Parasite stress and pathogen avoidance relate to distinct dimensions of political ideology across 30 nations

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People who are more avoidant of pathogens are more politically conservative, as are nations with greater parasite stress. In the current research, we test two prominent hypotheses that have been proposed as explanations for these relationships. The first, which is an intergroup account, holds that these relationships between pathogens and politics are based on motivations to adhere to local norms, which are sometimes shaped by cultural evolution to have pathogen-neutralizing properties. The second, which is an intergroup account, holds that these same relationships are based on motivations to avoid contact with outgroups, who might pose greater infectious disease threats than ingroup members. Results from a study surveying 11,501 participants across 30 nations are more consistent with the intergroup account than with the intergroup account. National parasite stress relates to traditionalism (an aspect of conservatism especially related to adherence to group norms) but not to social dominance orientation (SDO; an aspect of conservatism especially related to endorments of intergroup barriers and negativity toward ethnic and racial outgroups). Further, individual differences in pathogen-avoidance motives (i.e., disgust sensitivity) relate more strongly to traditionalism than to SDO within the 30 nations.

The costs imposed by pathogens on their hosts have spurred the evolution of complex antipathogen defenses, many of which are behavioral (1, 2). In humans, such defenses range from the proximate avoidance of pathogen cues to the execution of 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) (summarized in political ideology | pathogens | disgust | culture | evolutionary psychology

Significance

Pathogens, and antipathogen behavioral strategies, affect myriad aspects of human behavior. Recent findings suggest that antipathogen strategies relate to 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 these relationships between pathogens and politics. We find that national parasite stress and individual disgust sensitivity relate more strongly to adherence to traditional norms than they relate to support for barriers between social groups. These results suggest that the relationship between pathogens and politics reflects intragroup motivations more than intergroup motivations.


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risk of infection, so Tybur et al. (p. 78) prejudiced toward Africans, Asians, and (24). The first (intragroup) dimension is characterized by favoring virtualized as relating more to intragroup attitudes and the other of categorized along two dimensions (22, 23), one of which is conceptualized as providing converging evidence for behavioral immune system hypotheses of ideology, they differ in two important ways, each of which has implications for the 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 individual differences in pathogen-avoidance motives and social conservatism used US or Canadian samples (12). In contrast, studies at the societal level have necessarily tested group-level relationships between parasite stress and ideology across 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 (35, 36). For example, in describing the potential relationship between variables measured at the individual level (e.g., disgust sensitivity) and societal level (i.e., parasite stress), Fincher and Thornhill (14) argue, “Our approach suggests that the relationship between infectious disease and religiosity will be mediated... by disgust and contamination sensitivity” (p. 78).

No research has yet tested (i) whether the individual-level relationships between pathogen-avoidance motives and dimensions of ideology (including traditionalism and SDO) found in North America samples replicate across cultures; (ii) whether individuals adherence to versus departures from social traditions [frequently operationalized as right wing authoritarianism and, specifically, the traditionalism facet of right wing authoritarianism (25)]. The second (intergroup) dimension is characterized by favoring versus rejecting (hierarchical) boundaries between groups [frequently operationalized as SDO (26)].

Although traditionalism and SDO are generally positively correlated, they relate differently to social values (27-29). Whereas traditionalism relates strongly to religiosity (25), a key variable in the behavioral immune system and ideology literature, SDO relates only weakly to conformity and adherence to religious orthodoxy (30, 31). Moreover, although both traditionalism and SDO relate to prejudices, they relate to prejudices toward different targets. 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 (32). 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 (33) and New Zealanders’ prejudice toward Africans, Asians, and Maori (31, 32). Reactions to immigrants (i.e., outgroup members hailing from foreign ecologies) can further highlight differences between SDO and traditionalism. Traditionalism relates to anti-immigrant sentiments when immigrants are pictured as failing to adopt local cultures rules and rituals; in contrast, SDO relates to antimmigrant sentiment when immigrants are pictured as assimilating and, hence, increasing contact between groups (34).

Given the above considerations, the intragroup (traditional norms) hypothesis implies that pathogen-avoidance motives should relate to traditionalism, but not necessarily SDO. The intergroup (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 nontraditional subgroups within a common ecology (e.g., homosexuals, atheists) (31, 32, 34), 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 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 individual differences in pathogen-avoidance motives and social conservatism used US or Canadian samples (12). In contrast, studies at the societal level have necessarily tested group-level relationships between parasite stress and ideology across 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 (35, 36). For example, in describing the potential relationship between variables measured at the individual level (e.g., disgust sensitivity) and societal level (i.e., parasite stress), Fincher and Thornhill (14) argue, “Our approach suggests that the relationship between infectious disease and religiosity will be mediated... by disgust and contamination sensitivity” (p. 78).

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in higher parasite stress nations indeed score higher on instruments designed to measure pathogen-avoidance motives (e.g., disgust sensitivity); and (iii) whether individual-level pathogen-avoidance motives mediate any relationship between country-level parasite stress and traditionalism, SDO, or both. The current research aims to address these questions by measuring traditionalism, SDO, and (pathogen) disgust sensitivity across a number of nations that vary in parasite stress. In doing so, we test competing predictions made by the two behavioral immune system hypotheses of ideology provided in Table 1).

### Results

#### Traditionalism.

The intragroup, traditional norms hypothesis predicts a relationship between traditionalism and pathogen-avoidance motives. Results at both the individual and national levels were consistent with this account. Individuals in nations with greater parasite stress were more traditional \( r(26.54) = 4.16, P < 0.001; \) Fig. 1]; to illustrate, nations’ average traditionalism scores correlated strongly with parasite stress \( r = 0.70, P < 0.001 \). Notably, these results are similar to the results reported in previous analyses of the relationship between parasite stress and archival estimates of collectivism across 52 and 70 nations, which yielded correlations of \( r = 0.73 \) and \( r = 0.63 \), respectively (13). Within nations, disgust sensitivity also related to traditionalism \( r(25.97) = 8.46, P < 0.001 \), independent of national parasite stress. A random effects meta-analysis showed the correlation between disgust sensitivity and traditionalism to be \( r = 0.10 \) [95% CI (0.07, 0.12)]. Analyses on correlations disattenuated for unreliability yielded similar results \( r = 0.14, 95\% \) CI (0.10, 0.18)].

![Fig. 1. The scatterplot displays the relationship between national parasite stress and traditionalism \( r = 0.70 \). Each data point (labeled with a two-letter country code (abbreviations defined in Table 1)) represents a nation’s mean traditionalism, controlling for sample demographic characteristics (age and sex).](image-url)

### Table 1. Survey language(s), percentage male, mean age in years, and bivariate correlations for samples in each nation surveyed

<table>
<thead>
<tr>
<th>Country</th>
<th>Language(s)</th>
<th>n</th>
<th>Male</th>
<th>Age</th>
<th>( r_{T,DS} )</th>
<th>( r_{T,DS} )</th>
<th>( r_{SDO,DS} )</th>
<th>( r_{SDO,DS} )</th>
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<tbody>
<tr>
<td>Argentina (AR)</td>
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<td>827</td>
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<td>0.20</td>
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<td>0.11</td>
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<td>0.07</td>
<td>0.05</td>
<td>0.06</td>
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<tr>
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<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
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<td>Bosnian and Croatian</td>
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<td>0.12</td>
<td>0.15</td>
<td>0.05</td>
<td>0.07</td>
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<td>Brazil (BR)</td>
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<td>0.04</td>
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<td>-0.01</td>
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<td>-0.01</td>
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<tr>
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<td>0.12</td>
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<td>0.11</td>
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<td>-0.04</td>
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<tr>
<td>Denmark (DK)</td>
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<td>24</td>
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<td>0.08</td>
<td>-0.02</td>
<td>-0.02</td>
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<tr>
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<td>41</td>
<td>0.33</td>
<td>0.45</td>
<td>0.05</td>
<td>0.08</td>
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<tr>
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<td>23</td>
<td>0.09</td>
<td>0.12</td>
<td>0.15</td>
<td>0.21</td>
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<tr>
<td>Germany (DE)</td>
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<td>374</td>
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<td>32</td>
<td>0.12</td>
<td>0.17</td>
<td>0.05</td>
<td>0.08</td>
</tr>
<tr>
<td>Greece (GR)</td>
<td>Greek</td>
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<td>27</td>
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<td>0.15</td>
<td>0.08</td>
<td>0.11</td>
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<tr>
<td>India (IN)</td>
<td>Hindi and English</td>
<td>504</td>
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<td>23</td>
<td>0.02</td>
<td>0.03</td>
<td>0.08</td>
<td>0.14</td>
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<tr>
<td>Ireland (IE)</td>
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<td>32</td>
<td>0.09</td>
<td>0.12</td>
<td>0.17</td>
<td>0.23</td>
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<tr>
<td>Japan (JP)</td>
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<td>38</td>
<td>34</td>
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<td>0.27</td>
<td>0.03</td>
<td>0.04</td>
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<tr>
<td>Netherlands (NL)</td>
<td>Dutch</td>
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<td>42</td>
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<td>0.15</td>
<td>0.22</td>
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<tr>
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<td>-0.09</td>
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<tr>
<td>Poland (PL)</td>
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<td>28</td>
<td>-0.09</td>
<td>-0.12</td>
<td>-0.05</td>
<td>-0.09</td>
</tr>
<tr>
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<td>0.11</td>
<td>0.14</td>
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<tr>
<td>Singapore (SG)</td>
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<td>25</td>
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<td>0.08</td>
<td>0.03</td>
<td>0.04</td>
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<tr>
<td>Slovakia (SK)</td>
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<td>32</td>
<td>0.12</td>
<td>0.16</td>
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<td>0.03</td>
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<tr>
<td>Republic of Korea (KR)</td>
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<td>0.12</td>
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<td>0.00</td>
<td>0.00</td>
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<tr>
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<td>0.37</td>
<td>0.52</td>
<td>0.30</td>
<td>0.41</td>
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<tr>
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<td>50</td>
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<td>0.06</td>
</tr>
<tr>
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<td>0.18</td>
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<td>-0.07</td>
</tr>
<tr>
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<td>0.11</td>
<td>0.13</td>
<td>0.07</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Total: 11,501 42 30 0.10 (0.07–0.12) 0.14 (0.10–0.18) 0.04 (0.02–0.06) 0.06 (0.03–0.10)

The \( r \) statistics are disattenuated for unreliability. The total (bottom row) includes meta-analyzed correlations and 95% CIs. DS, disgust sensitivity; SDO, social dominance orientation; T, traditionalism.
The intergroup, 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 ($t(25.19) = 0.12, P = 0.91$; Fig. 2), and with the correlation between national parasite stress and SDO close to zero (and directionally opposite to predictions) ($r = -0.06, P = 0.75$). Within nations, disgust sensitivity was indeed related to SDO ($t(23.57) = 6.52, P < 0.001$). However, the random effects meta-analysis indicated that the correlation between disgust sensitivity and SDO was close to zero ($r = 0.04, 95\% \text{ CI } (0.02, 0.06)$). Analyses on disattenuated correlations yielded similar results ($r = 0.06, 95\% \text{ CI } (0.03, 0.10)$). Notably, these 95% CIs did not overlap with the 95% CIs for the relationship between disgust sensitivity and traditionalism.

**Cross-National Variability in Disgust Sensitivity.** Although we observed variation in disgust sensitivity across nations ($\chi^2(1) = 47.41, P < 0.001$), this variability was unrelated to parasite stress ($t(26.18) = 1.12, P = 0.27$; Fig. 3). However, results suggested that the disgust sensitivity instrument had similar validity across samples. In addition to observing a relationship between disgust sensitivity and traditionalism across nations, we replicated previously reported sex-related differences in disgust sensitivity (37, 38), with women consistently scoring higher than men across nations [$t(20.73) = 16.46, P < 0.001$, meta-analyzed $d = 0.41, 95\% \text{ CI } (0.36, 0.45)$].

**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, more strongly relates to intragroup attitudes, such as endorsement of traditional rules and rituals and antipathy toward within-group deviants. In contrast, the outgroup-avoidance account predicts that pathogen-avoidance motives should relate to SDO, which, relative to traditionalism, more strongly relates to intergroup attitudes, such as negative attitudes toward ethnic outgroups and support for barriers between groups. Results supported the traditional norms account over the outgroup-avoidance account, with national parasite stress relating strongly to traditionalism but not 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 United States (39), the SDO-disgust sensitivity relationship, while nonzero, was negligible.

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 may 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 dietary, sexual, and social contact opportunities (4, 40). 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 (41)] rather than avoiding them. Of course, our parasite stress data, like most used in this literature (36), were measured at the country level, and we cannot rule out the possibility that individual disgust sensitivity is calibrated by individual rather than national pathogen exposure. However, findings here corroborate previous results indicating that childhood illness in a pathogen-rich location (Bangladesh) is unrelated to disgust sensitivity in adulthood (42).

The observed null relationship between disgust sensitivity and national parasite stress suggests that different processes might account for the relationships between ideology and national parasite stress versus ideology and disgust sensitivity. At the national level, those norms categorized as “traditional” might be more successfully transmitted and sustained within pathogen-rich ecologies if such norms lead to reduced contact with pathogens (9–11, 20). Indeed, mathematical models indicate that pathogens can result in the cultural evolution of prophylactic rules and rituals (43). Alternatively, traditionalism might promote within-coalition alliances that can provide health care in times of illness, which might be especially critical in high parasite stress ecologies (14, 19, 44, 45). Alternatively, traditional norms might endure more in pathogen-rich nations simply because the ecologies of such nations are less hospitable to liberal Western institutions and infrastructures, and were thus less influenced by European colonialism (46).
categorized as traditional expose individuals to fewer pathogens (39) and reduce the ability for sexually transmitted infections to thrive within communities (47). Traditional food preparation techniques often include ingredients with antimicrobial properties (10), traditional food taboos sometimes limit pathogen and toxin exposure (7, 48), and traditional hygiene rules can coordinate behaviors to limit pathogen transmission (e.g., when one has used hands to contact bodily waste and is not used for physical contact with foods or with social allies). Within each of these accounts, relationships between pathogen avoidance and traditionalism could solely reflect motivations to avoid direct contact with pathogens, or they could also reflect motivations to regulate others’ behavior, which might indirectly increase infection risk (18, 47). Just as we have attempted to clarify why the behavioral immune system might relate to political ideology, based on either norm adherence or outgroup avoidance, future work can clarify which of these aspects of traditionalism might be especially appealing to those individuals especially motivated to avoid pathogens.

Methods

The study was reviewed and approved by the Vrije Universiteit Amsterdam Vaste Commissie Wetenschap en Ethiek Institutional Review Board. Further ethical approval was obtained where required by local ethics boards. Consent was gathered after participants read an information sheet describing the contents of the survey.

Participants. We recruited participants in 30 countries (Table 1). We aimed to allow for meaningful insights into how widespread the behavioral immune system was across different cultures, and whether it varied systematically. We included 11,501 participants (42% male, with a mean age of 30.06 y (SD = 12.62)).

Measures. Participants completed a short questionnaire described as concerning “attitudes toward people and groups in our country and in other countries.” We also included items that refer to traditionalism or SDO for individuals who are close to someone who is traditionalized or SDO. We aimed to test for effects of individual pathogen-avoidance motivations on SDO and traditionalism. We used historical parasite prevalence 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. We also tested whether disgust sensitivity (Y2 below) varied across nations as a function of parasite stress, with the following model:

\[
Y_{ij} = \beta_0 + \beta_1 \text{Disgust}_{ij} + \beta_2 \text{SEX}_{ij} + \beta_3 \text{AGE}_{ij} + \epsilon_{ij}
\]

\[
Y_{2ij} = \beta_0 + \gamma_1 \text{Parasite}_{ij} + \gamma_2 \text{SEX}_{ij} + \gamma_3 \text{AGE}_{ij} + \epsilon_{2ij}
\]

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