countries (Australia, Canada, Ireland, United Kingdom, and United States), the aggregate association was significant, $b = .534$, $SE = .190$, $z = 2.804$, $p = .005$, 95% CI [.161, .907], but the overall religiosity was not a significant moderator, $b = -.005$, $SE = .003$, $z = -1.840$, $p = .066$, 95% CI [-.010, .000]. Among Latin American countries (Argentina, Chile, Colombia, Mexico, Peru, and Venezuela), for which the dominant religion is Christianity and the language is Spanish, similar results were observed: The aggregate association was significant, $b = 1.390$, $SE = .648$, $z = 2.146$, $p = .032$, 95% CI [.121, 2.666], but the overall religiosity was not a significant moderator, $b = -.014$, $SE = .007$, $z = -1.932$, $p = .053$, 95% CI [-.028, .000]. In both groups, the moderating effect of religiosity was nonsignificant and trending towards a negative association, which is the opposite of what would be expected from a TMT perspective (see Footnote 2).

Study 2

In Study 2, I compared 51 territories in the US (50 states and District of Columbia). All these regions share the same predominant language (English) and the religion (Christianity) and they are parts of the same country (the US). These commonalities make them an ideal choice for comparison. The US states differ in their overall religiosity (Pew Research Center, 2016), and despite their commonalities, it would be expected that MS induced by illness-related search would elevate the search volume for religious concepts to a greater extent in highly religious states, as compared to the less religious ones, from a TMT perspective.

Google Trends provides weekly results only for the last 5 years.⁴ I set the date range as starting with the beginning of year 2015 (the week that starts on January 4, 2015) and ending with the date that I started gathering data (the week that starts on June 30, 2019), resulting in 235 consecutive weeks for each location. Search volumes for the same keywords described in Study 1 were included in the analyses.

Analysis Procedure

Hierarchical multiple regression analyses were conducted for each state. I opted for using hierarchical analyses to better isolate the effect of the main predictor, controlling for other relevant variables. In the first step, there were five predictors: Year (ranging from 2015 to 2019), religious search volume (search for the words *God*, *Jesus*, and *prayer*) in the preceding week (Week X-1), search volume for the word *sore throat*, and binary-coded variables for Christmas (0 = *No Christmas*, 1 = *The week that includes Christmas*), and Easter (0 = *No Easter*, 1 = *The week that includes Easter*). In the second step, disease-related search

⁴ This was not the case when Pelham et al. (2018) conducted their study. It appears that Google changed its policy regarding availability of data.

in the current week (Week X) was entered. The dependent measure was religious search volume in Week X. Unstandardized regression coefficients and standard errors for disease-related search in Week X predicting religious search in Week X (controlling for the five predictors in the first step of the hierarchical regression) for each state were entered into a meta-analysis. The fixed-effect method was used in the meta-analyses as there was no heterogeneity in the associations in any of the analyses. The percentages of adults in each state who are highly religious (Pew Research Center, 2016) are considered as religiosity scores for the states and religiosity was included as a covariate in the meta-analysis.

Results

When the national-level data for the USA were analyzed, it was found that illness-related search predicts search for religious concepts, after controlling for control variables, $b = .087$, $SE = .033$, $\beta = .152$, $p = .008$, 95% CI [.023, .151]. There was no heterogeneity in the associations across states, $Q(50) = 61.730$, $p = .124$. The combined effect of state-level disease-related religious searches, calculated by fixed-effects method, was significant, $b = .087$, $SE = .005$, $z = 16.901$, $p < .001$, 95% CI [.077, .097]. When religiosity of the states was added as a covariate, religiosity did not have a significant association, $b = -.001$, $SE = .000$, $z = -1.402$, $p = .161$, 95% CI [-.002, .000], whereas the combined effect of disease-related search remained as significant, $b = .126$, $SE = .028$, $z = 4.468$, $p < .001$, 95% CI [.070, .181] (see Figure 2).

Thus, disease-related search on Google positively predicted the next week's religious search. However, this association did not depend on the overall religiosity of the state; similar associations were observed among more and less religious states.

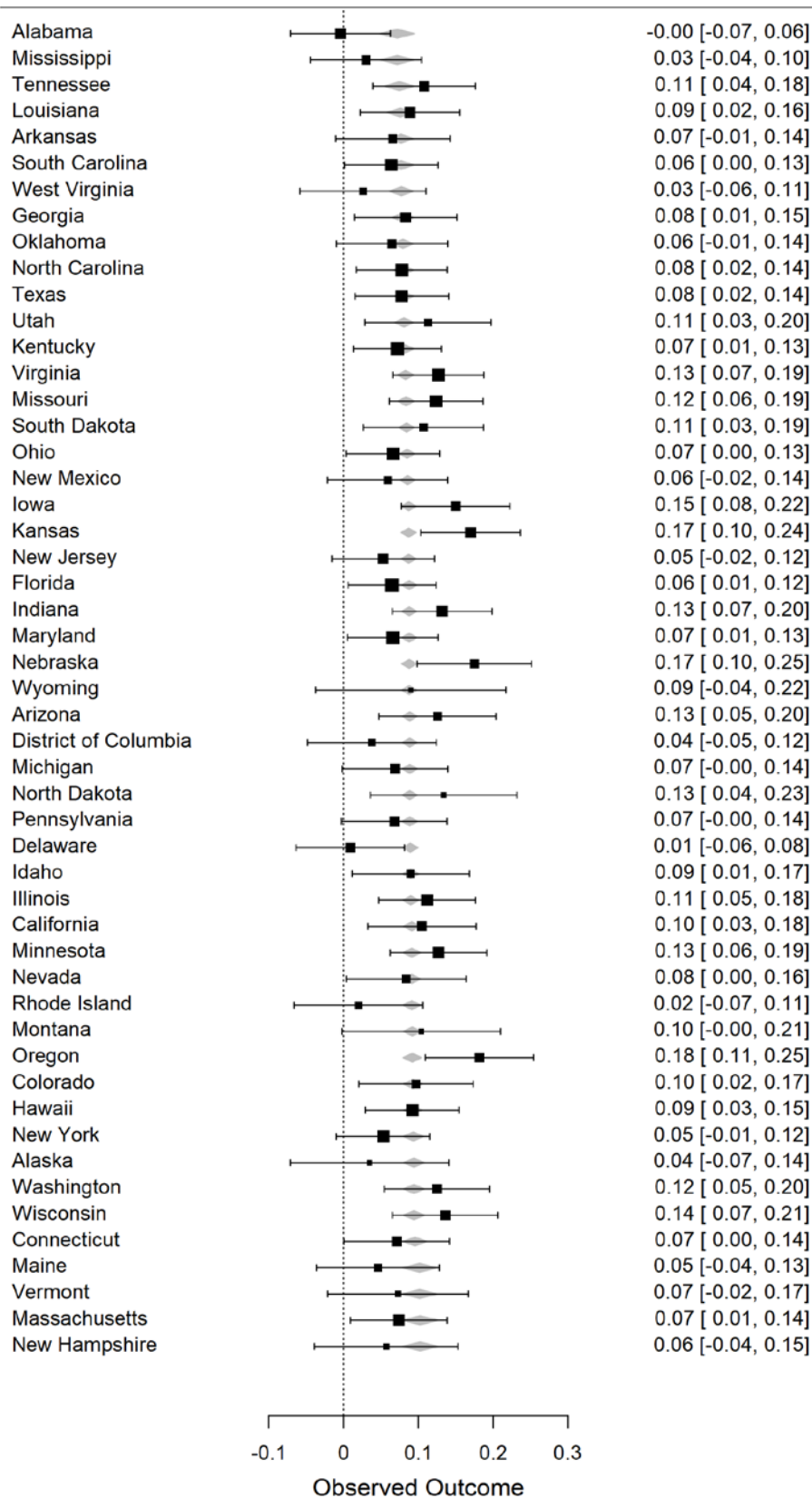


Figure 2. The distribution unstandardized regression coefficients predicting religion-related search on Google from disease-related search (Study 2). Whiskers represent 95% confidence intervals for the coefficients. Grey diamonds represent the predictions from the religiosity of the state. States are ranked from the most religious (Alabama) to the least religious (New Hampshire).

Study 3

In Study 3, the procedure in Study 2 was replicated on a Turkish context. In Turkey, there are 81 provinces. As a non-WEIRD (see Henrich, Heine, & Norenzayan, 2010) nation with a predominantly Muslim population, Turkey was a reasonable choice for investigating within-nation variations in Google search volumes in a way that would extend the implications of Study 2 beyond Western societies. Similar to Study 2, I investigated whether the association between illness-related and religious searches for each province varied according to the religiosity level of the province.

The same date range as in Study 2 was set during data retrieval. In several parts of the Materials and Procedure section (see below), there are mentions of missing data for some of the provinces. A detailed report exhibiting which search volumes were missing for which provinces are also available at the project's OSF page.

Materials and Procedure

Illness-related words. Similar to Study 1 and 2, search volume for *kanser* (cancer), *tansiyon* (hypertension), and *diyabet* or *şeker hastalığı*⁵ (diabetes) were considered as indicators of illness-related search on Google. Search volume for these three diseases had a

⁵ Exact translation of diabetes is *diyabet* in Turkish. However, *şeker hastalığı*, which literally translates into *sugar disease*, is commonly used in daily language to refer to diabetes. I have used the command “*diyabet+şeker hastalığı*” to retrieve the combined search volume. In some provinces, data were available for only one of the alternative names of the disease. In those cases, retrieved search volume reflected search for only one of the alternative names. However, this is unlikely to be a problem as they essentially have the same meaning.

good level of internal consistency ($\alpha = .822$) in the national-level data (i.e., data of search volumes throughout Turkey).⁶

Religiosity-related words. The words chosen to reflect religious search were as follows: *Kuran* (Quran; the holy book of Islam), *Allah* (the word used for God in Islam), *peygamber* (prophet), and *ayet* (verse; typically used for verses in Quran). Search volumes for these words had a reasonable internal consistency ($\alpha = .732$) in the national-level data.⁷

Control variables. Similar to Study 1 and 2, there was a need to control for variations in search for non-life-threatening diseases, like *sore throat*. However, Google Trends was able to provide data on search volume for *boğaz ağrısı* (sore throat) for only 44 out of 81 provinces. Thus, *grip* (flu) was used instead. Search volume for *grip* was available for 79 out of 81 provinces.

Similar to Study 1 and 2, year (ranging from 2015 to 2019) and religious search volume in the current week were also considered as control variables. Other variables that were accounted for were religious holy days in Islam which are commonly celebrated in Turkey: Ramadan month, Feast of Ramadan (Eid al-Fitr), Feast of the Sacrifice (Eid al-Adha), Laylat al-Raghaib, Lailat al Miraj, Mid-Sha'ban, and Mawlid an-Nabi. The weeks that included these days were coded as 1, whereas the remaining weeks were coded as 0.

Religiosity of the province. As there were no available statistics showing the religiosity level of each province in Turkey, I relied on overall search volumes for religiosity-related words (as described above) as a proxy for religiosity. Google Trends can rank provinces according to their search volume for particular words (relatively to the total volume

⁶ I have also considered adding “heart disease” and/or “heart attack” to the list, as they are common causes of death. However, Google Trends provided data on search volume for these keywords for only 20 out of 81 Turkish provinces. I have thus decided not to include them in the analyses.

⁷ Other candidate words were *Hız Muhammed* (Prophet Muhammad) and *cami* (mosque). However, Google Trends did not provide data on *Hız Muhammed* for 60 out of 81 provinces and adding *cami* to the composite decreased Cronbach’s alpha score to .704. Thus, these words were not included in the analyses.

of all searches conducted in that province). I had Google Trends rank Turkish provinces according to their overall search volume for religiosity-related words between January 4, 2015 and June 30, 2019. A higher score represented a higher percentage of search for religious concepts in all Google searches conducted in that province during the specified date range. Thus, a higher score indicated that people in that province have been more interested in religion as compared to provinces with lower scores.

Analysis Procedure

Four provinces had missing values for at least one of the variables. After they were removed, the analyses were conducted on 77 provinces. The procedure used in Study 2 was followed. In the first step of the hierarchical regression analysis, all control variables (see above) were entered. In the second step, illness-related search for the current week (Week X) was entered. The dependent variable was religious search volume for the current week (Week X).

Results

When the national-level data for Turkey were analyzed, it was found that illness-related search predicts the next week's search for religious concepts, after controlling for control variables, $b = .360$, $SE = .054$, $\beta = .413$, $p < .001$, 95% CI [.253, .467]. A meta-analysis of 77 Turkish provinces yielded a similar result: There was significant heterogeneity in the associations across provinces, $Q(76) = 81.131$, $p < .001$, and the combined effect of disease-related search on religious search, calculated by restricted maximum likelihood method, was significant, $b = .045$, $SE = .009$, $z = 5.077$, $p < .001$, 95% CI [.027, .062].

When religiosity of the province was added as a covariate, religiosity, $b = -.001$, $SE = .001$, $z = -1.235$, $p = .217$, 95% CI [-.002, .000] did not have a significant association while the combined effect of illness-related search, $b = .106$, $SE = .051$, $z = 2.094$, $p = .036$, 95% CI

[.007, .206], remained significant. Thus, illness-related search significantly predicted religious search, even after controlling for differences in religiosity, and the overall religiosity level of the province did not moderate this relationship. In other words, in both more and less religious provinces, similar associations were observed⁸.

⁸ One potential criticism would be regarding using “flu” as a control variable instead of “sore throat”, like in Study 1 and 2. Although search volume for “sore throat” was available only in 44 provinces, I repeated the same analysis with “*boğaz ağrısı*” (“sore throat”) instead of “flu”, and the results were not different: Religiosity was not a significant moderator, $b = .000$, $SE = .001$, $z = .094$, $p = .925$, 95% CI [-.002, .002]

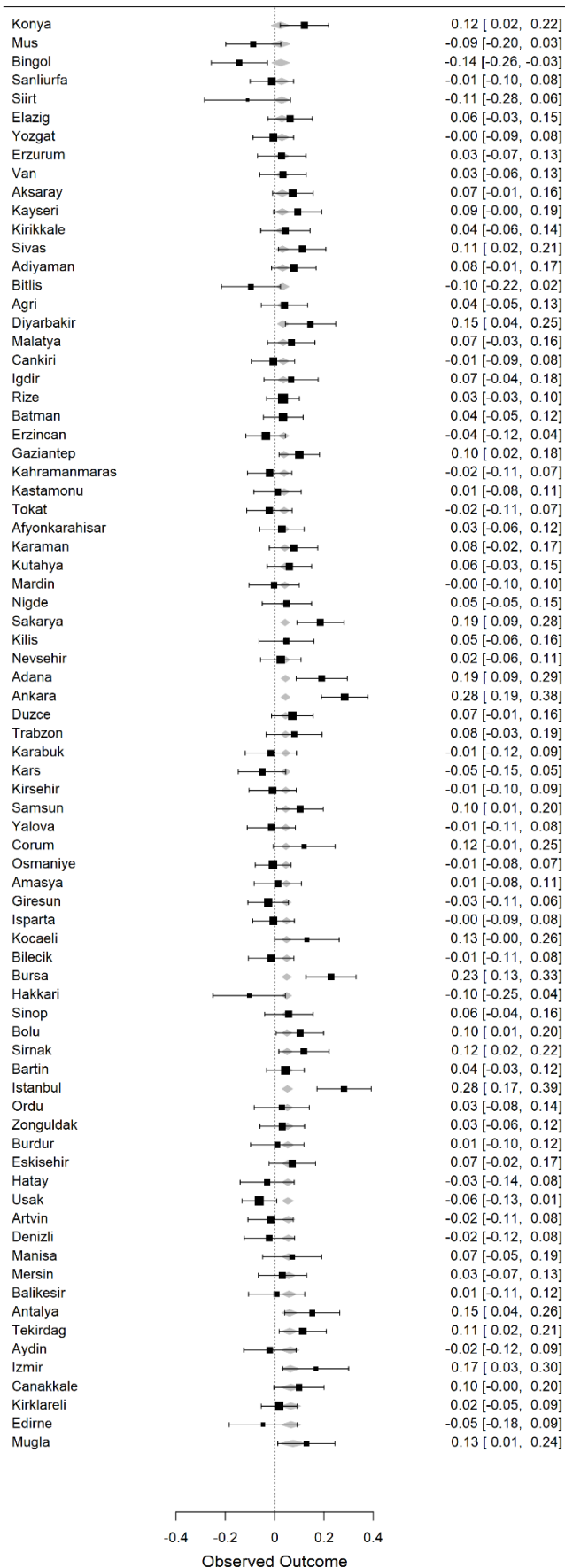


Figure 3. The distribution unstandardized regression coefficients predicting religion-related search on Google from disease-related search in Turkish provinces (Study 3). Whiskers represent 95% confidence intervals for the coefficients. Grey diamonds represent the predictions from the religiosity of the province. Provinces are ranked from the most religious (Konya) to the least religious (Mugla).

Discussion

Following recent research (Pelham et al., 2018), the current findings provided further evidence that illness-related search on Google predicts search for religious concepts. However, the level of observed associations did not vary with the existing level of religiosity. The same finding was replicated in both international (Study 1) and within-nation comparisons (Study 2 and 3) of regions dominated by Christian and Muslim populations.

The results of all three studies indicate that the association between MS and an interest in religion does not depend on the pre-existing level of religiosity. Such result might not be entirely consistent with a TMT framework: According to TMT, the terror caused by MS leads people to endorse their own worldview which promises either literal or symbolic immortality (e.g., Greenberg et al., 1990; Hirschberger & Ein-Dor, 2006; Pyszczynski et al., 2006; Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon; see Burke et al., 2010 for a meta-analysis). Thus, an increased level of religiosity after MS would be an expression of the process of endorsing one's own worldview. Accordingly, one would expect the association between illness-related and religious search on Google to be stronger among people who are already religious, because the worldview they endorse after MS would be a religious one, unlike the case of non-believers (Jong et al., 2012; Norenzayan & Hansen, 2006; Vail et al., 2012). However, the results did not support this expectation and showed that people in more and less religious regions around the world are equally likely to search for religious concepts after MS induced by illness-related search on Google.

By emphasizing the role of the existing level of religiosity, the current study also aimed to highlight that TMT is not the only theory with explanations for how people might react to the threat. One line of research suggests that people are motivated to live in a safe, predictable, and structured world (Jost et al., 2003). When there is a sense of threat, these psychological needs are not met; and as a result people react by becoming more conservative (Jost et al., 2003; Jost, Ledgerwood, & Hardin, 2008). It should be noted that this theoretical framework does not necessarily contradict with TMT, and in fact they are consistent to a great extent (see Jost et al., 2003 for a discussion). However, it diverges from TMT on one important detail: It does not argue that conservatives would become more conservative and liberals would become more liberal after MS, in contrast to what TMT suggests. Instead, it suggests that fear and threat have an overall effect of increasing conservatism. Accordingly, then, fear of death (which is induced by the salience of life-threatening illnesses in the current research) might render people more likely to endorse a conservative worldview which typically includes a higher level of religiosity. This might explain why, regardless of the pre-existing level of religiosity, most people were found to seek refuge in more conventional ways of dealing with death (i.e., finding comfort in religious beliefs) in the current research.

However, an alternative interpretation of the findings would be more consistent with the TMT framework. It has been previously argued that, among other worldviews, religious ones are distinct in their efficiency in promising immortality (Heflick & Goldenberg, 2012; Jackson et al., 2018; Vail & Soenke, 2018; Vail et al., 2012). A typical religion, including but not limited to Christianity and Islam which were more central to the current research, includes a belief in after-life. This puts religions in a more advantageous position in dealing with the effect of death anxiety as they promise literal immortality, unlike more secular worldviews (e.g., Vail et al., 2012). One could argue that people are relatively more likely to find comfort in religious beliefs to deal with death anxiety as they provide more comforting solutions for

the mortality problem. This might also be the reason why, regardless of the pre-existing level of religiosity, there is an overall positive association between illness-related and religious search on the internet.

It should be noted that the findings does not necessarily falsify TMT or prove that a system justification approach is a better explanation for the association between illness-related and religious searches due to (1) the possibility of an alternative interpretation of TMT, as described above; and (2) the further potential limitations, as discussed in the next section. Nevertheless, the current set of findings does show that the future research regarding the effects of death reminders should (1) consider all alternative theoretical accounts that might make similar predictions; and (2) test these accounts, by focusing on their differences, against each other to identify the theory that better explains the results. I argued that the existing level of religiosity is one such factor that might differentiate TMT from other alternative theories on the effects of threat. Future studies are needed to further replicate these findings and develop more advanced methods to test related theories against each other, preferably on larger and more representative data.

Potential Limitations

Like all research, the current study has also certain limitations. First, in the TMT literature, self-esteem has a pivotal role in understanding how MS affects endorsement of worldview. TMT suggests that self-esteem is an indicator of how much one is living up to his/her worldview and high self-esteem suggests that one is successful in accomplishing this (Pyszczynski et al., 1999, 2015). Self-esteem buffers the effects of death anxiety and MS leads to higher endorsement of worldview among people with low self-esteem (e.g., Harmon-Jones et al., 1997). Although it is practically challenging, future research could control for the differences in self-esteem, in addition to religiosity. This could be accomplished by collecting self-esteem scores from representative samples in each region of interest, or measure the self-

esteem through indirect factors that are known to predict self-esteem, like age, education, socioeconomic status, and physical health (e.g., Orth, Trzesniewski, & Robins, 2010). Second, there could be other life-threatening illnesses and religious concepts that could be included in the analyses. Future research could tap into a wider array of illnesses and investigate potential variations in their effect on interest in religion. Third, most of the countries in Study 1, the US states (Study 2), and the Turkish provinces (Study 3) are inhabited by predominantly Christian or Muslim populations. It should be noted that Christianity and Islam are both Abrahamic religions with many commonalities in their depiction of afterlife; thus future research should investigate whether the observed findings replicate in cultures with more diverse beliefs in what happens after death. Fourth, population-level religiosity of a region might not always represent the average religiosity of the people who searched something on Google in that region. Additionally, Pelham et al. (2018) suggested that the effect of MS on interest in religions might be stronger for religious minorities. Although such details are not available on Google Trends, it would be much better to analyze data on individual searching behavior and individual level of religiosity.

Conclusion

I investigated the association between searches on life-threatening illnesses and religious concepts. Both international (Study 1) and within-nation comparisons (Study 2 and 3) illustrated that this association was positive, so previous findings (Pelham et al., 2018) were replicated. I also argued that there might be alternative theoretical accounts that can explain these results and used existing level of religiosity as a candidate variable to differentiate these accounts. The association between searches did not depend on the overall religiosity of the region. This lack of effect of religiosity casted doubt on whether the findings were consistent with the worldview defense process explained by TMT and suggested that fear of death might have a universal effect of rendering people more religious, largely

regardless of their pre-existing beliefs. The current findings pave the way for further research in distinguishing the predictions of TMT, motivated social cognition accounts of political conservatism, and other related theoretical accounts in explaining the effect of threat on religiosity.

References

- Bonanno, G. A., & Jost, J. T. (2006). Conservative shift among high-exposure survivors of the September 11th terrorist attacks. *Basic and Applied Social Psychology*, 28(4), 311-323. https://doi.org/10.1207/s15324834basp2804_4
- Burke, B. L., Martens, A., & Faucher, E. H. (2010). Two decades of terror management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review*, 14(2), 155-195. <https://doi.org/10.1177%2F1088868309352321>
- Forscher, P. S., Lai, C. K., Axt, J. R., Ebersole, C. R., Herman, M., Devine, P. G., & Nosek, B. A. (2019). A meta-analysis of procedures to change implicit measures. *Journal of Personality and Social Psychology*, 117(3), 522-559. <http://dx.doi.org/10.1037/pspa0000160>
- Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A., Veeder, M., Kirkland, S., & Lyon, D. (1990). Evidence for terror management theory II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. *Journal of Personality and Social Psychology*, 58(2), 308-318. <http://dx.doi.org/10.1037/0022-3514.58.2.308>
- Greenberg, J., Simon, L., Pyszczynski, T., Solomon, S., & Chatel, D. (1992). Terror management and tolerance: Does mortality salience always intensify negative reactions to others who threaten one's worldview?. *Journal of Personality and Social Psychology*, 63(2), 212. <http://dx.doi.org/10.1037/0022-3514.63.2.212>
- Harmon-Jones, E., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., & McGregor, H. (1997). Terror management theory and self-esteem: Evidence that increased self-esteem reduced mortality salience effects. *Journal of Personality and Social Psychology*, 72(1), 24-36. <https://doi.org/10.1037/0022-3514.72.1.24>

- Heflick, N. A., & Goldenberg, J. L. (2012). No atheists in foxholes: Arguments for (but not against) afterlife belief buffers mortality salience effects for atheists. *British Journal of Social Psychology, 51*(2), 385-392. <https://doi.org/10.1111/j.2044-8309.2011.02058.x>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Most people are not WEIRD. *Nature, 466*(7302):29. <https://doi.org/10.1038/466029a>
- Hirschberger, G., & Ein-Dor, T. (2006). Defenders of a lost cause: Terror management and violent resistance to the disengagement plan. *Personality and Social Psychology Bulletin, 32*(6), 761-769. <https://doi.org/10.1177%2F0146167206286628>
- Jackson, J. C., Jong, J., Bluemke, M., Poulter, P., Morgenroth, L., & Halberstadt, J. (2018). Testing the causal relationship between religious belief and death anxiety. *Religion, Brain & Behavior, 8*(1), 57-68. <https://doi.org/10.1080/2153599X.2016.1238842>
- Jong, J., Halberstadt, J., & Bluemke, M. (2012). Foxhole atheism, revisited: The effects of mortality salience on explicit and implicit religious belief. *Journal of Experimental Social Psychology, 48*(5), 983-989. <https://doi.org/10.1016/j.jesp.2012.03.005>
- Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychological Bulletin, 129*(3), 339-375. <https://doi.org/10.1037/0033-2909.129.3.339>
- Jost, J. T., Ledgerwood, A., & Hardin, C. D. (2008). Shared reality, system justification, and the relational basis of ideological beliefs. *Social and Personality Psychology Compass, 2*(1), 171-186. <https://doi.org/10.1111/j.1751-9004.2007.00056.x>
- Landau, M. J., Solomon, S., Greenberg, J., Cohen, F., Pyszczynski, T., Arndt, J., ... & Cook, A. (2004). Deliver us from evil: The effects of mortality salience and reminders of

9/11 on support for President George W. Bush. *Personality and Social Psychology Bulletin*, 30(9), 1136-1150. <https://doi.org/10.1177/0146167204267988>

Nail, P. R., McGregor, I., Drinkwater, A. E., Steele, G. M., & Thompson, A. W. (2009).

Threat causes liberals to think like conservatives. *Journal of Experimental Social Psychology*, 45(4), 901-907. <https://doi.org/10.1016/j.jesp.2009.04.013>

Norenzayan, A., & Hansen, I. G. (2006). Belief in supernatural agents in the face of death.

Personality and Social Psychology Bulletin, 32(2), 174-187.

<https://doi.org/10.1177%2F0146167205280251>

Orth, U., Trzesniewski, K. H., & Robins, R. W. (2010). Self-esteem development from young

adulthood to old age: a cohort-sequential longitudinal study. *Journal of Personality and Social Psychology*, 98(4), 645. <http://dx.doi.org/10.1037/a0018769>

Pelham, B. W., Shimizu, M., Arndt, J., Carvallo, M., Solomon, S., & Greenberg, J. (2018).

Searching for God: Illness-related mortality threats and religious search volume in Google in 16 nations. *Personality and Social Psychology Bulletin*, 44(3), 290-303.

<https://doi.org/10.1177%2F0146167217736047>

Pew Research Center. (February 29, 2016). *How religious is your state?*. Retrieved

September 10, 2019, from <https://www.pewresearch.org/fact-tank/2016/02/29/how-religious-is-your-state/>

Pew Resarch Center. (June 13, 2018). *The age gap in religion around the world*. Retrieved

September 10, 2019, from <https://assets.pewresearch.org/wp-content/uploads/sites/11/2018/06/12094011/Appendix-B.pdf>

Pyszczynski, T., Abdollahi, A., Solomon, S., Greenberg, J., Cohen, F., & Weise, D. (2006).

Mortality salience, martyrdom, and military might: The great Satan versus the axis of

evil. *Personality and Social Psychology Bulletin*, 32(4), 525-537.

<https://doi.org/10.1177%2F0146167205282157>

Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: an extension of terror management theory. *Psychological Review*, 106(4), 835-845.

<https://doi.org/10.1037/0033-295X.106.4.835>

Pyszczynski, T., Solomon, S., & Greenberg, J. (2015). Thirty years of terror management theory: From genesis to revelation. In *Advances in Experimental Social Psychology* (Vol. 52, pp. 1-70). Academic Press.

Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory: I. The effects of mortality salience on reactions to those who violate or uphold cultural values. *Journal of Personality and Social Psychology*, 57(4), 681-690. <https://doi.org/10.1037//0022-3514.57.4.681>

Vail, K. E., Juhl, J., Arndt, J., Vess, M., Routledge, C., & Rutjens, B. T. (2012). When death is good for life: Considering the positive trajectories of terror management. *Personality and Social Psychology Review*, 16(4), 303-329.

<https://doi.org/10.1177%2F1088868312440046>

Vail, K. E., & Soenke, M. (2018). The impact of mortality awareness on meaning in life among Christians and atheists. *Religion, Brain & Behavior*, 8(1), 44-56.

<https://doi.org/10.1080/2153599X.2016.1238845>

Van de Vyver, J., Houston, D. M., Abrams, D., & Vasiljevic, M. (2015). Boosting belligerence: How the July 7, 2005, London bombings affected liberals' moral foundations and prejudice. *Psychological Science*, 27(2), 169-177.

<https://doi.org/10.1177/0956797615615584>

Van Leeuwen, F., & Park, J. H. (2009). Perceptions of social dangers, moral foundations, and political orientation. *Personality and Individual Differences*, 47(3), 169–173.

<https://doi.org/10.1016/J.PAID.2009.02.017>

Wright, J. C., & Baril, G. L. (2013). Understanding the role of dispositional and situational threat sensitivity in our moral judgments. *Journal of Moral Education*, 42(3), 383–397. [https://doi.org 10.1080/03057240.2013.820659](https://doi.org/10.1080/03057240.2013.820659)