RESEARCH ARTICLE

Is the Cure a Wall? Behavioral Immune System Responses to a Disease Metaphor for Immigration

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Abstract

Humans have evolved a capability to identify and subsequently avoid communicable pathogens. The current research tested whether activation of this system can be co-opted by disease metaphors, which frame abstract social issues as concrete disease risks. We predicted that language framing immigration as a disease would elicit heightened anti-immigration attitudes and greater support for restrictive social policies (study 1), tested whether this effect was moderated by pathogen concern (study 2), and compared aversion to disease metaphors with concerns of literal disease (study 3). We identified conditions under which the *disease* framing generally produced more anti-immigrant attitudes, particularly among individuals with stronger chronic disease concerns. Furthermore, we also identified boundary conditions for such effects, such that disease metaphors demonstrated limited efficacy in the presence of a literal disease threat. We explain these results at the intersection of evolutionary and conceptual metaphor theories.

Keywords Evolutionary psychology · Language · Immigration · Metaphor · Disease

Introduction

In response to consistent threat of infectious disease, our species (and many others) evolved bodily mechanisms to mitigate this threat. For example, in response to bacterial and viral infection, the immune system raises core body temperature to disrupt pathogens' preferred environmental conditions. Along with this biological immune system, humans similarly possess a *behavioral* immune system to detect and avoid pathogenic threats *prior* to exposure (Neuberg et al. 2011). Although humans developed biological resistance to local pathogens, resistance would have been less developed for exogenous disease sources. Thus, outgroup members carrying foreign microbes posed unique threats, likely resulting in selective pressures to assort with less-risky ingroup members (Faulkner et al. 2004).

Although contemporary disease risk is decreasing, communicable diseases remain a leading cause of worldwide mortality (Murray and Lopez 1997) and pathogen-avoidance motives unsurprisingly continue to influence intergroup relations. Historically, these motives were often exploited by policy makers to enact agendas against immigrants and foreigners. Specifically, policy makers employed propaganda utilizing rhetoric that metaphorically framed target groups as a disease. Most notoriously, propaganda in Nazi Germany described the Jewish people as infections to Germany's metaphorical body, intended to motivate German citizens to purge their country of perceived health threats (Musolff 2007). However, it could be possible that these responses to disease-related language could operate as a function of the behavioral immune system specifically. This paper seeks to further our understanding of the complementary evolutionary and rhetorical processes that account for the efficacy of disease metaphors in shaping contemporary intergroup attitudes and subsequent policies. Disease metaphors may be a particularly powerful framing because behavioral immune system activation could further bolster support for anti-immigration policy in the service of mitigating contact with real and/or figurative pathogens.

Pathogen Avoidance and Immigration Attitudes

Although humans have evolved a biological immune system to ameliorate the effects of pathogenic infection, biological

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responses are metabolically costly. For example, immunological responses to infections typically increase body temperature (e.g., fever, inflammation), requiring substantial increases in metabolic activity (Baracos et al. 1987). Energy allocated to this response would be diverted from other physiological systems, which could be debilitating and subvert from other fitness-enhancing behaviors (e.g., eating, mating).

It would have been adaptive to recognize disease vectors *prior* to infection to mitigate these costs. To meet this need, it has been argued humans have evolved a *behavioral* immune system (BIS; e.g., Murray and Schaller 2016). This suite of perceptual, affective, cognitive, and behavioral responses serves to preemptively identify and avoid environmental stimuli and conspecifics capable of transmitting infectious disease. For example, individuals experience affective disgust responses and aversion to rotting food (Rozin et al. 1986). Importantly, people who perceive themselves as vulnerable to disease subsequently demonstrate strong interpersonal aversions, particularly under disease threat (Miller and Maner 2011; Mortensen et al. 2010). Research further implicates pathogen-avoidant responses in attitude formation, particularly the stigmatization of those who appear diseased (Crandall and Moriarty 1995; Schaller and Neuberg 2012). Certain anomalous appearances (e.g., amputations, obesity) may similarly arouse discomfort, eliciting stigmatization, despite a lack of contagion threat (Park et al. 2007; Park et al. 2013). Taken together, findings suggest BIS responses rely on liberal identification criteria of what constitutes potential for disease (Haselton and Nettle 2006).

The aversive responses to pathogenic concerns further operate under overgeneralization principles, such that individuals exhibiting any type of anomalous features are perceived as potentially pathogenic. In other words, pathogen-avoidant responses appear to shape intergroup relations as a by-product of derogating anomalous others, including healthy members of outgroups, as if they were diseased ingroup members (i.e., Petersen 2017; van Leeuwen and Petersen 2018). Such responses include the promotion of prejudice, xenophobia, and ethnocentrism, which could also serve to prevent contact with potentially more virulent exogenous pathogens (e.g., Faulkner et al. 2004; Huang et al. 2011; Navarrete and Fessler 2006; Navarrete et al. 2007). A related consequence of pathogen-avoidant responses is the prioritization of ingroup boundaries to protect ingroup members (Tybur et al. 2016), which could foster intergroup conflict. Individuals with heightened aversion to environmental pathogens endorse restrictive social policies for ingroup boundaries, including limitations on immigration policies (Aarøe et al. 2017; Brenner and Inbar 2015), potentially serving to limit intergroup contact ostensibly related to infection risks. Furthermore, highly pathogenic environments promote higher levels of selective affiliation among ingroup members in the service of limiting contact with exogenous pathogens, resulting in strengthened family ties, restrictive social bonds, and highly conservative ideologies (Fincher and Thornhill 2012; Thornhill et al. 2009).

Disease Metaphors

Given the link between both motivations to avoid pathogens and close ingroup borders, it may be possible that metaphorically framing immigration (or other outgroup inclusion) as a disease could heighten anti-immigration attitudes to mitigate symbolic infection risks. Metaphors equivocating immigrants to parasites or viruses have been prevalent throughout American political discourse to bolster support for anti-immigrant policies (Cisneros 2008; O'Brien 2003). Initial research has explored how this language might leverage pathogen-avoidance motives, eliciting endorsement and enactment of restrictive policies about even unrelated topics.

According to the conceptual metaphor theory (Lakoff and Johnson 1980), individuals rely on familiar concepts to mentally represent abstract ideas. Individuals use their knowledge of one often concrete concept (a source) as a cognitive framework for representing knowledge of a distinct often more abstract *target* concept. This process relies on a cognitive mapping process through which features of the target can be meaningfully compared to analogous, structurally similar features of the familiar source. For example, an abstract threat like crime can be understood in terms of a dissimilar and relatively more concrete ideas (e.g., a disease or wild animal; Thibodeau and Boroditsky 2011, 2015). Thus, individuals must systematically represent abstract features of crime (e.g., relationship between criminals and society) as features of a simpler idea (e.g., viruses that weaken a host). Exposure to these kinds of systematic comparisons in language encourages the individual to scaffold abstract reasoning onto the straightforward implications of the concrete level. For example, a disease metaphor encouraged perceivers to apply their understanding of treating illness to the target domain of crime (Thibodeau and Boroditsky 2011). Multiple studies found that the use of disease-metaphoric (vs. alternative) language to describe crime caused individuals to subsequently propose policies based on *curing* it by addressing poverty and other perceived causes (Thibodeau and Boroditsky 2011). Conversely, the same studies found that conceptualizing crime as a wild animal elicited endorsement of radically different solutions to the problem focused primarily on *taming* crime through law enforcement and strict punishment.

In the context of immigration, past studies have indirectly explored how disease metaphors might similarly extrapolate anti-immigrant views. The logic of these studies is straightforward: If immigrants are metaphorically compared to a disease weakening the health of the nation, individuals should apply their natural avoidance of illness to support policies that *quarantine* the country to minimize future "infection." Although previous studies have not tested this question

directly, they have provided suggestive evidence. For example, framing the nation as a metaphorical body (e.g., by comparing integration to digestion) elicited anti-immigrant attitudes among those primed with physical health risks (Jia and Smith 2013; Landau et al. 2009). Similar effects were not observed among those who were similarly primed with disease risk but given a nonmetaphoric control article about the nation. These studies suggest that immigrants are foreign agents that pose some risk to the health of the nation, ostensibly deploying the same avoidance individuals would have about literal pathogens in this metaphorical context.

Other recent work has explored how metaphors that elicit disgust elicit more anti-immigrant attitudes (Marshall and Shapiro 2018). Although outside the domain of disease, the researchers found that language describing immigrants as rodents or vermin elicited greater disgust and more strict anti-immigration attitudes, particularly for those who strongly identified with the nation. As noted above, these linguistic comparisons ostensibly cause individuals to reason about immigration by relying on the intuitive logic of the source: If immigrants are seen as vermin, the implication is that they must be kept out to protect the nation.

Although these studies suggest that metaphoric language can leverage pathogen-avoidance motives (e.g., through disgust) to influence policy attitudes, none of these studies specifically present metaphors likening immigration itself to a disease. Therefore, it is unclear whether these effects are due to heightened concern over real threats of personal infection or over the symbolic threat immigrants figuratively pose to the nation's metaphorical health when this metaphor is salient. These studies also did not specifically explore the extent to which behavioral immune system responses may underlie the observed effects of disease rhetoric.

Current Research

The current research sought to identify whether representing immigration as a disease elicited avoidance motives toward immigrants through three experiments. Study 1 served to extend previous work by testing whether disease metaphors foster more anti-immigration attitudes. Given that disease metaphors could elicit pathogen-avoidant motives, study 2 further tested whether variation in such motives interact with immigration framing. Specifically, variability in susceptibility to communicable disease within a population has led to the emergence of individual differences in perceived vulnerability to disease, which would serve to bolster BIS responses to disease threats for those more concerned with pathogens (e.g., those in pathogenic environments, those experiencing recent illnesses; Miller and Maner 2011; Schaller and Murray 2008). We predicted individual differences in motivation to avoid physical illness would augment anti-immigration attitudes when immigration was framed as a disease

threatening the body of the country (vs. an alternative framing). Finally, study 3 sought to determine whether the effects of disease metaphors on immigration attitudes are driven primarily by an evolutionary or conceptual metaphor account, or if effects were rooted in a combination of both accounts.

Study 1

This experiment sought to extend previous findings demonstrating metaphors foster restrictive attitudes toward immigration, particularly related to language indirectly implicating immigration as a risk to the nation, when metaphorically likened to a body, and the attitudinal responses to this metaphoric framing (Jia and Smith 2013; Landau et al. 2009). Additionally, we tested the specific role of pathogen-avoidance motives in influencing attitudes in contemporary environments by heightening anti-immigration attitudes when disease rhetoric is salient. We compared a disease metaphor to an alternative framing designed to elicit a similar disgust response (immigration is pollution) to determine domain specificity in participants' responses. Although pollution elicits disgust from contamination threat, the historical recency of pollution suggests it lacks the same association with a suite of adapted behavioral responses intended to avoid infection.

We predicted disease metaphors would elicit the strongest anti-immigrant attitudes. To measure these attitudes, we included a suite of outcomes spanning abstract perceptions of immigration, concrete concerns over whether immigrants are a literal threat to public health, and endorsement of government policies meant to restrict immigration in the USA (i.e., border walls, travel bans) to demonstrate the practical significance of metaphor.

Method

Participants and Procedures We recruited 141 participants (120 women, 21 men; $M_{Age} = 19.92$; SD = 3.43; 51.8% White) at a public Southeastern U.S. university for course credit. Political ideology (1 = Very Liberal; 7 = Very Conservative; $M_{Grand} = 3.94$, SD = 1.49) was balanced across conditions ($p = 0.72$). Although we did not conduct an a priori power analysis, we sought to collect at least 120 participants in this study ($n = 40$); we deliberately oversampled in case we had to exclude participants from final analyses. Upon entering the laboratory, consenting participants were randomly assigned to read one of the metaphoric framing articles before responding to the dependent measures in randomized order.

Materials

Metaphoric Framing Participants were first randomly provided one of three fabricated articles containing a commentary

from a fictitious expert on problems posed by immigration in America. While articles matched in tone and length, they differed in how they framed immigration; the expert used metaphorical language describing immigrants as a *disease* ($n = 47$), *pollution* ($n = 46$), or used *no metaphor* (i.e., control, $n = 48$; Landau and Keefer 2014; Keefer et al. 2014).

The *disease* article contained language implicating immigration as an *infection* in need of a *cure* (e.g., "…festering within our country is a plague on our lives as Americans…"). The *pollution* metaphor likened immigration to a *contamination* in need of an immediate *cleanse*, serving to determine how other metaphors influenced attitudes without implicating immigration as infectious. The literal condition simply described immigration as a problem without using metaphorical language (e.g., "...lingering within our country is a challenge…"). Full text of primes for all three studies is available through https://osf.io/v7xjq/.

Dependent Measures After reading the article, participants completed four dependent measures assessing anti-immigration attitudes. Higher scores indicated stronger endorsement for these attitudes and policies.

Anti-immigration Attitudes Participants indicated their support for anti-immigration legislation using 15 items (e.g., "The US government should enact stricter border security before contemplating any broader immigration reform"; Mukherjee et al. 2012). Participants rated their agreement (1 = Strongly Disagree; 7 = Strongly Agree) with higher scores indicating greater anti-immigration sentiment. One item ("Authorities should prosecute and punish Americans who exploit illegal immigrants for their labor or other services") showed weak item-total correlation ($r = 0.13$), weakening the scale's reliability, and was therefore excluded from analysis (remaining items: $\alpha = 0.85$, $M_{\text{Grand}} = 3.33$, $SD_{\text{Grand}} = 1.06$).

Health Risk Participants indicated the degree they perceived immigrants as public health risks (1 = Strongly Disagree; 7 = Strongly Agree) using six ad hoc items (e.g., "I would be worried for my own health if immigrants entered this country," $\alpha = 0.88$, $M_{\text{Grand}} = 3.03$, $SD_{\text{Grand}} = 1.35$).

Travel Ban Support Participants indicated the degree to which they supported President Donald Trump's Executive Order 13769 of January 27, 2017, a 90-day order restricting travel to and from 17 countries on a single 7-point scale (1 = Not at All; 7 = Very Much; $M_{\text{Grand}} = 2.89$, $SD_{\text{Grand}} = 2.14$).

Border Walls Participants also indicated how high they would want hypothetical border walls between the USA with Mexico and Canada. Two single-item measures operated along 10-point Likert-type scales ascending in 5-ft increments between

0 ft (coded as 0) and 40+ ft (9) (Mexico: $M_{\text{Grand}} = 2.67$, $SD_{\text{Grand}} = 3.25$; Canada: $M_{\text{Grand}} = 2.00$, $SD_{\text{Grand}} = 2.91$).

Results and Discussion

Observed correlations between outcomes are presented in Table 1. Predictably, all measures of anti-immigration sentiment were strongly correlated. Thus, we report analyses for each measure separately as well as an overall composite.

Anti-immigration Attitudes A one-way ANOVA indicated a marginally significant main effect of condition, $F_{(2, 138)} = 2.380$, $p = 0.09$, $\eta^2 = 0.03$. Planned pairwise comparisons indicated the disease metaphor ($M = 3.57$, $SD = 1.11$) elicited greater anti-immigration attitudes than the control ($M = 3.10$, $SD = 0.91$, $p = 0.03$, $d = 0.44$). The pollution metaphor ($M = 3.34$, $SD = 1.06$) elicited no significant differences with the control or disease metaphors ($ps > 0.27$).

Health Risk A one-way ANOVA indicated another marginally significant main effect, $F_{(2, 138)} = 2.384$, $p = 0.09$, $\eta^2 = 0.03$. Planned pairwise comparisons indicated the disease metaphor ($M = 3.35$, $SD = 1.40$) elicited greater perceptions of immigrants as a public health risk relative to the control ($M = 2.75$, $SD = 1.36$, $p = 0.03$, $d = 0.45$). The pollution metaphor ($M = 3.01$, $SD = 1.24$) again elicited no significant differences with the control or disease metaphors ($ps > 0.21$).

Travel Ban A one-way ANOVA indicated a significant main effect, $F_{(2, 138)} = 3.55$, $p = 0.03$, $\eta^2 = 0.05$. Planned pairwise comparisons indicated the disease metaphor ($M = 3.40$, $SD = 2.37$) elicited greater support for Trump's travel ban relative to the control ($M = 2.27$, $SD = 1.87$, $p = 0.01$, $d = 0.53$). The pollution metaphor ($M = 3.00$, $SD = 2.04$) elicited marginally greater support for the travel ban than the control condition ($p = 0.09$, $d = 0.37$). The disease and pollution conditions did not differ ($p = 0.36$, $d = 0.23$).

Mexico Wall A one-way ANOVA indicated no main effect of condition on the desire for a higher border wall with Mexico, $F_{(2, 138)} = 1.05$, $p = 0.35$, $\eta^2 = 0.01$.

Canada Wall A one-way ANOVA indicated no main effect of condition on the desire for a higher border wall with Canada, $F_{(2, 127)} = 0.30$, $p = 0.73$, $\eta^2 = 0.00$.

Omnibus Anti-immigration Scores Given the strong correlations between anti-immigration measures, we finally computed an omnibus measure averaging across topics to provide an overall test of the effects of disease-metaphoric rhetoric. We first standardized scale-level scores (to account for differences in scaling) and calculated participant averages on the standardized variable ($\alpha = 0.87$). This combined outcome yielded

Table 1 Correlations between observed variables (*study 1*)

	Health risk	Travel ban support	Mexico wall	Canada wall
Anti-imm. attitudes	0.68***	0.75***	0.63***	0.47***
Health risk		0.52***	0.54***	0.47***
Travel ban support			0.55***	0.34***
Mexico wall				0.84***

***$p < 0.001$

no significant main effect of condition, $F(2, 138) = 1.80$, $p = 0.17$, $\eta^2 = 0.03$. However, a planned contrast indicated the pattern aligned with predictions with those in the disease condition reporting marginally more anti-immigration views ($M = 0.17$, SD = 0.87) than in the literal condition ($M = -0.14$, SD = 0.77, $p = 0.06$, $d = 0.38$). The pollution condition ($M = -0.02$, SD = 0.80) did not differ from either group ($ps > 0.25$).

Results demonstrate some alignment with previous research indicating body metaphors for the nation, suggesting the *infectability* of the nation through immigration elicits greater anti-immigration attitudes relative to framing immigration as simply a literal problem when disease is salient (e.g., Jia and Smith 2013; Landau et al. 2009; Marshall and Shapiro 2018). Along with reporting marginally negative attitudes toward immigration when conceptualized as a disease, participants reported marginally heightened distal responses toward immigrants which coincides with correlational research showing how restrictive immigration policies may be a consequence of disease-avoidant motives (e.g., Brenner and Inbar 2015).

Nonetheless, the efficacy of the disease metaphors in eliciting anti-immigration attitudes in this study was limited. Compared to the control condition, the disease and pollution metaphors appeared to act relatively equivocally in this study. This lack of difference could be explained by the ubiquity of disgust responses (Oaten et al. 2009). Disgust remains pervasive to other stimuli (e.g., moral) and the potential for contamination may not be differentiated in the service of avoiding disease (Tybur et al. 2009). Although pollution is ostensibly a more recent contaminant in human history that humans may not have evolved to address, the risk of contamination posed by pollution metaphors may have nonetheless elicited a similar disgust response from participants as the disease metaphor and elicited some degree of avoidance; disgust is a more ancient response that could have evolved to respond to the more recent cue of pollution in a similar capacity that requires similar levels of efficiency. However, the disease condition nonetheless reliably differed from the nonmetaphorical comparison, whereas the pollution condition did not.

Given design limitations, these results constrain our ability to infer the role of pathogen-avoidant motives in shaping anti-immigration attitudes. It may be that disease metaphors are ultimately most effective against individuals with higher

pathogen-avoidance motives (e.g., Duncan et al. 2009). Study 2 was designed to test whether disease metaphors would selectively affect individuals with higher aversion to disease.

Disease metaphors may have also elicited a general self-protective response rather than a response specific to pathogenic threat, potentially explaining efficacy for this condition, relative to pollution: One can take concrete actions to protect the self from disease (e.g., washing hands), but pollution is an ambient threat regardless of one's own behavior. If disease metaphors represent domain-specific responses to the threat of disease (but not other hazards), then such responses should be most apparent among those with more chronic pathogen-avoidant motives. Study 2 sought to demonstrate this aspect of domain specificity while considering how individual differences in pathogen-avoidance motives further augment these attitudes.

Study 2

Given some ambiguity in results from the metaphor in Study 1, Study 2 sought to demonstrate domain specificity for the aversive responses produced by disease metaphors. Because of the naturally occurring variability in disease concern as a function of environmental pathogen load (Schaller and Murray 2008), this study further considered individual differences in perceived vulnerability to disease as a moderator of the effects of a disease metaphor. Previous research demonstrates individual differences in pathogen-avoidance motives are especially predictive of aversive responses toward conspecifics implicated as pathogenic (e.g., Faulkner et al. 2004). We predicted individuals with high chronic pathogen-avoidant motives would more strongly endorse anti-immigration policies, particularly when framing immigration as a disease, but that these associations would be diminished or absent without disease framing.

Like study 1, we utilized a similar suite of outcome measures to tap various aspects of anti-immigration attitudes as perceptions of immigrants as public health threats. We also considered assessments of desired social distance and support for funding specific agencies to provide a broader scope of how BIS responses may influence additional aspects of anti-immigration attitudes. We also included perceptions of a

nonimmigration issue (media piracy) to test whether the moderating effects of motivation on metaphor would apply specifically to the target of the metaphor or whether they would extend to other domains.

We compared responses to disease metaphors with the equivalent nonmetaphoric article from study 1 as well as another evolutionarily relevant survival metaphor. Specifically, we utilized a metaphor implicating immigration as a physical threat to activate concerns of protection against physical danger (Murray and Schaller 2012). Although such a metaphor should also elicit aversion to immigration, aversive responses to the disease metaphor should be especially strong among those with dispositionally higher pathogen-avoidant motives.

Method

Participants We recruited 162 American adults (88 men, 61 women; $M_{Age} = 33.73$, SD = 10.78; 73.2% White) from Amazon's Mechanical Turk for $0.50 (Buhrmester et al. 2011). A power analysis indicated that 100 participants would be sufficient to detect effects ($f^2 = 0.10$, $\beta = 0.80$); we deliberately oversampled to account for potential data exclusions. Political ideology ($M_{Grand} = 3.48$, SD = 1.73) was balanced across conditions ($p = 0.56$). We excluded 12 participants for providing incomplete data.

Materials and Procedure

Perceived Vulnerability to Disease Consenting participants completed the 15-item Perceived Vulnerability to Disease (PVD) scale that assesses individual differences in chronic behavioral immune system activation (Duncan et al. 2009). This scale consists of two subscales assessing perceived infectability, or one's perceived susceptibility to physical illness (PI, 7 items), and germ aversion, one's motivation to avoid sources of illness (GA, 8 items).[1] Descriptive statistics and psychometric properties of all measures in study 2 are presented in Table 2.

Metaphoric Framing Participants received one of three articles about immigration. We used the articles framing immigration as *disease* ($n = 50$) and the *no metaphor* control ($n = 51$) from study 1. However, to further demonstrate the domain specificity of disease metaphors' influence on behavioral immune system responses (see Murray and Schaller 2012), a third metaphor described immigration as a *military invasion*, likening immigration to a *conquest* in need of immediate *defense* (e.g., "...occupation within our country is an assault...," $n = 49$).

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[1] We modified wording for an item, specifically, "I avoid using other people's cell phones because of the risk that I may catch something from them," whereas the previous incarnation referred to payphones.

Dependent Measures Like study 1, participants rated their endorsement of anti-immigration attitudes ($\alpha = 0.92$), perceptions of immigrants as health threats ($\alpha = 0.93$), and desire for border walls.

Social Distance Participants also indicated desire for social distance from immigrants using a single-item 7-point scale (Szczurek et al. 2012). Participants indicated their desired degree of social distance from immigrants (1 = A close, personal friend or romantic partner; 7 = Someone living in my state). Higher scores indicated greater desire for distance.

Funding Support Participants indicated the extent they wanted to fund three government agencies that enforce immigration laws (Border Patrol, Immigration and Customs Enforcement, Homeland Security). Items operated on a 7-point scale (1 = Strongly Disagree; 7 = Strongly Agree). The composite anti-immigration funding support measure had higher scores indicating greater support.

Piracy Along with assessing immigration-specific policies, participants indicated the extent they support anti-piracy policies to assess domain specificity. Support was assessed using an 8-item scale along 7-point Likert-type scales (1 = Strongly Disagree; 7 = Strongly Agree) with higher scores indicating greater support for such policies (e.g., "The government should enforce greater restrictions online to prevent piracy").

Consenting participants first completed PVD before reading one of three randomly assigned articles. This was followed by the dependent measures in random order and demographics. Participants were subsequently debriefed and provided redemption codes for compensation.

Results and Discussion

Full correlations between all observed outcomes are presented in Table 3. PVD subscales were moderately correlated, $r = 0.39$, $p < 0.01$, prompting separate analyses for both subscales (e.g., Brown and Sacco 2016; Duncan and Schaller 2009; Young et al. 2011). To test our hypothesis, we regressed each outcome on GA (centered and standardized), metaphor condition (disease vs. military vs. literal; dummy-coded with disease as the comparison condition), and their predicted interactions. PI yielded no significant moderation by condition (PI results, along with spotlight analyses for GA in studies 2 and 3, are available through OSF). See Table 4 for model parameters for each outcome variable.

Anti-immigration Attitudes The resulting model indicated the GA slope on anti-immigration attitudes was significantly stronger in the disease (vs. literal) condition (see Fig. 1). Simple slopes indicated GA positively predicted anti-immigration attitudes in the disease condition, $b = 0.62$, $\beta =$

0.58, SE = 0.12, $t(48) = 4.96$, $p < 0.001$. No association emerged in the literal condition, $b = 0.02$, $\beta = 0.01$, SE = 0.20, $t(49) = 0.12$, $p = 0.90$. At a reduced magnitude, the military condition showed a similar positive association to the disease condition, $b = 0.43$, $\beta = 0.29$, SE = 0.20, $t(47) = 2.13$, $p = 0.04$.

Mexico Wall GA association with wall support differed between our disease and literal conditions. When exposed to the *disease* metaphor, GA predicted desire for a higher U.S.–Mexico border wall, $b = 1.45$, $\beta = 0.40$, SE = 0.48, $t(48) = 3.01$, $p < 0.01$. No associations emerged in the literal, $b = -0.07$, $\beta = -0.02$, SE = 0.50, $t(49) = 0.13$, $p = 0.90$, or military conditions, $b = 0.83$, $\beta = 0.20$, SE = 0.59, $t(47) = 1.40$, $p = 0.17$.

Canada Wall A marginal difference in slopes emerged between the disease and literal conditions (Table 3). Like Mexico, GA predicted desire for a higher U.S.–Canada border wall for the disease metaphor, $b = 1.31$, $\beta = 0.37$, SE = 0.47, $t(48) = 2.76$, $p = 0.008$. No association emerged for the *literal*, $b = 0.26$, $\beta = -0.08$, SE = 0.43, $t(49) = 0.60$, $p = 0.549$, or military conditions, $b = 0.48$, $\beta = 0.14$, SE = 0.48, $t(47) = 0.99$, $p = 0.33$.

Social Distance GA effects differed between disease and military conditions. GA predicted greater desire for social distance from immigrants in the *disease*, $b = 0.96$, $\beta = 0.44$, SE = 0.28, $t(48) = 3.39$, $p = 0.001$, and *literal* conditions, $b = 0.55$, $\beta = 0.28$, SE = 0.26, $t(144) = 2.07$, $p = 0.04$. No association was present in the *military* condition, $b = 0.10$, $\beta = 0.04$, SE = 0.34, $t(47) = 0.28$, $p = 0.78$.

Health No significant interactions emerged for perceived health risk ($ps > 0.18$). Although differences between slopes did not reach significance, we observed patterns similar to our other outcomes. GA positively predicted perceptions of the health risks of immigration when the disease, $b = 0.60$, $\beta = 0.41$, SE = 0.19, $t(48) = 3.18$, $p < 0.01$, and military metaphors were provided, $b = 0.69$, $\beta = 0.38$, SE = 0.25, $t(48) = 2.83$, $p < 0.01$. No relation was present in the literal condition, $b = 0.21$, $\beta = 0.14$, SE = 0.21, $t(49) = 0.99$, $p = 0.33$.

Funding Support No significant differences in slopes emerged between conditions ($ps > 0.45$). The pattern of slopes again matched predictions; GA predicted anti-immigration services funding support in the disease condition, $b = 0.53$, $\beta = 0.35$, SE = 0.20, $t(48) = 3.18$, $p = 0.01$. No association emerged in the literal, $b = 0.31$, $\beta = 0.19$, SE = 0.22, $t(49) = 1.41$, $p = 0.17$, or military conditions, $b = 0.28$, $\beta = 0.14$, SE = 0.27, $t(48) = 1.01$, $p = 0.32$.

Piracy Finally, to test the discriminant validity of our predicted interactions. We regressed anti-piracy attitudes onto the model

Table 2 Descriptive statistics for all measures (*study 2*)

	M_{Grand}	SD	α
PVD – GA	3.99	1.15	0.79
PVD - PI	2.90	1.26	0.90
Anti-imm. attitudes	4.03	1.34	0.92
Mexico wall	3.76	3.81	
Canada wall	2.57	3.34	
Social distance	2.91	2.18	
Health risk	3.17	1.60	0.93
Funding support	4.23	1.68	0.87
Anti-piracy support	3.43	1.59	0.92

employed above. This model returned a main effect of GA, $b = 0.50$, $\beta = 0.32$, SE = 0.22, $t(143) = 2.29$, $p = 0.02$; however, there was no evidence of any interaction with article condition ($|\beta| < 0.15$, $ps > 0.13$). In short, the data suggest that while germ avoidance was predictive of anti-immigrant sentiment when a disease metaphor was salient, this pattern did not extend to other domains.

Omnibus Anti-immigration Scores Given the diverging patterns across outcomes, and strong correlations between anti-immigration measures, we finally computed an omnibus measure averaging across outcomes as in study 1 (Table 5). We first standardized scores (to account for differences in scale) on the various outcome measures and then calculated participant averages on the standardized variable ($\alpha = 0.86$).

In a full model regressing omnibus scores on GA (centered/standardized), condition, and their predicted interaction, we found overall evidence of a difference in the slopes of GA on anti-immigration attitudes comparing the disease and literal conditions indicating GA was a significantly better predictor of anti-immigration scores when a disease metaphor was salient. Specifically, GA predicted greater anti-immigration response in the disease condition, $b = 0.40$, $\beta = 0.55$, SE = 0.09, $t(48) = 4.55$, $p < 0.001$. However, no relationship was present in the *literal* condition $b = 0.11$, $\beta = 0.15$, SE = 0.10, $t(48) = 1.09$, $p = 0.28$. There was marginal evidence for a relationship in the military condition, $b = 0.22$, $\beta = 0.25$, SE = 0.12, $t(47) = 1.77$, $p = 0.08$. This marginal slope did not significantly differ from the slope in the disease condition ($p = 0.30$; see Table 4) nor the nonsignificant slope observed in the literal condition, $\Delta b = 0.11$, $\beta = 0.15$, SE = 0.15, $t(144) = 0.75$, $p = 0.45$. See Fig. 2.

Results suggest domain specificity toward disease threats based on metaphoric framing, as the most robust findings indicated highly pathogen-avoidant participants expressed more anti-immigrant views when exposed to disease metaphors. Indeed, military metaphors also weakly elicited aversion to immigration as a function of perceived vulnerability to disease. Such a relation is consonant with research indicating a

Table 3 Correlations between observed variables (*study 2*)

	PI	Anti-imm. attitudes	Mexico wall	Canada wall	Social distance	Health risk	Funding support	Piracy
GA	0.39***	0.25**	0.18*	0.20*	0.27***	0.29***	0.23*	0.25**
PI		0.06	0.03	0.07	0.06	0.16†	−0.09	0.01
Anti-imm. attitudes			0.61***	0.38***	0.50***	0.77***	0.70***	0.32***
Mexico wall				0.74***	0.41***	0.64***	0.50***	0.28***
Canada wall					0.30***	0.43***	0.33***	0.20*
Social distance						.54***	0.29***	0.22**
Health risk							0.58***	0.27**
Funding support								0.46***
Piracy								

$*p < 0.05$, $**p < 0.01$, $***p < 0.001$, $†p = 0.051$

relation between pathogen-avoidant and self-protection motives, as both would serve to mitigate contact with threats (e.g., Murray and Schaller 2012). However, the omnibus test showed the most robust pattern of associations between GA and anti-immigrant sentiment was present in the disease condition, suggesting aversion to immigrants served as domain-specific function in this study.

Although these data demonstrated disease language activates distal responses toward immigrants as a function of chronic PVD, the experimental design did not afford us to determine whether disease language was primarily driving the effect or if the effect was simply a product of literal pathogen concern. In other words, our effects may have been due to metaphoric framing of the target domain or merely because it incidentally primed real concern over illness. This would necessitate consideration of both metaphorical and literal disease threats separately to determine the extent to which metaphoric and literal disease threats interact to explain outgroup aversion. Study 3 sought to address this limitation by providing both threat cues to participants.

Study 3

This study sought to clarify the explanatory power of both literal and metaphoric disease threats within the same experiment, particularly as it relates to whether any disease threat would elicit outgroup aversion. Although disease metaphors appeared particularly impactful in its interplay with BIS responses, it could have been the case that disease language may have simply been an outlet for activating avoidant motives in a manner similar to other disease primes (e.g., Faulkner et al. 2004; Mortensen et al. 2010). We decoupled metaphorical and literal disease threats in this design by presenting participants with two pieces of information designed to cue literal health risk (or not) for a target group and framing that group metaphorically as a disease (vs. literally) in a 2 × 2 design.

We remained agnostic at the outset of this study and sought to test competing hypotheses. If effects in the prior studies were driven solely by literal disease threats, aversion to immigration would occur regardless of the disease metaphor. Conversely, if the disease metaphor interacts with the effects driven by literal disease threats, effects would support the notion of an additive effect of disease metaphors to more literal disease responses, suggesting language itself provides a unique contribution to activating pathogen-avoidant motives and responses.

Method

Participants We recruited 207 undergraduates at a public university in Southeastern USA to participate in exchange for course credit. A power analysis indicated that 130 participants would be sufficient to detect medium effects ($f = 0.25$, $\beta = 0.80$); we deliberately oversampled to account for potential data exclusions. We excluded 10 participants for failing attention checks (171 women, 23 men, 3 did not report being either; $M_{Age} = 20.36$, SD = 5.63; 71.6% White; political ideology, $M_{Grand} = 4.12$, SD = 1.44).

Materials and Procedures Participants initially responded to PVD similarly to study 2. Similarly, the GA ($\alpha = 0.69$; $M_{Grand} = 4.22$, SD = 1.01) and PI ($\alpha = 0.81$; $M_{Grand} = 3.43$, SD = 1.25) subscales were only moderately correlated ($r = 0.20$, $p < 0.01$), prompting us to consider subscales separately. Because PI similarly did not influence outcomes in this study, we do not consider it further.

Literal Disease Prime After completing PVD, participants were directed to read an infographic describing the country of Moldova, a small Eastern European country previously demonstrated to be neutrally valenced among undergraduates and the most unfamiliar country in a selection of lesser-known nations (Crandall et al. 2011); this specification afforded us the opportunity to manipulate outgroup status between

Table 4 Model parameters for each outcome regressed onto metaphor condition, germ aversion, and their interaction (*study 2*)

	b (SE)	β	t	p
Anti-imm. attitudes				
Intercept	4.11 (0.18)	− 0.004	22.70	< 0.0001
GA	0.62 (0.18)	0.27	3.47	0.0007
Military	− 0.35 (0.26)	− 0.12	1.36	0.18
Literal	0.07 (0.25)	0.02	0.29	0.77
Military × GA	− 0.19 (0.27)	− 0.07	0.71	0.48
Literal × GA	− 0.60 (0.24)	− 0.21	2.49	0.01
Mexico wall				
Intercept	3.50 (.53)	− 0.004	6.64	< 0.0001
GA	1.45 (0.52)	0.19	2.77	0.006
Military	− 0.23 (0.75)	− 0.03	0.30	0.76
Literal	0.91 (0.74)	0.11	1.23	0.22
Military × GA	− 0.61 (0.79)	− 0.08	0.77	0.44
Literal × GA	− 1.51 (0.70)	− 0.19	2.16	0.03
Canada wall				
Intercept	2.73 (0.47)	− 0.005	5.86	< 0.0001
GA	1.31 (0.46)	0.21	2.84	0.005
Military	− 0.49 (0.66)	− 0.06	0.74	0.46
Literal	− 0.08 (0.66)	− 0.01	0.12	0.90
Military × GA	− 0.83 (0.70)	− 0.12	1.19	0.24
Literal × GA	− 1.05 (0.62)	− 0.15	1.70	0.09
Social distance				
Intercept	3.09 (0.30)	− 0.007	10.43	< 0.0001
GA	0.96 (0.29)	0.25	3.27	0.001
Military	− 0.58 (0.42)	0.13	1.38	0.17
Literal	− 0.05 (0.42)	0.01	− 0.12	0.90
Military × GA	− 0.87 (0.44)	− 0.19	1.94	0.05
Literal × GA	− 0.42 (0.39)	− 0.09	1.06	0.29
Health risk				
Intercept	3.14 (0.22)	− 0.001	14.39	< 0.0001
GA	0.60 (0.22)	0.32	2.78	0.006
Military	− 0.02 (0.31)	− 0.006	0.07	0.94
Literal	0.15 (0.31)	0.04	0.51	0.61
Military × GA	0.10 (0.33)	0.03	0.29	0.77
Literal × GA	− 0.39 (0.29)	− 0.12	1.34	0.18
Funding support				
Intercept	4.07 (0.23)	− 0.003	17.61	< 0.0001
GA	0.53 (0.23)	0.26	0.34	0.02
Military	− 0.12 (0.33)	− 0.03	0.35	0.73
Literal	0.56 (0.32)	0.16	1.71	0.09
Military × GA	− 0.26 (0.35)	− 0.07	0.75	0.46
Literal × GA	− 0.23 (0.31)	− 0.07	0.74	0.46

Disease condition is dummy-coded as 0, so each interaction compares slopes between that condition and the *disease* comparison. GA is centered and standardized

subjects. In this infographic, participants read either that Moldova was a healthy country relatively free of disease (i.e., control; $n = 98$) or rampantly diseased (literal disease risk; $n = 99$).

Disease Metaphor Articles After reading about Moldova, participants read a similar metaphorical article to the previous studies, although the content was specified to concern a recent influx of Moldovan immigrants rather than general immigration. Importantly, Moldovan immigrants were either framed as a problem (i.e., nonmetaphor condition; $n = 94$) or metaphorically as a disease ($n = 103$).

Dependent Measures Following the article, participants responded to the dependent measures. We truncated our dependent measures considerably in the current study, as some items (border wall height; funding for border patrol) were not applicable to the context of Moldovan immigrants who cannot immigrate by land. To this end, we utilized only the immigration attitudes measure from both studies ($\alpha = 0.85$; $M_{Grand} = 3.54$, SD = 1.02) and the single-item social distance scale from study 2 ($M_{Grand} = 2.51$, SD = 1.92).

Results and Discussion

Anti-immigration Attitudes We submitted anti-immigration attitude scores to a 2 (risk: literal disease risk vs. control) × 2 (language: disease metaphor vs. literal) ANCOVA utilizing GA as a covariate to test for interactive effects. A significant main effect of risk emerged, such that participants reported more anti-immigration attitudes when presented with facts that Moldova was literally diseased ($M = 3.65$, SD = 1.01) than with facts suggesting that Moldova was healthy ($M = 3.44$, SD = 1.03), $F(1, 189) = 5.35$, $p = 0.02$, $\eta^2 = 0.03$. Effects were further qualified by a significant risk × GA interaction, $F(1, 189) = 4.03$, $p = 0.04$, $\eta^2 = 0.02$ (see Fig. 3). Contrary to predictions, metaphor elicited neither a main effect nor any interactions, $Fs < 0.70$, $ps > 0.400$.

Simple slopes tests indicated that GA positively predicted anti-immigration attitudes in the control condition, $b = 0.29$, SE = 0.11, $t(193) = 2.67$, $p = 0.01$. Conversely, in the literal disease risk condition, GA did not predict anti-immigration attitudes, $b < 0.01$, SE = 0.09, $t(193) = 0.00$, $p = 0.99$.

Social Distance We submitted our data to a similar 2 (Moldova: healthy vs. diseased) × 2 (metaphor: literal vs. disease) ANCOVA with GA as the covariate for the social distance scale. No main effects nor interactions emerged in this analysis, $Fs < 1.00$, $ps > 0.500$. Furthermore, GA marginally positively correlated with a desire for social distance, $r = 0.130$, $p = 0.07$.

Results from study 3 provided evidence for a simpler disease avoidance model for outgroup aversion based on literal disease risk. GA only interacted with information implicating an outgroup as a literal pathogenic threat, an effect consonant
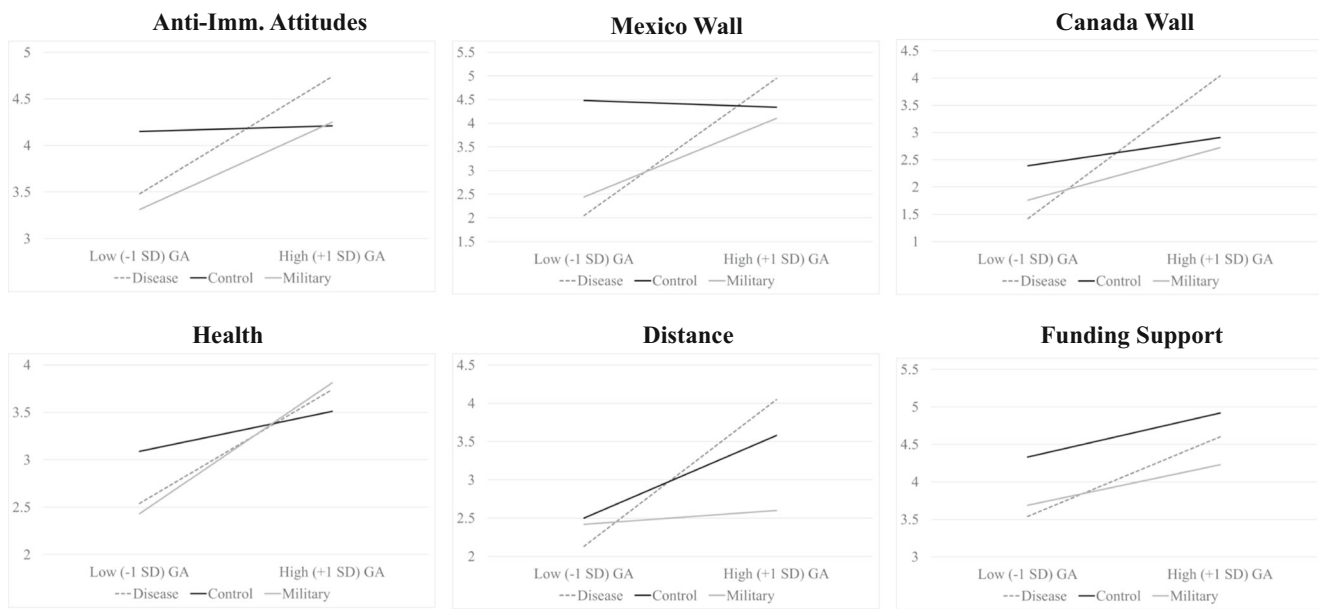
Fig. 1 Dependent variables in study 2 as a function of article condition, GA, and their interaction

with previous research considering pathogen avoidance as a predictor of outgroup prejudice (e.g., Makhanova et al. 2015; Faulkner et al. 2004; Navarrete and Fessler 2006; Navarrete et al. 2007). Conversely, and unlike study 2, the metaphor did not influence comprehension. Findings may suggest that the mere presence of a pathogenic cue suffices to elicit aversion in the service of reducing infection risk.

Although one prediction we had was that of a possible additive effect of disease metaphors, we did not find support for this interaction. This may indicate potential boundary conditions for the effects of disease language in attitude formation. Perhaps literal disease risks are just more concrete and motivating than figurative risks, with the presence of the literal threat being sufficient to activate pathogen-avoidant responses. Alternatively, the composition of our sample may have hidden this effect. After all, participants would need to entertain both literal and more subtle figurative risks simultaneously and feel that the outgroup poses a risk of both literally and figuratively infecting society for an additive effect to occur. Given that Moldova was likely unfamiliar to participants and the study was conducted online, students may have simply had an easier time attending to the literal disease risk and its salient imagery.

General Discussion

These studies extend previous findings highlighting how disease rhetoric shapes public perceptions toward immigration and influences social policies (Landau et al. 2009) while establishing boundary conditions and the importance of considering individual differences in studies informed by evolutionary

theory. Pathogen-avoidant motives can explain some efficacy of such language in fostering anti-immigration sentiments relative to other metaphors (study 1), particularly among those with heightened perceived vulnerability to disease (study 2). Because pathogen-avoidant motives elicit aversion toward perceived disease threats (Murray and Schaller 2016), conceptualizing groups of people as pathogenic connected concrete disease risk with abstract immigration concern. These prejudicial effects are also consonant with a litany of previous findings indicating that pathogen-avoidant motives heighten prejudicial attitudes toward racial and national outgroups and a desire for ingroup closeness (e.g., Faulkner et al. 2004; Huang et al. 2011; Tybur et al. 2016; Navarrete and Fessler 2006). In the service of avoiding potential exogenous disease sources in outgroups, participants in these studies appeared motivated to mitigate contact with immigrants, particularly in the instance of a salient pathogenic threat, whether it be metaphorical or literal. This research provides an experimental analog to previous research implicating such motives as especially predictive of anti-immigration attitudes (Brenner and Inbar 2015).

Table 5 Omnibus anti-immigration attitudes by GA, condition, and their interaction (*study 2*)

	b (SE)	β	t	p
Intercept	0 (0.10)	0	.006	1.00
GA	0.40 (0.10)	0.52	3.86	0.0002
Military	−0.14 (0.15)	−0.08	0.95	0.35
Literal	0.11 (0.15)	0.07	0.77	0.44
Military × GA	−0.18 (0.16)	−0.11	1.14	0.30
Literal × GA	−0.29 (0.14)	−0.18	2.09	0.04

Fig. 2 Omnibus analysis for study 2 dependent variables as a function of article condition, GA, and their interaction
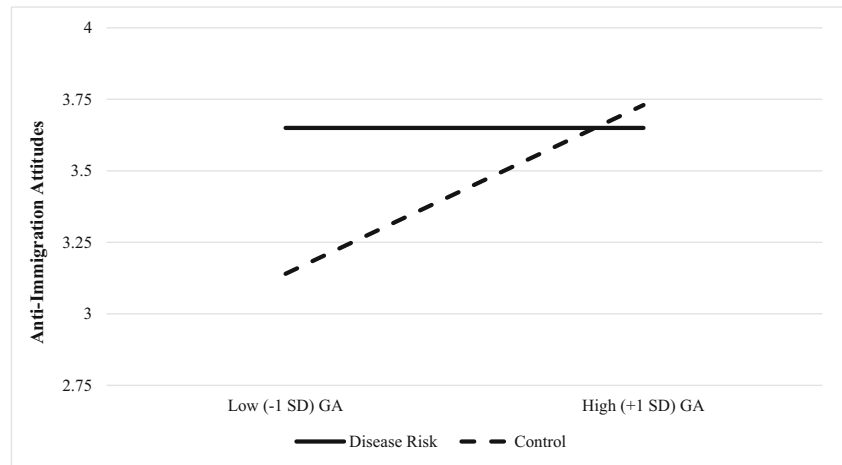
We observed some evidence that pathogen-avoidant motives elicited greater anti-immigration positions following conceptualization of immigration as a disease compared to other conceptualizations. In study 1, this could be attributed to the identification of historically relevant threats, given the consistent and stronger effects for disease metaphor relative to the pollution metaphor. For study 2, disease rhetoric especially, and consistently, elicited more anti-immigration views among those with higher pathogen-avoidant motivation, suggesting disease language activates domain-specific threat responses (e.g., Cottrell and Neuberg 2005). Nonetheless, study 3 established boundary conditions on the efficacy of disease rhetoric in shaping intergroup attitudes, as the metaphor did not influence anti-immigration sentiment; conversely, a literal disease threat was comparatively more impactful in motivating anti-immigration attitudes. This would suggest limits in disease metaphors being especially potent in shaping intergroup attitudes, rather than a general disease salience could be sufficient to heighten prejudice among germ-averse individuals.

The inconsistencies in GA's influence between studies 2 and 3 could be rooted in the fact that only a single disease threat is necessary to activate pathogen-avoidant motives with the disease metaphor being the sole threat in study 2. The disease metaphor could have served as the catalyst for high-GA individuals in study 2, whereas the sufficient catalyst in study 3 would be the literal disease information presented initially (i.e., primacy effect; Hogarth and Einhorn 1992). Within this logic, one could also explain the heightened prejudice among germ-averse individuals toward immigration based on a lack of knowledge of Moldova compared to Mexico. Previous research indicates that xenophobic attitudes toward perceived disease threats are especially strong when individuals perceive considerable dissimilarity between oneself and a target outgroup (Faulkner et al. 2004). Given a potential lack of knowledge of Moldova, it would seem sensible for BIS response concerns to overperceive pathogenic threats in something unfamiliar (Petersen 2017).

Another inconsistency between studies 2 and 3 is the fact that GA did not predict a desire for social distance in study 3. This difference may be related to the fact that individuals may have perceived the unfamiliar Moldovans as a more distal threat compared to other immigrant groups that could have been salient in study 2, a study that considered immigrants more ubiquitously and potentially including more proximal outgroup threats vis-á-vis the USA, such as those in Mexico or Canada. Indeed, previous research indicates distal responses are most prevalent threats close in proximity to threatened individuals (Löw et al. 2015), with disease salience being especially predictive of these responses (Mortensen et al. 2010). Future research would benefit from directly assessing the extent to which various outgroups implicated as pathogenic are perceived as proximally close to individuals and how that perception elicits aversive responses for literal and metaphorical threats.

We predicted that the effects of the disease metaphor would be distinct from the salience of metaphor in general and found some support for this view. Importantly, associations between germ aversion and anti-immigration attitudes were strongest when immigration was conceptualized as a disease (vs. without a metaphor or a military alternative). Nonetheless, GA marginally predicted anti-immigration attitudes following language implicating a concept as a physical safety threat (i.e., *military* framing). This finding seems somewhat counterintuitive, yet not fully surprising, given existing metaphorical connections in the English language between disease and military invasion (Hauser and Schwarz 2015). Further, motives to detect threats of disease and physical violence may be closely related (Neuberg et al. 2011). The large disease metaphor effects indicate a modest level of domain specificity in results when immigration is not initially implicated as a literal disease threat.

Effects emerging only for GA are also sensible, as they represent the emotional and motivational aspect of PVD to remove oneself from potential disease vectors. Our dependent variables tapped both aversive attitudes toward immigration (i.e.,

Fig. 3 Anti-immigration attitudes in study 3 as a function of disease risk, GA, and their interaction
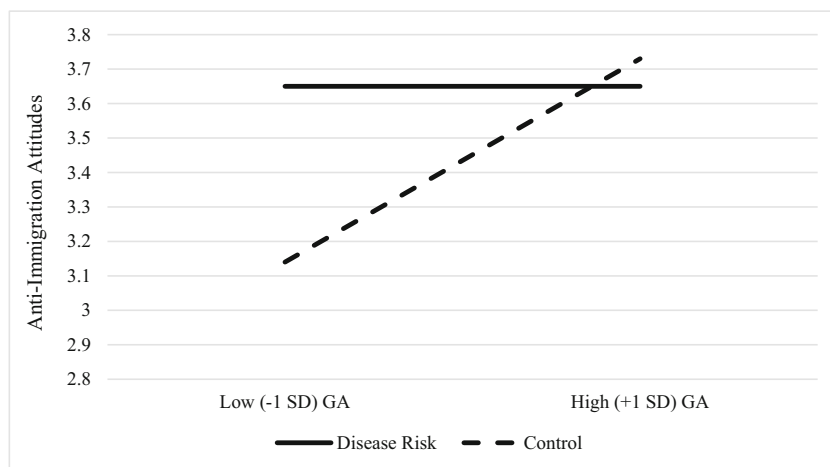
arguably more reactionary responses to perceived threat) and specific avoidant behaviors to mitigate contact with the perceived threat (e.g., wall height). In fact, certain outgroup prejudices are typically associated with GA (e.g., Duncan et al. 2009; Faulkner et al. 2004; Huang et al. 2011; Makhanova et al. 2015). It is also unsurprising PI did not predict immigration-related attitudes, as this facet typically concerns detecting veridical disease cues, resulting in more cognitive bases to pathogen avoidance and preferences toward those not possessing such cues (Brown and Sacco 2016; Young et al. 2011).

Limitations and Future Directions

Despite a level of sensibility in our results, our results remain limited in two important ways. First, several associations were not qualified by significant statistical interactions. Our results could have been underpowered to detect interactive effects, possibly because participants already held strong views on the topic. Future research could utilize experimental disease primes shown to increase germ avoidance instead of variability in perceived vulnerability to disease (Navarrete and Fessler 2006). Furthermore, the military metaphor elicited anti-immigration attitudes for higher-GA participants. Given the threatening nature of both violence and disease, and pathogen-avoidant and self-protection motives' association (Murray and Schaller 2012), participants may have expressed general threat management responses. A complementary test for domain-specific responses to the military metaphor could consider dispositional dangerous world beliefs, one motive for protection against physical violence (Altemeyer 1988). This perception could heighten anti-immigrant sentiment following military (but not disease) framing. Testing self-protection motives' interaction with military-related metaphors may also afford consideration of prejudice against outgroups not rooted in disease (e.g., homelessness; Cottrell and Neuberg 2005).

Responses to metaphors may also manifest through specific approach/avoidance behaviors. Pathogen-avoidant responses

are also rooted in disgust and self-protective responses are rooted in anger, an approach-based emotion (Carver and Harmon-Jones 2009). Future research could consider whether specific responses to metaphors differentially produce changes in approach/avoidance behavior (Mortensen et al. 2010). That is, conceptualizing immigration as an invasion among those with salient self-protection motives may elicit approach responses, whereas pathogen-avoidant motives may elicit avoidant responses when conceptualizing immigration as a disease.

Future research would also benefit considering how to mitigate aversion to immigration rooted in pathogen-avoidant motives. Knowledge on the effects of disease salience toward intergroup attitudes could shape the manner in which policy makers could deliver rhetoric toward others and could ultimately select language designed to reduce perceptions of immigrants, or other outgroups, as threatening. One could extend the disease metaphor further to highlight immigrants' benefits (Landau et al. 2017). For example, framing immigration as means of bolstering a nation's health by incorporating external bacteria and strengthening the constitution of a national body may dynamically recast effects of a disease metaphor. In other words, future manipulations could *inoculate* against disease metaphor effects (Huang et al. 2011). Such a program of research may also be amenable to the boundaries of threat metaphors and interplay with cure metaphors more readily. That is, when presented with a literal threat of disease, framing immigration as a metaphorical cure provides a counteractive effect to disease salience, given the especially heightened level of salience such implications provide for perceivers.

Conclusion

The current study synergized evolutionary theory and metaphorical language's effects to demonstrate how pathogen-avoidant motives interact with figurative language to influence attitudes. Policy makers intuitively exploit evolved motives to

avoid pathogens in order to promote xenophobia and ultimately shape attitudes toward those whom they subsequently perceive as a *disease* for the country. Understanding the roles of both metaphor and the BIS helps to illustrate why this rhetoric is so impactful. Importantly, these results show pathogen-avoidant responses to real and figurative disease heighten interpersonal restrictions toward outgroups both politically and physically.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

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