Parasite Stress and Pathogen Avoidance Relate to

Distinct Dimensions of Political Ideology Across 30 Nations

Joshua M. Tybura,1, Yoel Inbarb, Lene Aarøec, Pat Barclayd, Fiona Kate Barlowe, Micheal de Barraf, D. Vaughn Beckerg, Leah Borovoih, Incheol Choii, Jong An Choij, Nathan S. Consedinek, Alan Conwayl, Jane Rebecca Conwaym, Paul Conwayn, Vera Cubela Adorico, Ekin Demircip, Ana María Fernándezq, Diogo Conque Seco Ferreirar, Keiko Ishiis, Ivana Jakšićt, Tingting Jia, Florian van Leeuwenc, David M. G. Lewiso, Norman P. Liu, Jason C. McIntyrev, Sumitava Mukherjeew, Justin Parkx, Boguslaw Pawlowskiy, Michael Bang Petersenc, David Pizarroz, Gerasimos Prodromitisaa, Pavol Prokopbb,cc, Markus J. Rantaladd, Lisa M. Reynoldsk, Bonifacio Sandinee, Baris Sevip, Delphine de Smetff, Narayanan Srinivasangg, Shruti Tewarigg, Cameron Wilsond, Jose C. Youngu, Iris Žeželjhh

1. Department of Experimental and Applied Psychology, VU Amsterdam, Amsterdam 1081BT, The Netherlands.
2. Department of Psychology, University of Toronto, Toronto, Ontario, M1C 1A4, Canada.
3. Department of Political Science, Aarhus University, Aarhus 8000C , Denmark.
4. Department of Psychology, University of Guelph, Guelph, Ontario, N1G 2W1, Canada.
5. School of Applied Psychology, Griffith University, Nathan 4122, Australia.
6. Institute of Applied Health Sciences, College of Life Sciences and Medicine, University of Aberdeen, Aberdeen AB25 2ZD, United Kingdom.
7. Human Systems Engineering, Arizona State University, Mesa, AZ 85212.
8. Department of Education and Psychology, The Open University of Israel, Tel Aviv, Israel.
9. Department of Psychology, Seoul National University, Seoul 08826, South Korea.
10. Center for Happiness Studies, Seoul National University, Seoul 08826, South Korea.
11. Faculty of Medical and Health Sciences, The University of Auckland, Auckland 92019 , New Zealand.
12. School of Politics and International Relations, University College Dublin, Dublin 4, Ireland.
13. Institute of Psychiatry, Psychology & Neuroscience, King’s College London, London SE5 8AF, United Kingdom.
14. Department of Psychology, Florida State University, Tallahassee, Florida, 32304.
15. Department of Psychology, University of Zadar, 23000 Zadar, Croatia.
16. Department of Psychology, Bilkent University, 06800 Bilkent, Ankarak, Turkey
17. Department of Psychology, Universidad de Santiago de Chile, Santiago, Chile.
18. Department of Psychology, Universidade Federal de Sergipe, 49100-000 Sergipe, Brazil.
19. Department of Psychology, Kobe University, Kobe 657-8501, Japan.
20. Institute for Educational Research, Belgrade University, 11000, Belgrade, Serbia.
21. School of Social Sciences, Singapore Management University, Singapore 178903.
22. Institute of Psychology, Health and Society, University of Liverpool, Liverpool L3 5DA, United Kingdom.
23. Indian Institute of Management, Ahmedabad, Gujarat 380015, India.
24. School of Experimental Psychology, University of Bristol, Bristol BS8 1TH, United Kingdom.
25. Department of Human Biology, University of Wroclaw, Wroclaw 50-138, Poland
26. Department of Psychology, Cornell University, Ithaca, NY, 14853.
27. Department of Psychology, Panteion University of Social and Political Sciences, 176 71, Athens, Greece.
28. Department of Biology, Trnava University, 918 43 Trnava, Slovakia
29. Institute of Zoology, Slovak Academy of Sciences, 845 06 Bratislava, Slovakia
30. Department of Biology & Turku Brain and Mind Center University of Turku, 20014 Turku, Finland.
31. Facultad de Psicología, Universidad Nacional de Educación a Distancia, 28040 Madrid, Spain.
32. Department of Interdisciplinary Study of Law, Private Law, and Business Law, Ghent University, B-9000 Ghent, Belgium.
33. Centre of Behavioural & Cognitive Sciences, University of Allahabad, Allahabad, Allahabad 211002, Uttar Pradesh, India.
34. Faculty of Philosophy, Belgrade University, 11000 Belgrade, Serbia.
35. To whom correspondence should be addressed. Email: j.m.tybur@vu.nl

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**Abstract**

People who are more avoidant of pathogens are more politically conservative, and nations with greater parasite stress are characterized by greater ideological conservatism. In the current research, we test two prominent explanations for the relationships between pathogens and politics. The first, which we call the *outgroup-avoidance* account, holds that relationships between pathogen avoidance and ideology are based on motivations to avoid contact with outgroups (who might pose greater infectious disease threats than ingroup members). The second, which we call the *traditional norms* account, holds that these relationships are based on motivations to adhere to local traditional norms, which can evolve culturally to mitigate against pathogen threats. Results from a study surveying 11,538 participants across 30 nations were more consistent with the traditional norms account than with the outgroup avoidance account. National parasite stress related to traditionalism (an aspect of ideology especially related to adherence to group norms) but not to social dominance orientation (an aspect of conservatism especially related to prejudices toward ethnic and racial outgroups and to endorsements of intergroup barriers). Further, individual differences in pathogen-avoidance motives (i.e., disgust sensitivity) related more strongly to traditionalism than to social dominance orientation within the 30 nations.

**Significance Statement**

Pathogens—and behavioral strategies for neutralizing them—affect myriad aspects of human behavior. Recent findings suggests that some of these effects shape political attitudes, with more ideologically conservative individuals reporting more disgust toward pathogen cues, and with higher parasite stress nations being, on average, more conservative. However, no research has yet adjudicated between two theoretical accounts proposed to explain the relationship between pathogens and politics. We find that national parasite stress and individual disgust sensitivity relate more strongly to adherence to traditional norms than to support for barriers between social groups. These results suggest that pathogens affect political attitudes mainly via motivations to support traditional norms rather than motivations to erect and maintain barriers against outgroups.

The costs imposed by pathogens on their hosts have spurred the evolution of complex anti-pathogen defenses, many of which are behavioral (1, 2). In humans, such defenses range from proximate avoidance of pathogen cues to complex rituals, often with far-reaching consequences (3). At the individual level, functionally specialized psychological mechanisms detect pathogen cues and motivate avoidance of physical contact with pathogens (e.g., via the emotion of disgust; 4). These mechanisms—which have been collectively referred to as the *behavioral immune system*—influence, among other things, mate preferences (5, 6), dietary preferences (7), and person perception (8) (see 9, for a summary). At the cultural level, many rules and rituals might function to mitigate infection risk, including norms dictating the use of one hand in ablutions (and little else), rules concerning coughing and sneezing, and food-related taboos and rituals (e.g., 10, 11).

Some of the most provocative findings in the behavioral immune system literature suggest that pathogens—and human pathogen-avoidance motives—influence our political attitudes. At the individual level, the degree to which individuals are disgusted by pathogen cues and wary of infection-risky situations relates to a number of politically relevant variables, including political party preference, openness to experience, and collectivism (see 12, for a summary). At the group level, nations with greater infectious disease burdens (i.e., parasite stress) are more religious, more collectivistic, and less open to experience (13-15)—all hallmarks of conservative ideology. Two distinct hypotheses have been forwarded to explain these empirical patterns (13). The first—which we refer to as the *outgroup-avoidance* account—is based on the assumption that individuals develop greater resistance to locally-prevalent pathogens (14). According to this account, contact with outgroup members (who carry pathogens that individuals putatively have less immunity against) is more likely to result in infection than is contact with ingroup members (who carry pathogens that individuals have putatively acquired immunity against). Hence, this account suggests that individuals more invested in avoiding pathogens favor ideological positions that minimize intergroup contact. The second hypothesis—which we refer to as the *traditional norms* account*—*is based on the assumption that local rules and rituals (e.g., how foods are prepared and stored, which meats are acceptable, which hand one eats with) evolve culturally to neutralize local pathogen threats. According to this account, departures from traditional norms puts individuals at a greater risk of infection, so individuals who are more invested in avoiding pathogens favor ideological positions that encourage adherence to traditional values (11, 16, 17).

Which of these two hypotheses better explains the relationship between the behavioral immune system and ideology? Given that ideological conservatism is characterized both by stronger preferences for ethnic, racial, and national ingroups (vs. outgroups) and by greater adherence to traditional cultural norms (18), existing data have been interpreted as supporting both hypotheses. That said, no work has yet aimed to generate and test competing predictions derived from these two hypotheses. We aim to fill this gap here. To do so, we depart from standard practice in this area, which has interpreted several different constructs as reflecting a single dimension of ideology. For example, a recent meta-analysis of the relationship between the behavioral immune system and ideology treated right-wing authoritarianism, collectivism, religiosity, and social dominance orientation as interchangeable manifestations of social conservatism (12). In the current investigation, we consider how outgroup-avoidance and norm adherence accounts can be used to make distinct predictions regarding the relationship between the behavioral immune system and two distinct dimensions of ideology: social dominance orientation and traditionalism.

*Dimension-specific relationships between pathogens and ideology*

Political psychologists suggest that ideology can be broadly categorized along two dimensions (18, 19): (1) favoring adherence to versus departures from social traditions (often operationalized as right wing authoritarianism and, specifically, the traditionalism facet of right wing authoritarianism; 20), and (2) favoring versus rejecting (hierarchical) boundaries between groups (often operationalized as social dominance orientation; 21).

Although traditionalism and social dominance orientation (SDO) are generally positively correlated, they relate distinctly to both social values and intergroup attitudes (22-24). Whereas traditionalism relates strongly to religiosity (20)—a key variable in the behavioral immune system and ideology literature—SDO relates only weakly to conformity and adherence to religious orthodoxy (25, 26). Moreover, although both SDO and traditionalism relate to prejudices, they relate to prejudices toward different types of groups. Relative to SDO, traditionalism especially relates to prejudice toward the types of individuals who violate traditional social norms, including prostitutes, atheists, homosexuals, and drug users (27). In contrast, SDO especially relates to prejudice toward individuals possessing cues to different ecological origin (e.g., skin color), including White Americans’ prejudice toward Blacks (28) and New Zealanders’ prejudice toward Africans, Asians, and Maori (26, 27). Reactions to immigrants further highlight differences between SDO and traditionalism. Whereas traditionalism is associated with prejudice specifically toward immigrants that fail to adopt local cultures rules and rituals, SDO is associated with prejudice specifically toward immigrants who assimilate and, hence, increase contact between groups (29).

The traditional norms hypothesis, then, implies that pathogen-avoidance motives should relate to traditionalism, but not necessarily SDO. The outgroup-avoidance hypothesis implies a different prediction. Because SDO relates more strongly to prejudice toward individuals from foreign ecologies (e.g., immigrants, individuals from a different ethnic background), whereas traditionalism relates more strongly to prejudice toward non-traditional subgroups within a common ecology (e.g., homosexuals, atheists) (26, 27, 29), the outgroup-avoidance hypothesis implies that pathogen-avoidance motives should relate to SDO, but not necessarily to traditionalism.

*Testing competing behavioral immune system hypotheses within and across nations*

Although results at individual and societal levels have been interpreted as providing converging evidence for behavioral immune system hypotheses of ideology, they differ in two important ways, each of which has implications for the competing hypotheses described above. First, almost all studies reporting individual-level relationships between the behavioral immune system and ideology have been conducted using North American samples. For example, 23 of the 24 studies considered in a recent meta-analysis of the relationship between the pathogen-avoidance motives and social conservatism used American or Canadian samples (12). In contrast, studies at the societal level have necessarily tested the relationship between parasite stress and ideology across groups, such as nations or states. Second, whereas individual-level studies have used self-report instruments to assess pathogen-avoidance motives, cross-cultural studies have used national parasite stress estimates, with the assumption that greater ecological parasite stress leads to stronger individual-level motivations to avoid pathogens (30, 31). For example, in describing the potential relationship between variables measured at the individual level (i.e., pathogen-avoidance motives) and societal level (i.e., parasite), Fincher and Thornhill (14) argue, “Our approach suggests that the relationship between infectious disease and religiosity will be mediated…by disgust and contamination sensitivity” (page 78).

No research has yet tested (1) whether the relationship between individual-level pathogen-avoidance motives and conservatism found in North America replicates across cultures; (2) whether individuals in higher parasite stress nations are more motivated to avoid pathogens (e.g., they are more disgust sensitive); and (3) whether individual-level pathogen-avoidance motives mediate any relationship between country-level parasite stress and SDO, traditionalism, or both. The current research aims to address these lacunas by measuring (pathogen) disgust sensitivity, SDO, and traditionalism across a number of nations, which vary in parasite stress. In doing so, we test competing predictions made by the two behavioral immune system hypotheses of ideology described above, and we do so at both the national level and the individual level. We then use the same data set to test the common assumption that higher nation-level parasite stress burden at the country level is associated with stronger pathogen avoidance-motives at the individual level. In total, we report results using a sample of 11,538 individuals from 30 nations (see Table 1 for details).

Results

*Traditionalism*

The norm adherence hypothesis predicts a relationship between traditionalism and pathogen-avoidance motives. Results at both the individual and nation levels were consistent with these accounts. Individuals in nations with greater parasite stress were more traditional, *t*(26.31) = 3.93, *p* < .001 (see Figure 1). To illustrate, nations’ average traditionalism scores correlated strongly with their parasite stress, *r* = .70, *p* < .001. Notably, these results are similar to those reported in previous analyses of the relationship between parasite stress and archival estimates of collectivism across 52 and 70 nations, which yielded correlations of *r* = .73 and *r* = .63, respectively (13). *Within* nations, disgust sensitivity also related to traditionalism, *t*(25.16) = 8.42, *p* < .001, independent of national parasite stress. A random effects meta-analysis revealed the correlation between disgust sensitivity and traditionalism to be *r* = .10, 95% CI [.07, .12]. Analyses on correlations disattenuated for unreliability yielded similar results, *r* = .14, 95% CI [.10, .18].

*Social Dominance Orientation*

The outgroup-avoidance account predicts a relationship between SDO and pathogen-avoidance motives. Results were not consistent with this prediction at the nation level, with individuals in higher parasite stress nations scoring no higher on SDO, *t*(24.03) = 0.52, *p* > .25 (see Figure 2). Indeed, the correlation between national parasite stress and SDO was in the opposite direction of that predicted by the outgroup-avoidance hypothesis, *r* = -.06, *p* > .25. Within nations, disgust sensitivity was indeed related to SDO, *t*(22.13) = 6.50, *p* < .001. However, the random effects meta-analysis indicated that the correlation between disgust sensitivity and SDO was small and close to zero, *r* = .04, 95% CI [.02, .06]. Analyses on disattenuated correlations yielded similar results, *r* = .06, 95% CI [.03, .10]. Notably, these 95% confidence intervals did not overlap with those for the relationship between disgust sensitivity and traditionalism.

*Cross-National Variability in Disgust Sensitivity*

Although we observed variation in disgust sensitivity across nations, τ00 = .09, χ2(1) = 80.11, p < .001, this variability was unrelated to parasite stress, *t*(24.98) = 1.13, *p* > .25. That said, results did suggest that the disgust sensitivity instrument had similar validity across samples. In addition to observing a relationship between disgust sensitivity and traditionalism across nations, we also replicated previously reported sex differences in disgust sensitivity (32, 33), with women consistently scoring higher than men across nations, *t*(21.02) = 16.44, *p* <.001, meta-analyzed *d* = .41, 95% CI [.36, .45].

Discussion

Several lines of evidence point to a relationship between pathogens and politics (9, 12). Here, we aimed to clarify the nature of this relationship by generating competing predictions using two behavioral immune system hypotheses of conservatism. The traditional norms account predicts that pathogen-avoidance motives should relate to traditionalism, which, relative to SDO, relates to endorsements of traditional norms and prejudice toward within-group deviants. In contrast, the outgroup-avoidance account predicts that pathogen-avoidance motives should relate to SDO, which, relative to traditionalism, more directly relates to endorsements of barriers between groups and prejudice toward ethnic outgroups. Results supported the traditional norms account over the outgroup-avoidance account. National parasite stress was related to traditionalism, but it was unrelated to SDO. Furthermore, a meta-analysis of individual-level relationships within the 30 sampled nations revealed that disgust sensitivity relates more strongly to traditionalism than to SDO. Indeed, whereas the traditionalism-disgust sensitivity relationship was of a magnitude similar to that observed in a large recent study in the U.S. (34), the SDO-disgust sensitivity relationship, while statistically significant, was near zero.

Results also helped to clarify the relationship between national parasite stress and individual pathogen-avoidance motives. We found no support for the notion that individuals living in more pathogen-dense countries are more disgust sensitive. This null result can be understood by considering both the benefits and the costs of investing in pathogen avoidance. Although greater disgust sensitivity steers individuals away from cues to pathogens, it also constrains the dietary, sexual, and social contact opportunities (4, 35). If pathogens are ubiquitous enough that investments in avoidance do not decrease infection—at least not enough to offset the benefits of behaviors that pose some infection risk—then individuals in pathogen rich ecologies could invest more effort in resisting pathogens (e.g., through greater production of pathogen-combating cytokines; see 36) rather than avoiding them. Of course, our parasite stress data—like most used in this literature (e.g., 14)—was measured at the country level, and we cannot rule out the possibility that individual disgust sensitivity is calibrated by individual history of infection. However, these findings corroborate previous results indicating that childhood illness in a pathogen rich location (Bangladesh) is unrelated to disgust sensitivity in adulthood (37).

The fact that disgust sensitivity is unrelated to national parasite stress suggests that different processes might account for relationships between ideology and national parasite stress versus ideology and disgust sensitivity. At the national level, norms dictating adherence to traditional rules and rituals might replicate better in pathogen rich ecologies, or more progressive rules and rituals might have been imported to lower parasite stress nations during European colonialism, if such nations were more hospitable locations for Western institutions and infrastructure (38). At the individual level, those who are more motivated to avoid pathogens might find traditional rules and rituals more appealing. Just as we have attempted to clarify why the behavioral immune system might relate to political ideology—either based on outgroup avoidance or norm adherence—future work can clarify which aspects of traditionalism—including sexual monogamy (34, 39) versus general conformity (16) versus coalitional support in the event of illness (40) versus food preparation (7, 10)—might be especially appealing to those individuals motivated to avoid pathogens.

Method

*Participants*

We recruited participants in 30 countries (see Table 1). We aimed to enroll at least 200 participants in each country and to recruit participants from both universities and the general-population. After excluding participants who (a) reported being less than 18 years old, (b) did not report their sex, or (c) had completely missing data for any of the instruments described below, our final sample consisted of 11,538 participants, who were 42% male and had a mean age of 30.06 years (SD = 12.61).

*Measures*

Participants completed a short questionnaire described as concerning “attitudes toward political issues and groups of people.” In all but one country (Sweden, where English fluency is high), questionnaires were translated into the official or native language, with multiple languages offered in multilingual countries (see Table 1 for language details). The questionnaire contained measures of SDO, traditionalism, and disgust sensitivity. It also included items peripherally related to this paper, including sex, age, religious attendance, endorsement of policy issues (e.g., Should society increase its use of nuclear power?), and attitudes toward different groups of people. We focus only on SDO, traditionalism, and disgust sensitivity here, but all items are available in the online Supplemental Materials.

*Social dominance orientation.*

The four-item Short Social Dominance Orientation was used to assess social dominance orientation (41). The instrument has been used in at least one previous cross-cultural study, where it consistently (negatively) related to desires to protect ethnic and religious minorities across cultures. Example items include “In setting priorities, we must consider all groups” (reverse coded) and “Superior groups should dominate inferior groups.” Responses were recorded on a 0 (Extremely Oppose) to 6 (Extremely Favor) scale.

*Traditionalism.*

We assessed traditionalism using the six-item short form of the traditionalism facet of the Authoritarianism-Conservatism-Traditionalism scale (20). This instrument relates strongly to religiosity and other manifestations of traditional values. Example items include “The ‘old fashioned ways’ and ‘old fashioned values’ still show the best way to live” and “This country will flourish if young people stop experimenting with drugs, alcohol, and sex, and pay more attention to family values.” Responses were recorded on a 0 (Strongly Disagree) to 6 (Strongly Agree) scale.

*Disgust sensitivity.*

Most research in the behavioral immune system literature has operationalized pathogen-avoidance motives using self-report measures of disgust sensitivity or contamination sensitivity (31). We used the seven-item pathogen factor of the Three Domain Disgust Scale (42) for the current investigation, for two reasons: (1) its item content appears more interpretable to individuals from diverse cultures relative to other instruments, and (2) it is less confounded with sexual conservatism and neuroticism than other disgust sensitivity instruments (34, 43). Participants reported how disgusting they find each of six items on a 0 (not at all disgusting) to 6 (extremely disgusting) scale. Example items include “Stepping on dog poop” and “Sitting next to someone who has red sores on their arm.”

*Parasite stress*

Researchers have used several different indices to estimate parasite stress (31), the most widely two being the historical prevalence of pathogens within regions (44) and contemporary frequency of nonzoonotic parasites within regions (14). These two estimates were strongly correlated for the 30 nations sampled here, *r* = .75. We opted to use the historical prevalence estimates because they were less strongly skewed, with nation-level results less strongly influenced by the higher parasite stress nations sampled here (e.g., India, Brazil). No conclusions changed when using the nonzoonotic disease estimates, nor when we used alternative parasite stress estimates (zoonotic parasites and contemporary infectious disease deaths; see Supplementary Materials for details and results). To facilitate visual interpretation of results (Figures 1-3), we added a constant to each nation’s parasite stress score so that the lowest scoring country (Canada) had a score of zero.

*Analytical strategy*

Data were analyzed in SPSS version 23 using random slope, random intercept linear mixed modeling with Restricted Maximum Likelihood Estimation (REML) criteria. Participants (level-1 units) were nested within nations (level-2 units). Given that our samples varied in their sex ratio and mean age, we controlled for participant sex and age. We used disgust sensitivity as a level-1 predictor to test for effects of individual pathogen-avoidance motivations on SDO and traditionalism. We used parasite stress as a level-2 variable to test for effects of parasite stress on SDO, traditionalism, and pathogen-avoidance motivations. We allowed the effects of each level-1 variable to vary across level-2. Our analyses can thus be described as follows, where *Yij*refers to social traditionalism and inequality tolerance scores for individuals (i) within nations (j):

Level 1: *Yij* = β0*j* + β1*j*DISGUST*j* + *β2j*SEX*j* + *β3j*AGE*j* + *rij*

Level 2: β0*j* = γ00+ γ01PARASITE+ *u0j*; β1*j* = γ10+ *u*1j; β2*j* = γ20+ *u*2*j*; β3*j* = γ30+ *u*3*j*

We also tested whether disgust sensitivity (*Yij* below) varied across nations as a function of parasite stress, with the following model.

Level 1: *Yij* = β0*j* + *β1j*SEX*j* + *β2j*AGE*j* + *rij*

Level 2: β0*j* = γ00+ γ01PARASITE+ *u0j*; β1*j* = γ10+ *u*1j; β2*j* = γ20+ *u*2*j*

After multi-level analyses, we also meta-analyzed the level-1 effects using Comprehensive Meta-Analysis software. This strategy allows for a point estimate of the effect size of the relationship between disgust sensitivity and the two dimensions of ideology, as well as 95% confidence intervals for those relationships. Each country was treated as a different sample. For both traditionalism and SDO, we conducted two meta-analyses of the relationship with disgust sensitivity. The first involved meta-analyzing the observed effect size within each country; the second involved meta-analyzing the effect size after disattenuating for the country-specific unreliability in disgust sensitivity, traditionalism, and SDO.

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**Table 1**. Survey language(s), proportion male, mean age, and bivariate correlations for samples in each nation surveyed. T = traditionalism, DS = disgust sensitivity, and SDO = social dominance orientation. *r*' statistics are disattenuated for unreliability. The bottom row includes meta-analyzed correlations and 95% confidence intervals.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Language(s) | N | % Male | Age | *r*T\_DS | *r*'T\_DS | *r*SDO\_DS | *r’*SDO\_DS |
| Argentina (AR) | Spanish | 828 | 64 | 34 | .13 | .20 | .08 | .11 |
| Australia (AU) | English | 303 | 48 | 31 | .05 | .07 | .05 | .06 |
| Belgium (BE) | Dutch | 448 | 46 | 23 | .07 | .10 | .04 | .06 |
| Bosnia & Herzegovina (BA) | Bosnian and Croatian | 326 | 30 | 28 | .12 | .15 | .05 | .07 |
| Brazil (BR) | Portuguese | 289 | 46 | 23 | .03 | .04 | -.01 | -.01 |
| Canada (CA) | English | 310 | 42 | 35 | .03 | .04 | -.16 | -.22 |
| Chile (CL) | Spanish | 263 | 49 | 28 | .03 | .04 | -.01 | -.01 |
| China (CN) | Simplified Chinese | 377 | 10 | 21 | .12 | .22 | .12 | .20 |
| Croatia (HR) | Croatian | 554 | 23 | 30 | .08 | .11 | -.03 | -.04 |
| Denmark (DK) | Danish | 126 | 40 | 24 | .05 | .08 | -.02 | -.02 |
| Finland (FI) | Finnish | 190 | 42 | 41 | .33 | .45 | .05 | .08 |
| France (FR) | French | 269 | 29 | 23 | .09 | .12 | .15 | .21 |
| Germany (DE) | German | 375 | 47 | 32 | .12 | .17 | .05 | .08 |
| Greece (GR) | Greek | 318 | 27 | 32 | .10 | .15 | .08 | .11 |
| India (IN) | Hindi and English | 507 | 57 | 23 | .02 | .03 | .08 | .14 |
| Ireland (IE) | English | 151 | 52 | 32 | .09 | .12 | .16 | .22 |
| Israel (IL) | Hebrew | 339 | 38 | 34 | .22 | .27 | .03 | .04 |
| Japan (JP) | Japanese | 398 | 53 | 32 | .11 | .17 | -.04 | -.06 |
| Netherlands (NL) | Dutch | 574 | 42 | 35 | .15 | .22 | .02 | .02 |
| New Zealand (NZ) | English | 596 | 27 | 29 | .11 | .15 | -.06 | -.09 |
| Poland (PL) | Polish | 213 | 31 | 28 | -.09 | -.12 | -.05 | -.09 |
| Serbia (RS) | Serbian | 411 | 31 | 29 | .11 | .14 | .06 | .08 |
| Singapore (SG) | English | 239 | 48 | 25 | .06 | .08 | .03 | .04 |
| Slovakia (SK) | Slovak | 338 | 33 | 32 | .12 | .16 | .02 | .03 |
| Republic of Korea (KR) | Korean | 137 | 42 | 21 | -.05 | -.07 | .08 | .12 |
| Spain (ES) | Spanish | 699 | 33 | 33 | -.01 | -.02 | .00 | .00 |
| Sweden (SE) | English | 117 | 45 | 30 | .37 | .52 | .30 | .41 |
| Turkey (TR) | Turkish | 1082 | 50 | 34 | .12 | .15 | .03 | .06 |
| United Kingdom (UK) | English | 278 | 27 | 28 | .18 | .25 | -.05 | -.07 |
| United State (US) | English | 483 | 62 | 30 | .11 | .13 | .07 | .09 |
| Total |  | 11,538 | 42 | 30 | .10 [.07-.12] | .14 [.10-.18] | .04 [.02-.06] | .06 [.03-.10] |

Figure legends

Fig. 1. The scatterplot displays the relationship between national parasite stress and traditionalism (*r* = .70). Each data point represents the mean traditionalism for a nation (with data points labeled with two letter country codes), controlling for sample demographic characteristics (age and sex).

Fig. 2. The scatterplot displays the relationship between national parasite stress and social dominance orientation (*r* = -.06). Each data point represents the mean traditionalism for a nation (with data points labeled with two letter country codes), controlling for sample demographic characteristics (age and sex).

Fig 3. The scatterplot displays the relationship between national parasite stress and disgust sensitivity (*r* = .18). Each data point represents the mean traditionalism for a nation (with data points labeled with two letter country codes), controlling for sample demographic characteristics (age and sex).

**Figure 1**

**Figure 2**

**Figure 3**