

# Science rejection in Greece: Spirituality predicts vaccine scepticism and low faith in science in a Greek sample

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## Abstract

Recent research has identified spirituality as an important contributor to vaccine scepticism and low faith in science, particularly in WEIRD (Western, Educated, Industrialized, Rich and Democratic) nations. In the present study, we further tested the generalizability of these findings in a religious South-Eastern European country – Greece, with more extensive measures of key constructs. We replicate previous work using measures of improved construct validity. Spirituality was found to be the strongest predictor of vaccine scepticism and low faith in science. In addition, low science literacy was also predictive of vaccine rejection. Climate change scepticism was not associated with spirituality but with political conservatism, which corroborates previous findings. These results provide further evidence for two previously made observations: science scepticism is heterogeneous, and spirituality is an important factor in shaping science rejection.

## Keywords

environment, generalizability, health, science and religion, science scepticism, spirituality, WEIRD

The year 2020 has seen people worldwide facing the global COVID-19 pandemic caused by a novel coronavirus. Despite the fact that almost 2.5 million people<sup>1</sup> died because of the virus within a year after it was first identified, large numbers of anti-science protesters regularly gather in European capitals. The protesters express scepticism of mass coronavirus vaccination and mandated measures against the virus spread. Distrust of vaccination programmes represents a major global health concern, not only during the ongoing pandemic (World Health Organization, 2019).

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For example, vaccine scepticism<sup>2</sup> is associated with an increased risk of measles outbreaks (Wellcome Trust, 2019). Measles is easily controlled if enough people are vaccinated against it and herd immunity is achieved (Nature Editorial, 2017; Pierik, 2017; Wenner Moyer, 2018). Importantly, science rejection is not associated with universal factors, nor is it homogeneous cross-culturally (e.g. McPhetres et al., 2020; Rutjens et al., in press). It is therefore important to further explore and map the psychological antecedents of vaccine hesitancy and science rejection in general. In the present article, we report a study on attitudes towards vaccines specifically and science generally in an under-researched cultural context.

Previous research conducted in the US identified religiosity as an important contributor to vaccine rejection, with highly religious people being more sceptical (Rutjens et al., 2018a, 2018b). Other studies show that religiosity is associated with general negative attitudes towards science (McPhetres and Zuckerman, 2018). However, support for such conclusions was not consistently found beyond the cultural context of the United States (McPhetres et al., 2020). In recent research conducted in a secular Western European country (the Netherlands), it was self-identified *spirituality* rather than religiosity that predicted increased vaccine scepticism and low faith in science (Rutjens and Van der Lee, 2020). More recently, Rutjens et al. (in press) found that spirituality was the most consistent predictor of low faith in science across cultures (the effect was observed in 20 out of the 24 countries included in that research). This could be because spiritual beliefs do not align well with science: Although various definitions of spirituality exist, one common characteristic that is referred to is the reliance on subjective experience and an intuitive epistemology (Hanegraaff, 1996; Rutjens and Van der Lee, 2020; Saucier and Skrzypińska, 2006; Wong and Vinsky, 2009). The intuitive epistemological approach to truth (Hanegraaff, 1996) that characterizes spirituality and spiritual belief might stand in contradiction to science. Many scholars differentiate spirituality and religiosity by pointing to spirituality as a search for meaning and relating the self to reality that need not be expressed in a religious context. Moreover, religion – in contrast – reflects an *institutionalized* set of beliefs, experiences and behaviours (Canda et al., 2019; Versteeg and Roeland, 2011). Spiritual scepticism might indeed be a significant issue in the Netherlands (Rutjens and Van der Lee, 2020), as the majority of the Dutch population are non-religious (68%) with a substantial proportion also describing themselves as spiritual, often characterized as believing but not belonging (31%; Het Parool, 2016; also see Houtman and Aupers, 2007; Versteeg and Roeland, 2011). However, the aforementioned large-scale cross-cultural study indicates that the relation between spirituality and science rejection is surprisingly robust and found in both secularized as well as more religious countries (Rutjens et al., in press).

The previous work on spirituality and science scepticism described above is however limited in construct validity, using mostly very brief one-item and two-item measures to assess key constructs. The aim of the current research is to replicate key results from that work using more elaborate measures, both in terms of predictor variables (e.g. spirituality) and outcome variables (e.g. vaccine scepticism). Moreover, we do so by utilizing a sample from a country that is largely absent from the psychological database, which is crucial in order to increase confidence in the generalizability of research findings (Apicella et al., 2020; Henrich et al., 2010; Muthukrishna et al., 2020).

## Greece

We examine whether spirituality contributes to vaccine scepticism and low science faith in Greece, which is a religious country located in South-Eastern Europe. While Greece might be classified as a WEIRD country (Western, Educated, Industrialized, Rich and Democratic; Henrich et al., 2010), the Greek population is not widely represented in research studies, especially in psychology (Muthukrishna et al., 2020). Orthodox Christianity is the main religion in Greece, where 59% of

the Greek population report believing in God with absolute certainty (Lipka, 2018). To our knowledge, there are no official reports on the proportion of spiritual people in Greece. However, the emergence of spiritual groups inspired by Western European countries has been well documented (Helaas, 1996). In a recent ethnographic study, Greek spiritual groups were described as creatively combining Christianity and New Age beliefs (i.e. a range of diverse spiritual or religious beliefs) and directly challenging the authority of the dominant Orthodox church (Roussou, 2018). Overall, it seems that spiritual groups both in the Netherlands (Rutjens and Van der Lee, 2020) and Greece share the common feature of *believing without belonging*.

Based on previous research (Rutjens et al., in press; Rutjens and Van der Lee, 2020), we predicted that spirituality would be associated with increased levels of vaccine scepticism and low faith in science. To test this prediction, we recruited a convenience sample of Greek nationals and asked them to complete an online survey. In the survey, we asked participants to report their beliefs regarding vaccination and faith in science. We also measured spirituality with an extensive 14-item scale (Delaney, 2005). In addition, as previous work observed that low scientific literacy contributes to vaccine rejection (Rutjens et al., 2018a; Rutjens and Van der Lee, 2020), we also asked participants to complete a science literacy test. Finally, to test whether spirituality uniquely predicts vaccine scepticism and low faith in science compared to scepticism in other science domains, participants completed a measure of climate change scepticism. Based on previous research, we expected that climate change scepticism would be associated with political conservatism (Lewandowsky et al., 2013; Rutjens et al., 2018a, in press). At the end of the survey, participants reported demographic information (nationality, age, gender, student status, religious affiliation, religiosity, religious orthodoxy and political orientation). All materials were presented in Greek.

## I. Method

### *Participants*

We aimed at recruiting a final sample of at least 250 participants (Schönbrodt and Perugini, 2013). However, due to our broad sampling criteria, we predicted 50% data loss (e.g. due to missing data, recruitment of non-Greek nationals, participant inattentiveness). Hence, we recruited 502 participants via social media and emails to students at the University of Crete and employees at Heraklion Municipality in Crete, Greece. Participants' occupations were diverse. Most of the religious participants were Christian Orthodox (75.2%). In total, we excluded 180 participants (94 had missing data, 5 were non-Greek nationals, 19 were not Greek residents and 62 failed attention checks), yielding a final sample of 322 participants. Demographic information is presented in Table 1.

### *Materials*

We adapted materials and survey design from Rutjens and van der Lee (2020) but using more extensive measures. The study was administered online using Qualtrics. Key measures are presented in Table 2 and the full survey materials can be found in Supplemental Appendix C. We additionally collected demographic information about participants (gender, age, religious affiliation, student status, occupation, country of residence, nationality).<sup>3</sup> We embedded two attention checks within our survey (e.g. 'We would like to make sure that you pay attention to the wording of the questions. Please select "I strongly agree" in response to this item'). All materials were translated by Native Greek (and fluent English) speakers. The study was approved by the UvA Ethics Committee (code: 2020-SP-11807).

**Table 1.** Sample characteristics.

N	322
Age (years)	$M = 38.17$ ( $SD = 15.15$ , range = 18–81)
Gender	68.9% women, 30.4% men, 0.7% other
Student: Yes or no	Yes: 218 (67.7%), No: 104 (32.3%)
Political conservatism (1–10)	$M = 4.00$ ( $SD = 1.65$ )
Religiosity: Yes or no	Yes: 159 (49.4%), No: 163 (50.6%)
Religious orthodoxy (1–7)	$M = 3.31$ ( $SD = 1.70$ )
Spirituality (1–6)	$M = 3.76$ ( $SD = .85$ )
Scientific literacy (0–8)	$M = 6.18$ ( $SD = 1.44$ )

SD: standard deviation.

## 2. Results and discussion

We conducted multiple regression analyses to test which variables best predict vaccine scepticism and faith in science. We also analysed climate change scepticism for comparison. In each analysis, we controlled for age, gender and student status. The results are presented in Table 3. For the scepticism scales, high scores represent high scepticism. No multicollinearity was found (variance inflation rates  $< 2.23$ ).<sup>4</sup>

As hypothesized, we found that spirituality was a unique predictor of faith in science and vaccine scepticism. Spiritual individuals reported lower faith in science and were more sceptical about vaccines. The association was especially strong in the case of vaccine scepticism ( $\beta = .27$ ). As expected, spirituality did not predict climate change scepticism.

Furthermore, as expected, we found that low scientific literacy predicted high vaccine scepticism. Contrary to the recently obtained findings in the Netherlands (Rutjens and Van der Lee, 2020), where religiosity was not associated with vaccine scepticism, we found that in the Greek context, religiosity - surprisingly - predicted low scepticism.

Next, as expected, we found that political conservatism predicted climate change scepticism.

A final note is that the explained variance was modest but reasonable. The model predicting faith in science explained the most variance (10%),  $F(8, 313) = 5.56$ ,  $p < .001$ , followed by the model predicting vaccination scepticism (8%),  $F(8, 313) = 4.35$ ,  $p < .001$ , and climate change scepticism (6%),  $F(8, 313) = 3.75$ ,  $p < .001$  (Table 3).<sup>5</sup>

## 3. General discussion

Science rejection poses a threat to public health and safety. Intriguingly, vaccine scepticism does not seem to reduce even in the face of the ongoing coronavirus pandemic (Gayle and Blackall, 2020; The Observer, 2020). In the current article, we aimed at exploring antecedents of vaccine scepticism and low faith in science. Corroborating previous work, we present evidence for the importance of spirituality in explaining vaccine rejection and low science faith beyond well-studied cultural contexts. Previous studies identified religiosity and particularly spirituality as predictors of faith in science and vaccine scepticism (McPhetres and Zuckerman, 2018; Rutjens et al., 2018a, in press; Rutjens and Van der Lee, 2020). Building upon these findings and using measures of better construct validity, we tested their generalizability in Greece. By utilizing a sample from an under-represented country, we aimed at providing a more stringent test of the robustness of the previously observed association between self-reported spirituality and science scepticism. As expected, spirituality significantly contributed to vaccine scepticism and low faith in science,

**Table 2.** Outcome and predictor variables.

Variables	Example item	Scale and reliability	Source
<b>Outcome variables</b>			
Vaccine scepticism (5 items)	I believe that vaccines have negative side effects that outweigh the benefits of vaccination for children.	1 ( <i>strongly disagree</i> )–7 ( <i>strongly agree</i> ); $\alpha = .85$	Lewandowsky et al. (2013); Rutjens et al. (2018a).
Faith in science (5 items)	Science is the most efficient means of obtaining truth.	1 ( <i>strongly disagree</i> )–7 ( <i>strongly agree</i> ); $\alpha = .74$	Farias et al. (2013); Hayes and Tariq (2000); Rutjens et al. (2018a).
Climate change scepticism (5 items)	I believe that the climate is always changing and what we are currently observing is just natural fluctuation.	1 ( <i>strongly disagree</i> )–7 ( <i>strongly agree</i> ); $\alpha = .67$	Lewandowsky et al. (2013); Rutjens et al. (2018a).
<b>Predictors</b>			
Scientific literacy (8 questions)	The centre of the earth is very hot.	True or false; scores from 0 ( <i>all responses were incorrect</i> ) to 8 ( <i>all responses were correct</i> )	Hayes and Tariq (2000); Kahan et al. (2012); Rutjens et al. (2018a).
Spirituality scale & Self-reported spirituality collapsed (14 items in total)	I meditate to gain access to my inner spirit.	1 ( <i>strongly disagree</i> )–6 ( <i>strongly agree</i> )	Delaney (2005).
	To what extent do you consider yourself to be a spiritual person? To what extent do others consider you to be a spiritual person?	1 ( <i>strongly disagree</i> )–7 ( <i>strongly agree</i> ); $\alpha = .84$	Rutjens et al. (2018a).
Religiosity (1 item)	Do you consider yourself to be a religious person?	Yes – 1 or no – 0	Rutjens et al. (2018a).
Religious orthodoxy (two items)	God has been defined for once and for all; Religion is the one thing that gives meaning to life in all its aspects.	1 ( <i>strongly disagree</i> )–7 ( <i>strongly agree</i> ); $\alpha = .75$	Rutjens et al. (2018a); Fontaine et al. (2003).
Political orientation (2 items)	What is your political orientation: (1) left vs right-wing, (2) liberal vs conservative?	1 (left-wing/very liberal)–10 (very right-wing/conservative)	Rutjens et al. (2018a).

replicating previous work. However, contrary to previous findings among US participants (McPhetres and Zuckerman, 2018; Rutjens et al., 2018a), more religious people in Greece reported lower scepticism towards vaccines. In addition, religiosity did not play a role in predicting faith in science, as it did in the United States. Overall, spirituality was the strongest predictor of low faith in science and vaccine scepticism.

Supporting recent cross-cultural work, the current findings demonstrate that spirituality is an important contributor to faith in science and vaccine scepticism across diverse countries across the globe (Rutjens et al., in press). This holds true regardless of levels of religiosity. Furthermore, on one hand, spirituality across the studied countries can be considered as a diverse set of beliefs, as

**Table 3.** Multiple linear regressions of faith in science, vaccination scepticism and climate change.

Predictors	Faith in science			Vaccine scepticism			Climate scepticism		
	$\beta$	95% CI	<i>p</i>	$\beta$	95% CI	<i>p</i>	$\beta$	95% CI	<i>p</i>
Age	-.01	-.16 to .13	.853	-.04	-.19 to .10	.584	.00	-.14 to .15	.978
Gender (men – 0, women – 1, other – 2)	-.08	-.19 to .03	.146	-.04	-.15 to .07	.472	-.10	-.21 to .01	.086
Student (yes – 1, no – 0)	<b>-.19</b>	<b>-.34 to -.05</b>	<b>.009</b>	-.01	-.15 to .14	.930	<b>-.17</b>	<b>-.32 to -.02</b>	<b>.025</b>
Conservatism (1 – liberal, 10 – conservative)	-.01	-.13 to .11	.891	.06	-.06 to .19	.301	<b>.13</b>	<b>.01 to .25</b>	<b>.039</b>
Scientific literacy (0 – low, 8 – high)	.04	-.06 to .15	.424	<b>-.13</b>	<b>-.24 to -.02</b>	<b>.022</b>	.07	-.04 to .18	.233
Spirituality (all questions)	<b>-.23</b>	<b>-.35 to -.11</b>	<b>.001</b>	<b>.27</b>	<b>.15 to .40</b>	<b>.001</b>	.03	-.09 to .16	.586
Religiosity (yes – 1, no – 0)	-.14	-.29 to .00	.053	<b>-.17</b>	<b>-.32 to -.02</b>	<b>.025</b>	-.02	-.17 to .13	.768
Religious orthodoxy	.02	-.13 to .18	.786	.08	-.08 to .23	.343	.07	-.09 to .23	.376
<i>N</i>	322			322			322		
<i>R</i> <sup>2</sup> adjusted	.10			.08			.06		
Descriptive statistics	<i>M</i> =4.46, <i>SD</i> =1.17			<i>M</i> =2.23, <i>SD</i> =.99			<i>M</i> =2.79, <i>SD</i> =.84		

CI: confidence interval; SD: standard deviation.

these beliefs are country specific (Roussou, 2018; Versteeg, 2007; for example, Greek spirituality involves some Orthodox Christian beliefs, while Dutch spirituality borrows from liberal forms of Roman Catholicism). On the other hand, Dutch and Greek forms of spirituality might be universal in the sense of being associated with Christianity overall and the absence of institutional affiliation. It is possible that such commonalities might contribute to uniform science attitudes among European spiritual groups. Nevertheless, future research needs to address measurement equivalence issues when comparing effects of beliefs and worldviews across countries.

Finally, our study also corroborates previous evidence suggesting that low scientific literacy contributes to vaccine scepticism (Rutjens et al., in press; Rutjens and Van der Lee, 2020). Furthermore, consistent with previous work (Hornsey et al., 2018; Lewandowsky et al., 2013; Rutjens et al., 2018a, in press), we found that political conservatism contributes to climate change scepticism. Altogether, the current findings support previous evidence indicating that science scepticism is heterogeneous; that is, different types of beliefs contribute to science rejection in different science domains.

#### 4. Limitations and future directions

It is important to note that the current findings are not based on a representative sample of Greek nationals. Our convenience sample consisted of a relatively large number of students (around two-thirds), and a little over two-thirds of the participants were women. However, we did aim at recruiting participants with diverse set of religious, non-religious and spiritual beliefs (see Table 1). Furthermore, our study is correlational in nature and points to associations between predictor and outcome variables. Therefore, it is possible that additional and not yet identified variables

contribute to the observed relationships between spirituality and the studied science attitudes. Future studies should explore the mechanism that drives this association (e.g. reliance on intuition; Rutjens and Van der Lee, 2020).

## 5. Conclusion

The current findings extend previous research by showing that spirituality is a unique and strong predictor of vaccine rejection and low faith in science, specifically, in a country that was not included in earlier work. This study contributes to the growing body of literature suggesting that spirituality is a belief system that shapes negative attitudes towards vaccination as well as towards science in general.

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## Supplemental material

Supplemental material for this article is available online.

## Notes

1. Source: John Hopkins Coronavirus resource centre, 23 February 2021.
2. In this article, we define scepticism as unwarranted rejection of scientific evidence and denial of scientific facts (also see Rutjens et al., in press; Rutjens and Van der Lee, 2020).
3. We also asked participants to report whether they believed in *God or a higher power* on a scale from 1 (*not at all*) to 10 (*very much*). However, we decided not to include this variable in the regression analyses, as we aimed to investigate spirituality and religiosity as separate belief systems, and the question about beliefs in God and higher power potentially relate to both religiosity and spirituality, respectively.
4. Bivariate correlations among all variables are presented in Supplemental Appendix A.
5. For exploratory purposes, we also ran multiple regressions of vaccination and climate change scepticism in which we controlled for faith in science (see Rutjens and Van der Lee, 2020). The results largely replicated the main analyses presented in Table 2. However, for vaccination scepticism, faith in science was the strongest predictor – higher faith in science predicted less scepticism about vaccination ( $\beta = -.35$ ). See Supplemental Appendix B for details.

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