Regional variation in pathogen prevalence predicts endorsement of group-focused moral concerns

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Abstract

According to Moral Foundations Theory, people endorse “individualizing” foundations (Harm/care, Fairness/reciprocity) or “binding” foundations (Ingroup/loyalty, Authority/respect, Purity/sanctity) to varying degrees. As societies with higher pathogen prevalence have been found to exhibit more pronounced antipathogen psychological tendencies and cultural practices (e.g., conformity, collectivism), we hypothesized that pathogen prevalence may predict endorsement of the binding moral foundations, which may also serve to minimize pathogen transmission. We examined associations between historical and contemporary pathogen prevalence and endorsement of the moral foundations via multilevel analyses. Country-level analyses showed that even when controlling for gross domestic product per capita, historical (but not contemporary) pathogen prevalence significantly predicted endorsement of the binding foundations, but not individualizing foundations. Multilevel analyses showed that this pattern held even when controlling for individual-level variation in political orientation, gender, education, and age. These results highlight the utility of a functional–evolutionary approach to understanding patterns of morals across societies and individuals.

1. Introduction

For some people, morality is primarily about upholding justice and not harming others (and condemning those who violate justice and cause harm). For others, morality is also about a number of additional concerns, including being loyal to one’s group, respecting authority, and maintaining bodily/spiritual purity (and condemning those who violate these norms). According to Moral Foundations Theory (Haidt & Graham, 2007; Haidt & Joseph, 2007), these five concerns correspond to distinct psychological systems—rooted in evolved psychological mechanisms—that individuals and societies employ to suppress selfishness (Haidt & Kesebir, 2010). Two of these concerns—Harm/care and Fairness/reciprocity—have been labeled “individualizing” foundations because they are concerned primarily with how individuals ought to treat other individuals. The other concerns—Ingroup/loyalty, Authority/respect, and Purity/sanctity—have been labeled “binding” foundations because they give rise to morals that bind people into groups and institutions. Research has found that whereas political liberals (i.e., those of left-wing political ideology) tend to endorse the individualizing foundations much more than the binding foundations, political conservatives (i.e., those of right-wing political ideology) tend to endorse all five foundations relatively equally (Graham, Haidt, & Nosek, 2009; Van Leeuwen & Park, 2009).

Large-scale studies have found that this association between moral foundations and political ideology is robust across many cultures (Graham, Nosek, Haidt, Iyer, Kovela, & Ditto, 2011). Nevertheless, just as there is variation in the...
extent to which people within a society endorse particular moral foundations, there is substantial variation across societies as well. For example, Graham et al. (2011) found that Easterners endorse Ingroup/loyalty and Purity/sanctity foundations more strongly than do Westerners. Is any of that variation systematic? If so, what might explain it? Recently, geographical differences in parasite stress (i.e., prevalence of infectious diseases) have been found to partially explain cross-cultural differences in a wide range of psychological and behavioral phenomena, including personality traits, cognitive abilities, religiosity, and societal values (e.g., Eppig, Fincher, & Thornhill, 2010, 2011; Fincher & Thornhill, 2008; Fincher, Thornhill, Murray & Schaller, 2008; Schaller & Murray, 2008). The present research investigated whether the variation in moral foundation endorsement across world regions is explained in part by regional variation in pathogen prevalence.

For many organisms, and for a very long time, pathogens have posed a threat to health and reproduction, constituting a major recurring adaptive problem. Selection pressure imposed by pathogens has led to the evolution not only of physiological defenses (e.g., the vertebrate immune system), but also of behavioral defenses that facilitate avoidance of pathogens (Curtis & Biran, 2001; Kurzban & Leary, 2001; Loehle, 1995; Möller, Dufva, & Allander, 1993; Schaller & Park, 2011). In humans, behavioral antipathogen defenses have been found to play a role in the selective rejection of individuals perceived to pose contagion risks, such as foreigners and those with an anomalous appearance (Faulkner, Schaller, Park, & Duncan, 2004; Navarrete & Fessler, 2006; Park, Faulkner, & Schaller, 2003; Park, Schaller, & Crandall, 2007). Furthermore, human cultures are characterized by distinct traditions and interpersonal styles (e.g., use of culinary spices, wariness of strangers) that may function to suppress the transmission of pathogens (Schaller & Murray, 2010; Sherman & Billing, 1999).

Cultures vary in their antipathogen tendencies, and some of this variation may reflect the operation of mechanisms that have evolved to be functionally flexible, such that the defensive tendencies are amplified when pathogens are more prevalent (Schaller, Park, & Kenrick, 2007; Schaller & Park, 2011). Like physiological immune responses, the benefits of behavioral defenses are offset by costs, which could range from physiological and psychological (e.g., elevated energy expenditure, increased vigilance) to cultural and economic (e.g., missed opportunities to learn from, or to trade with, other groups). The costs of behavioral defenses suggest that behavioral defenses may have evolved to be contingent upon pathogen threat, with amplification dependent upon the degree of pathogen risk. There is much evidence for such flexibility at the level of individuals: People who are—or perceive themselves to be—more vulnerable to disease tend to exhibit stronger antipathogen psychological responses (e.g., Duncan, Schaller, & Park, 2009; Faulkner et al., 2004; Hamamura & Park, 2010; Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010; Navarrete, Fessler, & Eng, 2007; Prokop & Fančovičová, 2010; Prokop, Fančovičová, & Fedor, 2010; Prokop, Usak, & Fančovičová, 2010a, 2010b). As well, higher perceived vulnerability to disease has been found to be associated with stronger endorsement of the binding—relative to individualizing—moral foundations (Park & Isherwood, 2011).

At the level of regions, the functional contingency between pathogen threat and behavioral defenses has been referred to as the parasite-stress model (e.g., Low, 1990; Thornhill, Fincher, & Aran, 2009; Thornhill & Fincher, 2011; Thornhill, Fincher, Murray, & Schaller, 2010). Some regions of the world are characterized by greater prevalence of pathogens, and people residing in those regions are expected to exhibit antipathogen tendencies more strongly. As suggested by Thornhill et al. (2009), a likely proximate mechanism for the activation of the behavioral defense system is the activity of the physiological immune system within individuals; nevertheless, its consequences may be visible at the societal level. Pathogen prevalence covaries across world regions with a variety of antipathogen psychological and cultural tendencies, including polygyny rates (because under high pathogen stress, fewer males are perceived as suitable mates; Low, 1990); individualism–collectivism (Fincher et al., 2008); sociosexuality, extraversion, and openness to experience (Schaller & Murray, 2008); democratization (Thornhill et al., 2009); conformity (Murray, Trudeau, & Schaller, 2011); and religious diversity (Fincher & Thornhill, 2008). Further substantiating the parasite-stress model, many of these cultural defenses vary with person-to-person parasites but not with animal-to-person parasites (Thornton et al., 2010).

We propose that, in line with observed associations between pathogen stress and psychological/cultural tendencies, antipathogen defenses could manifest as the activation of group-oriented moral concerns. That is, morals emphasizing group loyalty, respect for authority and tradition, and bodily/spiritual purity may serve the function of reducing parasite transmission and its consequences. They could do this directly by disposing individuals to avoid outgroup members (who may bear novel pathogens), to conform to traditions (which may protect against pathogens), or to avoid triggers of disgust (which may be pathogenic). Since interactions expose ingroup members to one another’s pathogens, when pathogen risk is high, individuals can also indirectly reduce their pathogen exposure by getting other ingroup members to conform to the binding foundations. High pathogen prevalence might therefore increase tendencies to condemn and punish violators of these morals (see DeScioli & Kurzban, 2009). As a measure of endorsement of the binding foundations, we used data from the Moral Foundations Questionnaire (MFQ; Graham et al., 2011). This questionnaire asks participants to indicate both the relevance of moral principles in the abstract and their agreement with more specific moral judgments. Increased endorsement of the binding foundations (i.e., heightened relevance of principles of group loyalty, respect
for authority, and bodily/spiritual purity, and stronger agreement with judgments following these principles) may reduce pathogen transmission and its consequences by increasing the costs of moral violations through condemnation and punishment. Condemnation and punishment of violations of group loyalty, respect for authority, and bodily/spiritual purity may reduce the occurrences of such violations, which may reduce pathogen transmission and its consequences through reduced contact with outgroup members, increased conformity to authorities and traditions, and reduced contact with sources of contamination. To the extent that these claims are true, regional variation in pathogen prevalence should covary with patterns of endorsement across societies of the binding moral foundations.

The hypothesis that high regional pathogen prevalence will be associated with endorsement of the binding moral foundations is in line with the finding that higher pathogen prevalence is associated with higher conformity (Murray et al., 2011) and higher collectivism (which in turn is associated with higher conformity and ethnocentrism; Fincher et al., 2008), tendencies that conceptually overlap with two binding moral foundations: Ingroup/loyalty and Authority/respect. The third binding moral foundation—Purity/sanctity—was specifically proposed by Haidt and Joseph (2007) to be an antipathogen defense system that underlies moral concerns regarding issues of contamination. Supporting their proposal, the moral foundation of Purity/sanctity is related to disgust (Horberg, Oveis, Keltner, & Cohen, 2009), an emotion that plays a central role in disease avoidance (Oaten, Stevenson, & Case, 2009). Thus, Purity/sanctity should be endorsed especially strongly by people residing in pathogen-prevalent regions. Accordingly, we predicted that higher pathogen prevalence across countries will be associated with stronger endorsement of the binding foundations by individuals in those countries. We made no predictions regarding endorsement of the individualizing foundations.

These predictions regarding the association between regional pathogen prevalence and endorsement of the binding moral foundations are in line with the parasite-stress model. According to the model, value systems that promote adherence to existing traditions and norms reduce pathogen transmission, so endorsement of such values should be stronger in regions with higher pathogen stress (Thornhill et al., 2009, 2010; Thornhill & Fincher, 2011). As endorsement of the Ingroup/loyalty and Authority/respect foundations promotes adherence to existing traditions and norms, our prediction for these two foundations is in line with the parasite-stress model. Our prediction for the Purity/sanctity foundations is in line with the general claim of the parasite-stress model that parasitic diseases are a major force in shaping human psychology and behavior. However, to the extent that purity concerns are part of existing traditions and norms (e.g., traditional religious norms concerning sexuality), condemning Purity/sanctity violations promotes adherence to existing traditions and norms. From this perspective, the prediction for endorsement of the Purity/sanctity foundation is—at least partly—in line with the prediction of the parasite-stress model regarding cross-cultural differences in societal values.

The hypothesized relation between pathogen prevalence and endorsement of the binding foundations should—in our view—be seen as part of the relation between pathogen prevalence and collectivism, rather than necessarily referring to an independent or mediating process. There is considerable overlap between key aspects of collectivism (i.e., sharp ingroup-outgroup distinctions, conformity, and xenophobia; Sagiv & Schwartz, 1995; Triandis, Bontempo, Villareal, Asai, & Luca, 1988) and the contents of the binding moral foundations (group loyalty, respect for authority, bodily/spiritual purity). Indeed, it would be odd for a collectivist society to not at all endorse these foundations. However, the relation between collectivism and endorsement of the binding foundations is not straightforward. Individualism-collectivism is a description of a wide range of cross-cultural differences, including values, goals, and characteristics of language (Schwartz & Bilsky, 1990; Triandis, 1996; Kashima & Kashima, 1998). Growing up (i.e., being socialized) in a collectivistic culture undoubtedly influences an individual’s endorsement of the moral foundations. On the other hand, endorsement of the binding foundations by the people of a society (regardless of its cause) may contribute to that society’s level of collectivism. An analysis of the relation between binding moral foundations and collectivism is beyond the scope of the current investigation. Nevertheless, the current study can—minimally—be seen as a test of the association between pathogen prevalence and collectivism (as predicted by the parasite-stress model) on a kind of data not yet examined in this context (i.e., endorsement of group-focused moral foundations) while controlling for individual-level variables (i.e., political orientation, education, age, gender).

In testing the parasite-stress model, researchers have used “historical” (based on early 20th century data) and “contemporary” (based on the most recent data) pathogen prevalence estimates. The two have been found to be highly correlated—Fincher et al. (2008) reported a correlation of .77. While we analyzed the data using both estimates, we expected the effects to emerge especially strongly for historical pathogen prevalence. The reason is that the antipathogen tendencies of a given society may not necessarily reflect responses to current adaptive problems, but may be calibrated to adaptive problems faced by previous generations. This is due to cross-generational lag resulting from older members of society having had their behavioral defense system activated in response to growing up in, and otherwise experiencing, historically earlier conditions (Thornhill et al., 2009). Consistent with this, studies have found that contemporary cultural defensive tendencies are better predicted by historical than by contemporary pathogen prevalence (Fincher et al., 2008; Schaller & Murray, 2008).
2. Method

2.1. Country-level measures

Historical pathogen prevalence estimates were from Murray and Schaller (2010). These authors compiled data for 160 countries or geopolitical regions, each of which was assigned a standardized score based on estimated historical prevalence of nine diseases (leishmanias, schistosomes, trypanosomes, leprosy, malaria, typhus, filariae, dengue, and tuberculosis). The historical estimates were based on publications from around the middle of the 20th century. Contemporary pathogen prevalence estimates were from Fincher et al. (2008). These authors compiled data for 98 countries or geopolitical regions, each of which was assigned a score (ranging from 23 to 47) for prevalence of seven classes of pathogens (filariae, leishmanias, leprosy, malaria, schistosomes, spirochetes, and trypanosomes). For purposes of analyzing the pathogen prevalence data with the moral foundations data, historical and contemporary pathogen prevalence estimates for England were used as estimates for the United Kingdom (i.e., estimates for Scotland and Northern Ireland were ignored). For all countries, estimates of gross domestic product (GDP) per capita were obtained from the CIA 2010 World Factbook (www.cia.gov/library/publications/the-world-factbook/index.html).

2.2. Individual-level measures

Participants were 120,778 adult visitors (42.0% female, median age=35 years) to the website YourMorals.org who completed the MFQ (Graham et al., 2011) and provided demographic data for country (for participants who moved to their current country at age 14 years or older, the country they grew up in was used instead, cf. Graham et al., 2011). Data from the MFQ were available for 147 countries for which historical pathogen prevalence data were available; no MFQ data were available for Chad, Burkina Faso, Equatorial Guinea, Guinea Bissau, Mauritania, Mozambique, San Marino, Sierra Leone, Togo, and Turkmenistan. Except for Burkina Faso, data from the MFQ were available for all countries for which contemporary pathogen prevalence data were available. Most participants were from the USA (n=97,087; 80.4%). For the majority of the other countries, moderate sample sizes were available (for countries with historical pathogen data, mean n=146, S.D.=587.6; for countries with contemporary pathogen data, mean n=240, S.D.=716.6). For the analyses involving contemporary pathogen prevalence, 18 countries, data from fewer than 20 participants were available (see electronic supplementary material S1, available on the journal’s website at www.ehbonline.org). For the analyses involving historical pathogen prevalence, 65 countries, data from fewer than 20 participants were available (see electronic supplementary material S2, available on the journal’s website at www.ehbonline.org).

For the country-level analyses with historical pathogen prevalence, participants from countries for which no historical pathogen prevalence data were available were excluded from analysis, yielding N=120,389, 42.0% female, with a mean age of 38.09 years (S.D.=15.27). A similar process for the analyses regarding contemporary pathogen prevalence yielded N=119,921, 42.0% female, with a mean age of 38.08 years (S.D.=15.25).

For the multilevel analysis, participants who did not provide demographic data for gender, age (in years), education (9-point scale from some high school to completed graduate or professional degree), and political orientation (7-point scale from very liberal to very conservative) were excluded, as were data from those who indicated “libertarian,” “do not know or not political,” or “other” for political orientation. For the analyses involving historical pathogen prevalence, this yielded data from 92,169 participants (43.7% female, mean age=40.01 years, S.D.=15.30) from 141 countries. A similar process for the analyses involving contemporary pathogen prevalence yielded data from 91,830 participants (43.7% female, mean age of 40.00 years, S.D.=15.37) from 94 countries.

2.3. Statistical analyses

Statistical analysis consisted of country-level and multilevel analysis. Country-level analysis assessed correlations between countries’ average endorsement scores for the moral foundations and pathogen prevalence scores. In the multilevel analysis, we assessed the ability of country-level pathogen prevalence to predict moral foundation endorsement while controlling for individual-level demographic variables. To do so, we applied multilevel modeling (hierarchical linear regression) to the data with PASW Statistics 18.0 using maximum likelihood estimation. We analyzed the moral foundations separately from one another and separately for historical and contemporary pathogen prevalence. The Level 1 (individual level) dependent variable was the endorsement scores for one of the moral foundations. Endorsement scores were predicted by the Level 2 (country level) variable of historical (or contemporary) pathogen prevalence, while controlling for Level 1 variables of political orientation, gender (0=female, 1=male), education, and age. Participants were nested within countries. Age, education, and political orientation were grand-mean centered. Preliminary null models for each dependent variable indicated significant between-group variance (i.e., moral foundation endorsement scores differed across countries; see electronic supplementary material S3, available on the journal’s website at www.ehbonline.org), justifying our subsequent analyses that attempt to explain this between-group variability. The multilevel models were built up by sequentially including political orientation, gender, education, and age as Level 1 fixed effects (i.e., the regression coefficient for each variable could not vary across countries) and then as random effects (i.e., the
regression coefficient for each variable could vary across countries, and this variability was estimated). For each dependent variable (the moral foundation endorsement scores), we selected as the best model the one that successfully converged and had the lowest value for Schwarz’s Bayesian Information Criterion (BIC), which takes into account both model fit and complexity. For Harm, Fairness, and Ingroup, the best models included, in addition to historical or contemporary pathogen prevalence, all predictors—political orientation, gender, education, and age—as random effects. For Authority, in the analysis with historical pathogen prevalence, the best model included political orientation and age as random effects, and gender and education as fixed effects. For Authority, in the analysis with contemporary pathogen prevalence, the best model had fixed effects for all predictors. For Purity, in the analyses for historical and contemporary pathogen prevalence, the best models included political orientation, education, and age as random effects, and gender as a fixed effect. As an effect size measure, we calculated change in education, and age as random effects, and gender as fixed effects. For Authority, in the analysis with contemporary pathogen prevalence, the best model had fixed effects for all predictors. For Purity, in the analyses for historical and contemporary pathogen prevalence, the best models included political orientation, education, and age as random effects, and gender as a fixed effect. As an effect size measure, we calculated change in $R^2$ as the unique contribution of historical (or contemporary) pathogen prevalence in explaining country-level variability in moral foundations by adding pathogen prevalence to models that already included political orientation, education, age, and gender.

3. Results

3.1. Country-level analysis

To obtain an estimate of the endorsement of the moral foundations for each country, endorsement scores were averaged over all participants of each country. To control for biased averages due to small samples, countries with $n<20$ were excluded from the analysis (see electronic supplementary material S4, available on the journal’s website at www.ehbonline.org). As shown in Table 1, historical pathogen prevalence correlated significantly with endorsement of Ingroup/loyalty, Authority/respect, and Purity/sanctity, but not with endorsement of Harm/care and Fairness/reciprocity. Fig. 1 shows the relationship between historical pathogen prevalence and endorsement of the binding foundations (mean of Ingroup/loyalty, Authority/respect, and Purity/sanctity). The data for contemporary pathogen prevalence showed a similar pattern.

GDP per capita correlated significantly with both historical ($r=-.65, N=147, p<.001$) and contemporary pathogen prevalence ($r=-.58, N=96, p<.001$). When excluding countries with $n<20$ (giving $N=82$), GDP per capita was moderately but significantly correlated with Ingroup ($r=-.39, p<.001$), Authority ($r=-.42, p<.001$), and Purity ($r=-.48, p<.001$), but not significantly with Harm ($r=-.14, p=.202$) and Fairness ($r=-.12, p=.268$). When controlling for GDP per capita, the pattern of correlations between historical pathogen prevalence and endorsement of moral foundations remained largely unchanged; however, contemporary pathogen prevalence was not significantly correlated with any of the moral foundations (Table 2).

3.2. Multilevel analysis

The estimated regression coefficients of the best models are shown in Table 3 (historical pathogen prevalence) and Table 4 (contemporary pathogen prevalence). The results of the multilevel analyses showed that historical pathogen prevalence—even when controlling for individual-level variation in political orientation, gender, education, and age—significantly predicted endorsement of Ingroup/loyalty [95% confidence interval (CI) for $b=.069; .164$], Authority/respect (95% CI for $b=.116; .220$), and Purity/sanctity (95% CI for $b=.166; .309$); it did not predict endorsement of Harm/care (95% CI for $b=-.023; .069$) or Fairness/reciprocity (95% CI for $b=-.008; .084$). The estimates of these regression weights were not substantially influenced by the large proportion of

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**Table 1**

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<thead>
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<th>Moral foundation</th>
<th>Historical pathogen prevalence</th>
<th>Contemporary pathogen prevalence</th>
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<td>$r$</td>
<td>$p$</td>
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<tr>
<td>Harm</td>
<td>.13</td>
<td>.254</td>
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<tr>
<td>Fairness</td>
<td>.10</td>
<td>.389</td>
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<tr>
<td>Ingroup</td>
<td>.50</td>
<td>&lt;$.001$</td>
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<tr>
<td>Authority</td>
<td>.60</td>
<td>&lt;$.001$</td>
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<tr>
<td>Purity</td>
<td>.59</td>
<td>&lt;$.001$</td>
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Note. Correlations were calculated over all samples with $n>20$, yielding $N=82$ and $N=78$ for historical and contemporary pathogen prevalence, respectively.
participants from the USA or by participants from countries with small samples (see electronic supplementary material S5, available on the journal’s website at www.ehbonline.org). The results for contemporary pathogen prevalence showed a similar pattern, but with a significant effect for endorsement of Fairness/reciprocity: Controlling for individual-level variation in political orientation, gender, education, and age, contemporary pathogen prevalence significantly predicted endorsement of Fairness/reciprocity (95% CI for $b=0.01$; .11), Ingroup/loyalty (95% CI for $b=0.04$; .15), Authority/respect (95% CI for $b=0.08$; .20), and Purity/sanctity (95% CI for $b=0.14$; .30); it did not predict endorsement of Harm/care (95% CI for $b=-0.00$; .009). The estimates of these regression weights were not substantially influenced by the large proportion of participants from the USA or by participants from countries with small samples (see electronic supplementary material S6, available on the journal’s website at www.ehbonline.org). The change in $R^2$ values indicate that the largest effects were of historical pathogen prevalence as a predictor of country-level variability in the binding foundations.
4. Discussion

Based on the parasite-stress model of human sociality, we predicted a correlation between historical pathogen prevalence and endorsement of the binding foundations. In line with the antipathogen functions of conformity and collectivism (e.g., Fincher et al., 2008; Murray et al., 2011), endorsing morals of Ingroup/loyalty and Authority/respect may reduce pathogen transmission by promoting adherence to existing traditions and norms. The prediction for Purity/sanctity is in line with the parasite-stress model, as the model broadly predicts psychological adaptations for pathogen stress (according to Moral Foundations Theory, Purity/sanctity evolved specifically as a pathogen-defense system; Haidt & Joseph, 2007). Analyses revealed results consistent with our predictions. The country-level analysis showed that even when controlling for GDP per capita, historical pathogen prevalence significantly predicted endorsement of the binding foundations, but not endorsement of the individualizing foundations. These results complement a number of recent findings documenting covariations between pathogen prevalence and psychological/cultural variables, particularly those pertaining to cautious antipathogen tendencies such as collectivism and conformity (e.g., Fincher et al., 2008; Murray et al., 2011; Schaller & Murray, 2008). These results are also in line with the association between the “tightness” of cultures (i.e., cultures with strong norms and low tolerance for deviance) and high levels of ecological and historical threats (Gelfand et al., 2011). The multilevel analysis showed that even when controlling for individual-level variation in political orientation, gender, education, and age, country-level historical pathogen prevalence significantly predicted endorsement of the binding moral foundations, but not endorsement of the individualizing foundations. The multilevel aspect of these results is novel, and it attests to the predictive power of societal-level pathogen prevalence. In summary, these results support the parasite-stress model of human sociality and the proposed antipathogen function of the Purity/sanctity foundation as described by Moral Foundations Theory.

Previous research has shown that endorsement of the binding foundations covaries with political orientation (Graham et al., 2009; Van Leeuwen & Park, 2009). Our finding that endorsement of all three binding foundations covaries with historical pathogen prevalence provides insight into a possible evolved function of human morality. However, it is important to note that Moral Foundations Theory specifies a link between the problem of disease avoidance and just one moral foundation: Purity/sanctity. Outgroup challenges and dominance–submission concerns should trigger the other binding foundations of Ingroup/loyalty and Authority/respect, respectively (Haidt & Joseph, 2007). Why then were all three binding foundations, but neither individualizing foundation, found to covary with historical pathogen prevalence? We consider six possible explanations. First, the association between pathogen stress and endorsement of all three binding foundations may be driven by the association between pathogen stress and collectivism/conformity (Fincher et al., 2008; Murray et al., 2011): Pathogen stress may influence psychological mechanisms that result in collectivism and conformity, which through socialization processes may increase endorsement of the binding foundations. Second, as proposed by Moral Foundations Theory, pathogen stress may be only directly related with endorsement of Purity/sanctity, and the association between pathogen stress and the other binding foundations may be due to effects of pathogen stress on collectivism and conformity as described above. Third, contrary to Moral Foundations Theory, pathogen avoidance could be a central adaptive challenge for all three binding moral foundations, not just Purity/sanctity. This seems unlikely, given the disparate contents of the binding foundations: Between-group competition (Ingroup/loyalty) and within-group hierarchy (Authority/respect) may affect pathogen exposure, but their effects clearly extend beyond disease avoidance. Alternatively, the three binding moral foundations may have evolved in response to distinct adaptive problems, as suggested by Moral Foundations Theory, but covary for other reasons. Thus, a fourth explanation for their co-activation is that they share one or more psychological mechanisms. In this case, ontogenetic calibration of one binding foundation could affect the calibration of the other foundations. Consistent with this possibility, disease vulnerability enhances negativity towards outgroups (Faulkner et al., 2004; Navarrete & Fessler, 2006; Navarrete et al., 2007); however, we know of no research that evaluates either the reverse relationship wherein outgroup threat enhances perceived disease vulnerability or whether Authority/respect is related to perceived disease vulnerability or to outgroup threat. Fifth, outgroup threat, ingroup hierarchy, and pathogen stress could have covaried historically. For example, perhaps resource shortages tended to result in malnourishment and therefore increased pathogen prevalence, as well as increased between-group conflict over scarce resources, with more organized groups outcompeting less organized groups. If the three adaptive problems covaried in recent history, then even if the systems underlying binding foundations evolved independently in response to different adaptive problems and with distinct activation cues, they would tend to be co-activated because their activating cues tend to be present together. Finally, all three binding foundations could have evolved to play at least a partial role in helping to solve the adaptive problem of pathogen threat. From this perspective, the moral foundations could have been shaped primarily by one adaptive problem (as suggested by Moral Foundations Theory) but secondarily by other adaptive problems that they helped to solve (consistent with the pathogen defense function of the Ingroup/loyalty
and Authority/respect foundations as described in the Introduction). In this case, cues of adaptive problems and moral foundations may not map one-to-one, but instead cues may activate multiple moral foundations, and each moral foundation could be activated by multiple cues. In short, why all three binding moral foundations are activated in response to pathogen threat remains an open question.

Given that responses on the Moral Foundations Questionnaire were collected on a Web site about morality by self-selected volunteers, the data analyzed in this study may not be representative of any identifiable population. Although the majority of the participants who provided data on the Moral Foundations Questionnaire were from the USA, the results of the country-level and multilevel analyses showed that the effects were robust across societies. Future studies might explore the effects of historical pathogen prevalence on moral foundations among people who are unlikely to have exposure to Western and scientific ideas regarding morality, especially those with minimal contact with technologically advanced cultures.

Future studies should also explore how manipulations of pathogen threat or salience can experimentally affect moral concerns and judgments. The present results complement previous findings suggesting that specific (perceived) threats—including perceived vulnerability to disease—may systematically calibrate people’s morality (Park & Isherwood, 2011; Van Leeuwen & Park, 2009). Given the many psychological implications and practical consequences of different moral attitudes, understanding the impact of threats on morality is important.

Our findings highlight the utility of a functional–evolutionary approach to understanding patterns of morals across societies and individuals. The modern synthesis in moral psychology integrated theory and findings across scientific disciplines to produce Moral Foundations Theory (Haidt & Graham, 2007; Haidt & Joseph, 2007). This broad theoretical backdrop embodies and encourages consilience, the evaluation and integration of multiple types of explanation, in contrast to the theoretical myopia of previous reason-based approaches to morality. For example, Kohlberg focused on demonstrating cross-cultural consistency in the developmental sequence of stages of moral judgment. When adults of some cultures did not reach his highest stage, he interpreted this cultural variability ethnocentrically, failing to recognize that the moral judgments of other groups may reflect better adaptation to their ecological situation. As a case in point, he speculated that the “lower-level reasoning” of Turkish villagers was due to pressure to conform to consensual norms and a lack of external prods to question their normative system (Nisan & Kohlberg, 1982, p. 875). In contrast, our results suggest that people up-regulate the binding moral foundations in response to pathogen prevalence as an adaptive response to ecological threat, emphasizing the extent to which human morals function to cope with adaptive problems.

Supplementary Materials

Supplementary data to this article can be found online at doi:10.1016/j.evolhumbehav.2011.12.005.

References


