



Disgust sensitivity and support for immigration across five nations

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ABSTRACT. Immigration has become a focal debate in politics across the world. Recent research suggests that anti-immigration attitudes may have deep psychological roots in implicit disease avoidance motivations. A key implication of this theory is that individual differences in disease avoidance should be related to opposition to immigration across a wide variety of cultural and political contexts. However, existing evidence on the topic has come almost entirely from the United States and Canada. In this article, we test the disease avoidance hypothesis using nationally representative samples from Norway, Sweden, Turkey, and Mexico, as well as two diverse samples from the United States. We find consistent and robust evidence that disgust sensitivity is associated with anti-immigration attitudes and that the relationship is similar in magnitude to education. Overall, our findings support the disease avoidance hypothesis and provide new insights into the nature of anti-immigration attitudes.

Key words: Disgust, disgust sensitivity, behavioral immune system, immigration

In recent years, debates over immigration have come to the forefront in countries around the world, contributing both to the election of Donald Trump (e.g., Hooghe & Dassonneville, 2018; Sides et al., 2017) and to the United Kingdom's withdrawal from the European Union (e.g., Goodwin & Milazzo, 2017). As immigration plays an increasingly central role in politics, understanding the sources and nature of immigration attitudes is more important than ever.

Scholars have debated a variety of explanations for anti-immigration attitudes (for a review, see Hainmueller and Hopkins 2014), including economic concerns (e.g., Hainmueller et al., 2014; Scheve & Slaughter, 2001), status threat (Craig & Richeson, 2014; Major et al., 2018), perceived threat (De Vreese & Boomgaarden,

2016; Kentmen-Cin & Erisen, 2017), emotions (Brader et al., 2008; Erisen et al., 2020), and racial prejudice (Hartman et al. 2014). Recent work points to more fundamental roots of immigration attitudes, suggesting that anti-immigration attitudes are partially a by-product of an evolved psychological system—the behavioral immune system—that facilitates disease avoidance. According to this theory, out-group members are tagged as potential disease threats, motivating avoidance. This argument is supported by a number of psychology studies (e.g., Navarrete & Fessler, 2006), but it has been tested most comprehensively by Aarøe, Petersen, and Arceneaux (2017). If correct, this theory has novel implications for our understanding of immigration attitudes, including the promise of intergroup contact and the nature of political ideology.

The evolutionary logic behind the behavioral immune system (BIS) hypothesis makes it both provocative and challenging to test. However, one key implication of the

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BIS hypothesis is universality (for related discussion, see Petersen 2015). That is, the BIS hypothesis ought to hold across a variety of political and cultural contexts. Existing research, however, has provided only a narrow set of tests. As discussed by Aarøe, Petersen, and Arceneaux (2017), the psychological literature has relied almost entirely on student samples from Canada. These authors improve upon this body of research by testing the BIS hypothesis in nationally representative samples in both the United States and Denmark. These findings greatly strengthened the body of evidence for the BIS hypothesis, but the evidence remains limited to a few select countries. Thus, one of the key implications of the theory has been subjected to an extremely limited test.

In this article, we provide a more thorough test of the BIS hypothesis, drawing on nationally representative samples from Norway, Sweden, Turkey, and Mexico, as well as two diverse samples from the United States. These data provide the most comprehensive test of the universality of the BIS hypothesis to date. Overall, we find strong support for the BIS hypothesis while raising new questions about how it operates across different political contexts.

Disgust and the behavioral immune system

The BIS hypothesis stems from a large psychological and physiological literature on the nature and origins of disgust. The BIS is a set of psychological mechanisms designed to detect the potential presence of a pathogen and motivate a series of behavioral responses that minimize the chances of infection (for a review, see Schaller & Park 2011). Disgust plays a key role in this system as the emotional response to perceived disease threats that motivates avoidant behavior (Oaten et al., 2009). A wide variety of evidence supports this hypothesis. For example, common pathogen vectors, such as bodily fluids, pests, and rotten foods, reliably elicit disgust across cultures (Curtis & Biran, 2001). Images of disease threats also reliably elicit disgust and do so at a greater rate than similar images that are not tied to disease threat (Curtis et al., 2004). Thus, the emotion of disgust seems to have evolved specifically to help avoid infection.

While everyone is expected to show a disgust response to potential disease threats, there are individual differences in the strength of this tendency, known as *pathogen disgust sensitivity*. Women, in particular, tend to score higher in disgust sensitivity (Tybur et al., 2011). This trait is both heritable (Sherlock et al., 2016) and moderately

stable over time (Olatunji et al., 2012), but it is theorized to respond to environmental variation in individual health and the benefits of contact with potential pathogens (Tybur et al., 2013). However, there is an emerging consensus that pathogen disgust sensitivity is the best available indicator of the BIS (Tybur et al., 2014).

While there is variation in pathogen disgust sensitivity, people tend to be overly sensitive to potential pathogen cues. This is because the potential cost of failing to avoid a disease is typically much higher than the potential cost of missing out on a meal or an opportunity for social interaction (Haselton & Nettle, 2006). As a result, many phenotypically abnormal individuals are tagged as potential disease threats. For example, people who are more sensitive to disease threats tend to have more negative attitudes toward obese people (Lieberman et al., 2012; Park et al., 2007), make harsher judgments of unattractive individuals (Park et al., 2012), and avoid physical contact with disabled people (Park et al., 2003). These findings suggest that many forms of social stigmatization and exclusion may be driven by implicit disease concerns and feelings of disgust (Kurzban & Leary, 2001).

Given that the function of disgust is to avoid pathogens, the primary behavioral output is avoidance. Disgust thus works as an implicit germ theory of disease. People avoid close physical contact with any person or object that is perceived as a potential contamination threat (Park et al., 2013). This insight has proven valuable in explaining a variety of political attitudes. For example, people who are higher in disgust sensitivity are more likely to oppose interracial dating and marriage (Kam & Estes, 2016), hold more negative attitudes toward transgender people (Miller et al., 2017; Vana-man & Chapman, 2020), and worry about genetically modified foods and vaccines (Clay, 2017; Clifford & Wendell, 2016). Some of the clearest findings come from studies on homelessness. People who are higher in disgust sensitivity are more likely to support exclusionary policies that promote distance from homeless people, such as banning panhandling and banning sleeping in public (Clifford & Piston, 2017). However, disgust sensitivity did not emerge as a predictor of policies that are less directly relevant to physical distance, such as government aid to homeless people.¹ Moreover, the effects of disgust sensitivity on support for exclusionary policies could not be explained by negative affect. These findings

¹Similarly, disgust sensitivity is a stronger predictor of “body-centric” transgender policies (e.g., bathroom laws) than civil rights policies (Miller et al., 2017).

suggest that negative affect is not a prerequisite for the desire to avoid social contact.

Beyond directly motivating the avoidance of potentially infected others, the BIS also drives a variety of psychological dispositions that facilitate avoidance of potentially infected others and help enforce rules designed to inhibit the spread of infection (e.g., hygienic and dietary norms). At the country level, higher levels of parasite stress are associated with a suite of psychological dispositions related to adherence to in-group norms, such as authoritarianism (Murray et al., 2013), conformity and obedience (Murray et al., 2011), collectivism (Fincher et al., 2008), and group-oriented morality (van Leeuwen et al., 2012). At the individual level, various indicators of pathogen threat and disgust sensitivity are linked with increased conformity (Wu & Chang, 2012), right-wing authoritarianism (Liuzza et al., 2018), and lower social trust (Aarøe et al., 2016). A 30-nation study found that pathogen disgust sensitivity is consistently tied to traditionalism, and more strongly so, than to intergroup dominance (Tybur et al., 2016). These dispositions all serve to enforce tradition and in-group norms while decreasing contact with strangers. In short, they all fulfill a basic disease avoidance strategy.

Disgust sensitivity and immigration attitudes

Drawing on the logic of the BIS, scholars have argued that disgust sensitivity may help explain opposition to immigration. As discussed earlier, the BIS is overly cautious, tagging many individuals and objects as potential disease threats. Just as this process results in obese, homeless, or disabled people being tagged as disease threats, it may also represent many members of racial, ethnic, and cultural out-groups as potential threats. This could be attributable to phenotypical group differences, such as skin tone, as well as cultural differences in diet, hygiene, or sexual practices. Indeed, disgust sensitivity consistently predicts opposition to immigration, primarily for ethnically and culturally distinct out-groups (Aarøe et al., 2017; Faulkner et al., 2004). A recent series of experiments provide evidence that this pattern is a by-product of pathogen avoidance mechanisms, rather than a direct response to out-group membership (Petersen, 2017; van Leeuwen & Petersen, 2018). In other words, disgust sensitivity motivates anti-immigration views because an overly sensitive system tags phenotypical and cultural differences as potential indicators of illness.

The predictions of the BIS model fit well within the existing research on immigration. For example,

numerous studies have found that White Americans tend to react more negatively to ethnically and culturally distinct immigrants. For example, several studies have shown that country of origin weighs heavily in immigration attitudes (Brader et al. 2008; Erisen and Kentmen-Cin 2017; Hainmueller & Hangartner 2013; Hartman et al., 2014). Similarly, higher levels of acculturation, signaled by language proficiency, consistently influence immigration attitudes (Hainmueller & Hopkins, 2015; Newman et al., 2012; Sniderman et al., 2004). Thus, many of the characteristics of immigrants that seem to drive opposition to immigration fit within the BIS theory.

One of the most novel implications of the BIS theory, however, has not been extensively tested. Because of the evolutionary origins of the BIS, pathogen disgust sensitivity ought to be linked to anti-immigration attitudes in a wide variety of cultural contexts. However, a systematic literature review revealed that nearly all of the research testing the BIS hypothesis had been conducted in Canada or the United States, and most of this work relied on student samples (Aarøe et al., 2017). There are, of course, some exceptions in the literature. For example, researchers found a significant relationship between disgust sensitivity and opposition to immigration in a student sample in Switzerland (Green et al., 2010). Other studies have used convenience samples in other countries to assess the relationship between disgust sensitivity and concepts related to immigration, such as social dominance orientation (data from 30 nations; Tybur et al., 2016) and travel bans in the context of a pandemic (data from Singapore; Moran et al., 2021), but they did not directly measure immigration attitudes. More recent work has used large, nationally representative samples in both the United States (Kam & Estes, 2016) and Denmark (Aarøe et al., 2017). Overall, however, the existing body of research relies heavily on convenience samples and evidence from the United States and Canada.

The heavy reliance on data from the United States and Canada is problematic for at least two reasons. First, it is possible that the link between disgust sensitivity and immigration attitudes is culturally bound. For example, patterns of political rhetoric or media coverage within a particular country may create a connection between disgust and immigration where one might not otherwise exist. Second, these findings have also focused almost entirely on the attitudes of Whites toward Latino and African immigrants. Thus, examining the BIS hypothesis across a wide variety of countries and cultural contexts is critical for testing the theory.

The common use of convenience samples, and college samples in particular, also raises questions about the generalizability of past work. While some research suggests that convenience samples and representative samples tend to produce similar relationships between personality traits and political variables (Vitriol et al., 2019), there is also evidence that these relationships tend to be overestimated in convenience samples (Clifford et al., 2015). This may be due to higher levels of political knowledge, and thus more constrained belief systems in convenience samples (Kalmoe, 2020).

Overall, the BIS hypothesis has received support across a number of studies. However, in spite of the universal applicability of the hypothesis, it has been tested in only a narrow set of countries and often relies on convenience samples. In the next section, we provide novel tests of the BIS hypothesis in five nations: Norway, Sweden, Turkey, Mexico, and the United States.

A comparative approach to immigration attitudes

The context for immigration varies across our five countries in a number of ways that influence immigration attitudes. To begin with, economic conditions differ substantially. Mexico and Turkey are distinct from the other three countries in having a lower gross domestic product (GDP) per capita as well as higher poverty and inequality rates than the United States, Sweden, and Norway. Turkey, the United States, and Mexico have lower levels of educational attainment among migrants than Norway and Sweden (Organisation for Economic Co-operation and Development [OECD], 2022). The United States and Norway have more similar rates of economic participation between foreign-born and native populations than the other three countries (OECD, 2022). These countries also vary in the generosity of their welfare policies. Norway and Sweden are distinct from the other three countries in having higher social expenditures, as a percentage of their GDP, than the average reported for the OECD (OECD, 2022). Overall, the economic conditions in Mexico and Turkey make them more likely to perceive immigrants as an economic threat than the United States, Norway, and Sweden. Notably, according to our theory, economic factors should be less relevant to disgust sensitivity, but this variation across countries helps establish the generalizability of claims about the role of disgust sensitivity.

Our five focal countries also differ substantially in the social and cultural context for immigration. In Norway, Sweden, and the United States, international migrants make up between 15% and 20% of the population. However, this number is much lower in Turkey (7%) and Mexico (less than 1%; United Nations, 2019). The composition of these immigrant groups differs as well. Refugees make up a small share of international migrants (less than 15%) in all of our cases except Turkey, where nearly two-thirds of all migrants are refugees. Citizens tend to be more accepting of immigrants who are fleeing war or persecution, rather than seeking economic opportunities (Bansak et al., 2016; Hainmueller & Hopkins, 2015).

Perhaps most importantly for our theory, there is variation in the ethnic and cultural similarity between immigrant groups and their host population, which plays a large role in immigration attitudes. For example, shared language and religious identity all influence acceptance of immigrants (Bansak et al., 2016; Hainmueller & Hopkins, 2015). Norway and Sweden are both relatively ethnically homogenous in comparison to the United States, Turkey, and Mexico. Ethnic differences between the host population and immigrant groups are perhaps most stark in Norway and Sweden, where the political focus has been on Middle Eastern immigrants, particularly Muslims. In Turkey, however, Syrian immigrants share a religious identity with a majority of the host population. Although there are more political and social dissimilarities between Turkey and Syria, on religious grounds, a significant majority of the Syrian refugees residing in Turkey are Sunni Muslims, the main religious sect in the country. In Mexico, there are relatively few cultural and ethnic differences between the host population and immigrant groups. Qualitative evidence illustrates how both groups can fake their accents and learn a few key words to either blend in with the crowd or tap into people's sympathy (Acosta-García & Martínez-Ortiz, 2015; Castañeda et al., 2002).

Overall, while disgust sensitivity should play a broad role in immigration attitudes, the expectations are clearest for Norway and Sweden, and the weakest for Mexico.

Overview of the studies

To provide a more comprehensive test of the BIS theory of immigration attitudes, we rely on six surveys conducted in five countries. Each study differed in methodology and measures, which we detail here. Crucially, however, the Norway, Sweden, Turkey, and Mexico

surveys are all probability samples of the population, while the US surveys rely on internet panels.

US sample 1. Respondents were recruited through Qualtrics Panels in May 2016. After excluding inattentive respondents, 786 respondents completed the survey. The sample is not nationally representative, but invitations to participate in the survey were balanced on census demographics (age, gender, ethnicity, and census region) and partisanship. As a result, the sample is highly diverse and similar to the population in many dimensions.

US sample 2. A total of 2,462 respondents were recruited through the Lucid platform in April 2019. Lucid uses a quota sample to match to US Census Bureau demographic margins on gender, ethnicity, education, region, age, and income. Lucid samples tend to closely resemble the demographic composition of nationally representative samples (Coppock & McClellan, 2019).

Norwegian sample. Data from Norway come from the Norwegian Citizen Panel (Norsk Medborgerpanel) hosted by the University of Bergen. Participants were drawn based on a probability sample of the general Norwegian population, with an average active participant pool of about 10,000. Each wave of the survey constitutes a representative cross-section of the Norwegian population. Our data are drawn from wave 3 (October–November 2014), and a subsample of 619 respondents completed our questions about disgust sensitivity. The overall panel recruitment rate for wave 3 was 23.1 percent.

Swedish sample. Data from Sweden come from the Citizen Panel (Medborgarpanelen or MP), which is an online panel survey from the Laboratory of Opinion Research (LORE) hosted at the University of Gothenburg. Each wave of the Citizen Panel is a probability sample recruited through multiple modes of contact. Our questions were included in LORE Citizen Panel 21, which was fielded between May 31 and June 23, 2016. A total of 1,396 respondents completed our disgust sensitivity battery.

Turkish sample. Data come from a stratified random probability sample of 1,224 Turkish voters, which was fielded by Infakto RW. The distribution of the sample across geographical areas and provinces is based on the Nomenclature of Territorial Units for Statistics classification in order to cover the whole country including urban and rural settlements. These interviews include an oversample from four municipalities (Adana, Mersin, Şanlıurfa, and Mardin) in the south and southeastern parts of the country, where Syrian refugees have settled in larger

numbers.² Interviews were conducted face-to-face during May 5–18, 2017. The average length of the interview was approximately 24 minutes. According to American Association of Public Opinion Research (AAPOR) standards, the response rate in our study was 19%, the cooperation rate was 36%, and the refusal rate was 34%.

Mexican sample. Data come from a quarterly omnibus survey fielded by Buendía and Laredo in May 2019. The study consists of a stratified probability sample of 1,000 Mexican adults enrolled to vote, 18 years and older, and residing in housing units within the national territory. Interviews were conducted face-to-face. According to AAPOR standards, the response rate was 59%, the cooperation rate was 84%, and the refusal rate was 11%.

Measures and descriptive statistics

Disgust sensitivity

With a few minor variations, all five studies included the same seven-item measure of pathogen disgust sensitivity, a subscale of the Three Domains of Disgust Scale (TDDS; Tybur et al., 2009).³ Although there are alternative measures of disgust sensitivity, the pathogen disgust subscale of the TDDS is argued to be the best available measure of the BIS (Tybur et al., 2014). The scale asks respondents to imagine a series of scenarios, such as seeing mold on leftovers in your refrigerator, and then rate how disgusting that scenario is on a scale ranging from “not disgusting at all” (1) to “extremely disgusting” (5). The scale has been extensively validated using a variety of methods (Olatunji et al., 2012; Tybur et al., 2009). Olatunji and colleagues (2012) use a behavioral avoidance task (e.g., would the participant be willing to touch an object) as well as an image-viewing galvanic skin conductance measure to demonstrate that the TDDS is correlated with behavior and physiology.⁴ Additionally, pathogen disgust sensitivity, as measured by the TDDS, is substantially heritable (Sherlock et al., 2016) and reliably perceived by others (Karinen et al., 2019). Evidence also suggests that sex

²Using survey weights to account for the oversample does not affect any of the substantive conclusions.

³We do not use a physiological measure because it would not be feasible to carry out on nationally representative samples in multiple countries. Additionally, recent evidence suggests that such physiological measures are highly unreliable (Bakker et al., 2020).

⁴Other similar disgust sensitivity scales have also been behaviorally validated, most often with avoidance tasks (Deacon & Olatunji, 2007; Fan & Olatunji, 2013; Olatunji et al., 2007; Reynolds et al., 2014; Rozin et al., 1999).

Table 1. Measuring pathogen disgust sensitivity.

Item	US (Qualtrics)	US (Lucid)	Norway	Sweden	Turkey	Mexico
Stepping on dog poop	0.73 (0.29)	0.70 (0.29)	0.62 (0.24)	0.76 (0.25)	0.66 (0.33)	0.62 (0.28)
Sitting next to someone who has red sores on their arm	0.42 (0.30)	0.45 (0.32)	0.36 (0.24)	0.29 (0.25)	0.55 (0.36)	0.33 (0.28)
Shaking hands with a stranger who has sweaty palms	0.45 (0.30)	0.47 (0.30)	0.42 (0.22)	0.46 (0.26)	0.68 (0.30)	0.29 (0.26)
Seeing some mold on old leftovers in your refrigerator	0.64 (0.30)	0.58 (0.32)	0.39 (0.26)	0.52 (0.32)	0.69 (0.31)	0.66 (0.25)
Standing close to a person who has body odor	0.63 (0.29)	0.61 (0.29)	0.60 (0.22)	0.69 (0.24)	0.78 (0.25)	0.49 (0.27)
Seeing a cockroach run across the floor	0.63 (0.32)	0.59 (0.32)	0.49 (0.31)	—	—	0.49 (0.31)
Seeing a mouse run across the floor	—	—	—	0.52 (0.34)	0.66 (0.35)	—
Accidentally touching a person’s bloody cut	0.63 (0.32)	0.57 (0.34)	0.57 (0.27)	—	0.63 (0.33)	0.43 (0.31)
Average	0.59 (0.21)	0.57 (0.22)	0.49 (0.16)	0.54 (0.17)	0.67 (0.23)	0.47 (0.17)
Men	0.56	0.53	0.45	0.52	0.63	0.46
Women	0.62	0.60	0.53	0.56	0.71	0.48
Difference	0.06***	0.07***	0.08***	0.04***	0.08***	0.03*
Alpha	0.80	0.82	0.75	0.68	0.85	0.72
Observations	766	2442	1,619	1,396	1,208	974

Notes: * $p < .05$; ** $p < .01$; *** $p < .001$, two-tailed. All variables scaled to range 0–1.

differences in pathogen disgust sensitivity using the TDDS are small, and the scale measures the same constructs across the sexes (Tybur et al. 2011; but see Balzer & Jacobs, 2011).

In addition to being translated into each country’s native language, there is one difference in how the scales were administered. In discussion with colleagues in Sweden, it was determined that a scenario involving a cockroach would be more familiar to respondents if it were replaced with a scenario regarding a mouse. This item was also used in the Turkish sample. Additionally, we were unable to include all seven items in the Swedish survey, so one item was excluded from the scale. The full text of the items is shown in Table 1.

Immigration attitudes

For some of the surveys, we had considerable control over the content of the immigration questions asked, but not for all surveys. As a result, most of our questions were not asked in all surveys, and not all were asked in identical form. As detailed here, we focus our attention on five questions that were asked in similar form in at least three countries. These questions involve preferred immigration levels, whether immigrants bring disease, whether immigration threatens national identity, whether immigrants should have access to

social welfare programs, and whether begging or panhandling should be banned. Regarding the last item, panhandling is strongly associated with immigrants in many countries, though perhaps less so within the United States. In addition to analyzing these items, we also use all of the available items in each study for factor analysis, and so we discuss each additional item in the text below.

US study 1 (Qualtrics). In addition to four common items, the US 1 study included two questions about accepting 75,000 Syrian refugees into the United States and providing financial aid to countries hosting Syrian refugees.

US study 2 (Lucid). In addition to two common items, the US 2 study included a question about accepting Syrian refugees into the United States.

Norwegian study. In addition to two common items, the Norwegian study asked whether “Norwegian Muslims have greater loyalty to other Muslims in the world than to people in this country.”

Swedish study. In addition to four common items, the Swedish study asked two questions about encouraging immigrants to leave Sweden and whether police should be able to interrogate anyone who they believe is in the country illegally.

Turkish study. In addition to three common items, the Turkish study asked about encouraging immigrants to

leave, giving citizenship to refugees who make large financial investments in Turkey, and whether refugees should be given the right to work.

Mexican study. Four common items were included.

Results

We begin our analysis with a discussion of descriptive statistics across each country. All *p*-values reported in the text are two-tailed. The pathogen disgust scale has not been widely used in comparative research, so it is worth some attention to measurement. Table 1 displays the item means, scale means, and standard deviations for each study. To maintain consistency with the following analyses, we rescale each item to range from 0 to 1. The seven items formed a reliable scale in each country, with alphas ranging from 0.68 (Sweden)

to 0.85 (Turkey). Thus, we take the arithmetic mean of the seven items as our measure of disgust sensitivity.

Past work has found consistent gender differences, with women more likely to report higher levels of pathogen disgust sensitivity (e.g., Tybur et al., 2011). Given the importance of gender differences in past research, we examine whether these differences replicate in each of our samples. The results are shown at the bottom of Table 1. In each case, we find that women score significantly higher than men (*ps* < .05), with effect sizes ranging from 0.03 (Mexico) to 0.08 (Turkey), or about 0.16 to 0.50 standard deviations. These findings support the generalizability of gender differences in pathogen disgust and the utility of the scale.

Turning to immigration attitudes, Table 2 displays the question wording and descriptive statistics for the five common items. Starting at the top, four studies

Table 2. Immigration attitudes and descriptive statistics.

Study	% Taking Anti-immigration stance	95% Confidence interval	Question wording
<i>Reduce immigration levels</i>			
US 1	0.44	[.41, .48]	Do you think the U.S. should increase or decrease the number of [<i>low/high</i>]-skilled immigrants who are allowed to come live in the U.S.?
US 2	0.39	[.37, .41]	Do you think the U.S. should increase or decrease the number of immigrants who are allowed to come live in the U.S.?
Sweden	0.34	[.31, .36]	All further immigration to Sweden should be halted.
Turkey	0.83	[.81, .85]	To what extent should we increase or decrease the number of Syrian refugees allowed into Turkey?
Mexico	0.69	[.66, .72]	Do you think Mexico should increase or decrease the number of low-skilled migrants who can live in Mexico?
<i>Immigrants spread disease</i>			
US	0.55	[.51, .58]	Immigrants coming to the U.S. increase the danger of disease outbreaks.
Sweden	0.35	[.33, .38]	Immigrants coming to Sweden increase the danger of disease outbreaks.
Turkey	0.58	[.56, .61]	Refugees coming to Turkey increase the danger of disease outbreaks.
Mexico	0.54	[.51, .57]	Migrants who come to Mexico increase the risk of disease outbreaks.
<i>Loss of identity</i>			
Sweden	0.36	[.34, .39]	Sweden will end up losing its identity if more Muslims come to live here.
Norway	0.45	[.40, .49]	Norway will end up losing its identity if more Muslims come to live here.
Mexico	0.39	[.36, .42]	Mexico will end up losing its identity if more migrants come to the country.
<i>Prevent immigrant access to welfare</i>			
US	0.71	[.67, .74]	Undocumented immigrants should have the same access to welfare benefits as U.S. citizens.
Sweden	0.49	[.46, .52]	Immigrants who are not Swedish citizens, but who live in Sweden, should have the same access to welfare schemes as Swedish citizens.
Norway	0.45	[.43, .48]	Refugees should have the same rights to social assistance as Norwegians have.
Turkey	0.53	[.50, .56]	Immigrants who are not Turkish citizens, but who live in Turkey, should have the same access to welfare programs as Turkish citizens.
Mexico	0.42	[.38, .45]	Undocumented immigrants should have the same access to social security as Mexican citizens.
<i>Ban begging and panhandling</i>			
US 1	0.47	[.44, .51]	Banning panhandling
US 2	0.40	[.38, .42]	Banning panhandling
Norway	0.65	[.62, .69]	Begging should be prohibited in Norway.
Turkey	0.85	[.83, .87]	Begging should be prohibited in Turkey.

Note: All variables scaled to range 0–1.

asked about immigration levels. In the US samples, 39% and 44% of respondents wanted to decrease immigration levels, while 34% in Sweden wanted to halt all immigration. In Mexico, 69% of respondents reported wanting to decrease low-skilled immigration, and 83% of our Turkey sample reported wanting to decrease the number of refugees allowed into the country. While these questions are not directly comparable, there is clearly considerable anti-immigration sentiment in each country.

While the BIS is expected to operate at an implicit level, we were able to include a question in four of our studies assessing the extent to which people explicitly associate immigrants with disease. In three countries—the United States, Turkey, and Mexico—a majority of respondents (54% to 58%) agree that immigrants increase the risk of disease outbreaks. Only in Sweden does this fall below a majority, but still 35% agree with the statement. Thus, many people make an explicit association between immigrants and disease, and this association is not isolated to any individual country. This suggests that this association is not simply a function of the local political context.

Our studies also shared three questions assessing the perceived social and economic costs of immigration. Starting with social costs, a substantial proportion of respondents indicated that immigration posed a threat to their country's national identity in Sweden (36%), Norway (45%), and Mexico (39%). Turning to economic benefits, US respondents were the most opposed to undocumented immigrants receiving welfare benefits (71%), while close to half of the respondents opposed this policy in Sweden (49%), Turkey (53%), and Mexico (42%). A similar number in Norway opposed refugees receiving the same social assistance as citizens (45%). Finally, three countries also included a question about banning panhandling or begging, which is commonly associated with immigrants. Support was lowest in the United States (47%, 40%), where the association between panhandling and immigrants is weaker, while support was high in Norway (65%) and Turkey (85%).⁵ Overall, there is considerable anti-immigration sentiment in all five countries, including Turkey and Mexico, whose native populations have greater cultural and ethnic similarity to the dominant immigrant population. Sweden, on the other

hand, tended to display the lowest levels of anti-immigrant sentiment.

The effects of disgust sensitivity on immigration attitudes

In this section, we turn to our core tests of the relationship between pathogen disgust sensitivity and immigration attitudes. We again focus our attention on the common items across our studies and model each outcome using ordinary least squares (OLS). Following previous work (Aarøe et al., 2017), we control for basic sociodemographics (age, gender, and education) and political identity (ideological identification and/or partisan identity, as available).⁶ Additionally, we control for race and ethnicity, as appropriate. Specifically, we include a dummy variable for White respondents in the United States and a dummy for Kurdish respondents in Turkey.

For the broadest test of the BIS hypothesis, we conducted a factor analysis of all of the available immigration questions in each country, including the noncommon items discussed earlier (see Appendix for details). Each analysis is restricted to a single factor and estimated using maximum likelihood. All items are scored such that higher values correspond with greater opposition to immigration. To aid interpretation, disgust sensitivity is standardized. Figure 1 plots the OLS coefficients for each country (see Appendix for model details).⁷

As is clear, the BIS hypothesis is supported across all countries. All coefficients are statistically significant, even when applying the Holm correction for multiple comparisons. Of course, because different sets of items were used to construct the factor scores, the coefficients may not be directly comparable across countries. However, it is worth examining the effects within each country. Across the various models, a one standard deviation increase in disgust sensitivity is associated with an increase in opposition to immigration that ranges from 0.09 standard deviations to 0.21 standard deviations.

⁶Political ideology and partisanship are arguably post-treatment to disgust sensitivity (Aarøe et al., 2020). However, given the weak relationship between disgust and these variables, and the evidence that it makes little difference to the results above, we opt to include these controls.

⁷Bivariate correlations between disgust sensitivity and the immigration factor score are all statistically significant and range from $r = .06$ (Turkey) to $r = .20$ (United States, Sweden). See Table 3 for further detail.

⁵Notably, in the factor analyses of immigration attitudes, the factor loading for the panhandling item was the weakest in the United States and the strongest in Norway.

Disgust sensitivity and immigration support

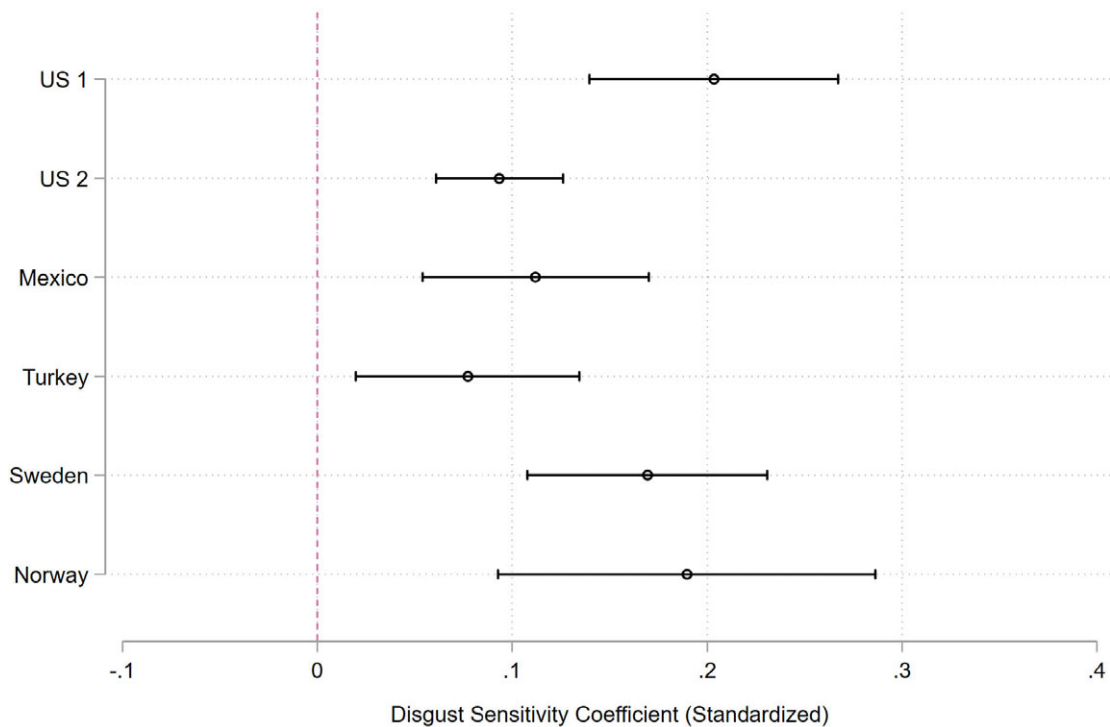


Figure 1. Disgust sensitivity and opposition to immigration (factor score). Figure displays estimated regression coefficients and 95% confidence intervals.

For comparison, we examine education, which has long been considered an important force in immigration attitudes (e.g., Hainmueller & Hiscox, 2007). Across these same models, the standardized magnitude of holding at least a college degree ranges from .09 to .25. Thus, the effects of disgust sensitivity are quite similar in magnitude to the effects of a variable that has long been considered a crucial factor in immigration attitudes.⁸ As shown in Table 3, whether or not we control for ideological and partisan identification makes little substantive difference, consistent with only weak relationships between disgust sensitivity and these variables (Kam & Estes, 2016; Terrizzi et al., 2013).

We can make better comparisons across countries by focusing on single questions that were similar or identical across multiple countries. The coefficients for disgust are displayed for each outcome and each country in Figure 2 (see Appendix for model details). All dependent variables are scored such that higher values indicate greater opposition to immigration. The

⁸The effects for both disgust sensitivity and education are substantively identical when excluding the “spreads disease” item from the factor analysis that generates the outcome variable.

top panel displays the results for increasing or decreasing immigration levels. Disgust sensitivity has a positive and significant effect in all three countries available (Turkey, Norway, United States), and of roughly similar magnitude. Standardized effects range from .07 to .13. To examine whether there is meaningful variation across countries, we estimated two alternative models: one with country dummy variables, and one in which country dummies are interacted with disgust sensitivity, allowing the relationship to vary across the country. Model fit is slightly better for the simpler model according to the BIC and Bayes factor, but the evidence is equivocal (for further details, see Appendix).

Turning next to whether immigrants spread disease, the effect is positive and significant in all four countries we tested (United States, Mexico, Turkey, Sweden). The next panel down displays results for the question of whether immigration threatens the identity of the host nation. The effect of disgust is positive and significant for Sweden and Norway, but it is small and not statistically significant in Mexico. However, we cannot rule out a modest association in this case. The last two panels focus on policies that are more

Table 3. Robustness checks on the effects of pathogen disgust sensitivity.

	US 1	US 2	Norway	Sweden	Turkey	Mexico
<i>Baseline models</i>						
Disgust sensitivity only	0.20***	0.09***	0.15**	0.20***	0.07*	0.14***
Demographics	0.20***	0.12***	0.20***	0.20***	0.07*	0.12***
Symbolic ideology (+ demographics)	0.19***	0.09***	0.15***	0.13***	0.08*	
Partisanship (+ demographics)	0.21***	0.12***			0.09**	0.13***
Ideology & partisanship (+ demographics)	0.20***	0.10***			0.09**	
<i>Baseline + models (include all available covariates above)</i>						
Sexual disgust sensitivity	0.21***					
Social/sexual policy attitudes	0.15***	0.08***	0.15***			
Moral disgust sensitivity	0.20***					
Big Five personality traits		0.08***				
Humanitarianism	0.21***					
Authoritarianism	0.16***					

Note: Standardized coefficients presented for pathogen disgust sensitivity in the corresponding model. * $p < .05$; ** $p < .01$; *** $p < .001$, two-tailed. Blank cells represent models that cannot be estimated due to unavailable measures.

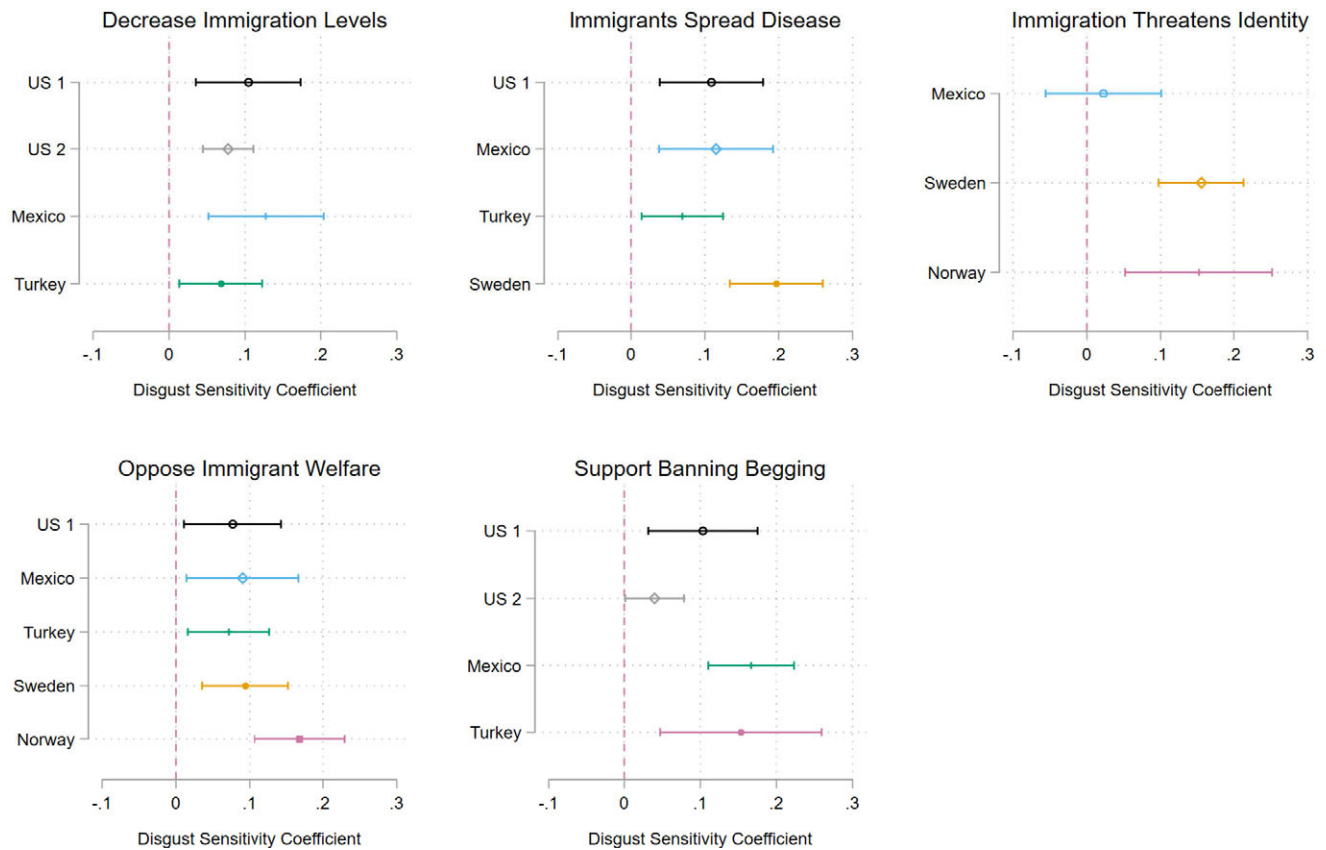


Figure 2. Effects of disgust sensitivity on immigration attitudes. Figure displays estimated regression coefficients and 95% confidence intervals.

oriented toward economics. In all five cases, including Turkey and Mexico, disgust is associated with opposition to providing welfare to immigrants and there is little apparent variation in effect size. Finally, the

effect of disgust on banning begging is positive and significant for all three countries. Overall, the effects of disgust sensitivity are largely consistent across the five questions that were asked in at least three

countries, supporting the generalizability of the relationship between disgust sensitivity and immigration attitudes.

Robustness to alternative explanations

Additional variables measured in each dataset allow us to test alternative explanations of the relationship between disgust sensitivity and immigration attitudes and explore the robustness of this relationship. To simplify our analyses, we focus on the immigration factor score as the outcome in each case.⁹ We estimated a series of models predicting immigration attitudes as a function of disgust sensitivity and alternative sets of covariates. To briefly summarize these results, [Table 3](#) displays standardized coefficients for disgust sensitivity in each model with asterisks denoting statistical significance. Blank cells represent models that cannot be estimated due to unavailable covariates.

To summarize the findings, disgust sensitivity is significantly related to anti-immigration attitudes in every single model we estimated. This includes models with no covariates, models with only demographics, and models that include ideological identity and/or partisanship (in addition to demographics). Thus, our findings are robust to a variety of specifications and not driven by suppression effects (Lenz & Sahn, 2021). More importantly, the effect size is largely unaffected by the inclusion of covariates.

The lower half of the table presents a series of models that allow us to test a number of alternative hypotheses. Each of these models includes all of the controls described earlier. The primary alternative explanation is that disgust sensitivity is related to social conservatism, but that disgust has no unique effects on immigration attitudes. For example, it may be that disgust sensitivity motivates social conservatism because of attitudes toward sexuality, such as gay rights and abortion, and the relationship between disgust sensitivity and immigration attitudes is only due to their shared relationship with social conservatism (Billingsley et al., 2018; Tybur et al., 2015). On this view, the link between disgust sensitivity and immigration attitudes is spurious. We can test this in multiple ways in the United States and Norway. First, one of our samples (US 1) includes the full TDDS, including sexual disgust sensitivity. If the relationship between pathogen disgust sensitivity and immigration attitudes is entirely driven by

attitudes connected to sexuality, then controlling for sexual disgust sensitivity should eliminate the effect of pathogen disgust sensitivity (Billingsley et al., 2018; Shook et al., 2015). However, consistent with our theory, pathogen disgust sensitivity remains significantly related to immigration attitudes, while sexual disgust sensitivity is not. Additionally, both US studies and Norway include issue attitudes related to sex, such as abortion, same-sex marriage, polygamy, and transgender rights. In each study, we created an index of these social policy attitudes and added them as a control.¹⁰ If the relationship between pathogen disgust sensitivity and immigration attitudes is merely a product of more general social conservatism, then controlling for social policy attitudes should eliminate any effect of pathogen disgust. However, in each case, the effect of pathogen disgust remains positive and significant. Thus, social conservatism and sexual attitudes do not explain the consistent relationship between disgust sensitivity and immigration attitudes.

In addition, we have a host of other variables that are related to immigration attitudes. Similar to Aarøe, Petersen, and Arceneaux (2017), we find that controlling for the Big Five personality traits does not affect our inferences. Neither do controls for moral disgust sensitivity, authoritarianism, or humanitarianism substantively affect our results. Overall, the results are quite robust to alternative explanations and model specifications.

Conclusion

As the topic of immigration increasingly takes center stage in politics, understanding the nature of immigration attitudes among the mass public is as important as ever. Psychological research suggests that the intensity of immigration attitudes may derive in part from an evolved disease avoidance mechanism. In this article, we expanded on this research by providing the broadest test of this explanation to date. Our results show consistent support for the BIS hypothesis across five countries that vary considerably in economic and social conditions, as well as cultural distance between the host and immigrant populations. These findings support the universality of the BIS hypothesis.

¹⁰Specifically, in US 1, the measure of sexual attitudes consists of 13 questions on abortion, same-sex marriage, transgender rights, and polygamy. In US 2, the measures consist of two items on transgender rights and same-sex marriage. In Norway, our measure of sexual attitudes consists of a single item measuring attitudes toward gay rights.

⁹Results are substantively identical when using a factor score that omits the “spread disease” item. See Appendix for details.

While our findings rely on observational methods, they are consistently robust to a variety of alternative potential explanations, including controls for partisanship and ideological identification, issue-based measures of social conservatism, sexual disgust sensitivity, as well as other personality traits and psychological dispositions. Additionally, the magnitude of the effects of disgust sensitivity is similar to the effects of education, a variable that has long been concerned a central factor in explaining immigration attitudes. Thus, we confirm a substantively important relationship between pathogen disgust sensitivity and immigration attitudes that is not readily explained by alternative factors. Nonetheless, there is recent evidence that many stable personality traits may not be exogenous to politics (Bakker et al., 2021; Boston et al., 2018; Luttig, 2021), and thus further research is needed to identify a causal effect of disgust sensitivity.

While we found consistent support across all five countries we studied, the findings were similar across countries. This runs contrary to the expectation that greater ethnic and cultural similarity between immigrant and host populations should decrease the magnitude of the relationship between disgust sensitivity and opposition to immigration. However, we were unable to directly measure perceived ethnic or cultural similarity and may have had insufficient statistical power to observe variation across countries. Thus, an important avenue for future work is to explore the specific mechanisms that drive the relationship between disgust sensitivity and immigration attitudes, and how the levels of the mechanisms vary across countries and contexts.

Understanding the source and nature of anti-immigration attitudes may help provide new insight into dealing with this form of intergroup conflict. Social contact has long been considered one of the most promising solutions to conflict. However, those who are high in disgust sensitivity are the most likely to avoid such contact (Aarøe et al., 2017), creating a potential roadblock to this solution. Additionally, people high in disgust sensitivity may be more likely to have negative experiences with intergroup contact, in turn affecting intergroup attitudes (Sirin et al., 2017). Thus, gaining an understanding of the emotional roots of immigration attitudes may help to understand the challenges to attitude change.

Supplementary Materials

To view supplementary material for this article, please visit <http://doi.org/10.1017/pls.2022.6>.

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