Evolutionary Psychological Science (2022) 8:333–342
https://doi.org/10.1007/s40806-022-00321-4

RESEARCH ARTICLE

The Behavioral Immune System and Intergroup Bias: Evidence for Asian-Specific Bias at the Onset of the COVID-19 Pandemic

Anastasia Makhanova[1]

Received: 4 February 2022 / Revised: 22 March 2022 / Accepted: 2 April 2022 / Published online: 18 April 2022

Abstract

Pathogen avoidance has been linked to biases against various groups of people, including ethnic outgroups. The present research explored how a non-hypothetical pathogen threat associated with a specific foreign ecology may differentially prompt biases against different ethnic groups. Two studies used an experimental design to examine how the salience of the COVID-19 threat (in early 2020, before COVID-19 was labeled a pandemic) affected perceptions of targets from different racial groups. Study 1 ($N = 375$; Prime Panels) found that participants in the COVID-19 threat condition, compared to those in the non-pathogen threat condition, perceived all social targets to be more contagious, with the effect being stronger for Asian targets relative to Latino, Black, and White targets. Study 2 ($N = 167$; undergraduate sample) found that participants in the COVID-19 threat condition, compared to those in the non-pathogen threat condition, were more likely to categorize Asian (but not Latino, Black, or White) targets as outgroup members in a modified minimal group paradigm. Data suggest that the patterns of biases prompted by pathogen avoidance may dynamically change depending on salient heuristic associations.

Keywords Pathogen avoidance · COVID-19 · Assortative sociality · Asian prejudice · Intergroup bias

Introduction

At the beginning of the COVID-19 pandemic, American media reports documented wariness of and violence against Asian-Americans. Asian-Americans were targeted because of the association between the novel disease threat and its country of origin—China. Such prejudice against ethnic groups in the context of pathogen threat can be understood from the perspective of research on the behavioral immune system (i.e., the psychological processes that help people avoid pathogens; Schaller & Park, 2011). Pathogen avoidance motives have been linked to prejudice against others from different racial and ethnic backgrounds. However, it is unknown whether the ecological origins of a pathogen threat influence which groups are targeted by such biases. The present research thus leveraged data collection during a time when COVID-19 was an ambiguous threat (prior to the World Health Organization announcing the pandemic) to advance the theoretical understanding of the behavioral immune system and resulting intergroup biases. Specifically, I examined cognitive biases that may precipitate overt prejudice and discrimination. Across two studies, I explored whether the threat of COVID-19 was associated with any of three patterns of intergroup bias suggested by the behavioral immune system literature.

Pathogen Avoidance and Bias Against Ethnic Outgroups

The recurring pressure to avoid disease has shaped psychological processes such that people possess affective, behavioral, and cognitive strategies that help them avoid objects and people that pose a pathogen threat (Ackerman et al., 2018; Navarrete & Fessler, 2006; Oaten et al., 2017; Schaller & Park, 2011; Tybur et al., 2013). In addition to avoidance of actual pathogen sources, the behavioral immune system also prompts avoidance of others who are only *heuristically* associated with disease (Schaller & Park, 2011). When motivated to avoid pathogens, people demonstrate biases against others who are elderly, overweight, have physical abnormalities, or are perceived as foreign (e.g., Ackerman et al., 2009; Faulkner et al., 2004; Miller & Maner, 2012).

✉ Anastasia Makhanova
ammakhan@uark.edu

[1] Department of Psychological Science, University of Arkansas, 216 Memorial Hall, Fayetteville, AR 72701, USA

The link between pathogen threat and biases against people of different racial and ethnic backgrounds has been the subject of much interest, as well as recent debate. Chronic and situationally activated pathogen avoidance is associated with negative attitudes toward immigrants from less familiar (versus more familiar) backgrounds (Faulkner et al., 2004), as well as general xenophobia and ethnocentrism (Navarrete & Fessler, 2006). The association between pathogen avoidance and social biases against people perceived as foreign is robust (Aarøe et al., 2017; Brown et al., 2019; Huang et al., 2011; Makhanova et al., 2020; O'Shea et al., 2020; Oaten et al., 2017). However, the theoretical explanation of this association has recently been debated (Ji et al., 2019; Karinen et al., 2019; Petersen, 2017; van Leeuwen & Petersen, 2018).

Although some theories argue that prejudice against racial outgroups arises from the threat of novel pathogen transmission (Fincher & Thornhill, 2008, 2012), others critique this explanation because contact with different racial groups was infrequent in the evolutionary past, so a specific selection pressure for this bias was unlikely to exist (Fessler et al., 2015). Indeed, racial outgroup membership does not appear to activate pathogen avoidance strategies (van Leeuwen & Petersen, 2018). Moreover, the link between pathogen threat and prejudice against immigrants may be more closely connected to the perpetuation of local cultural norms that stave off pathogen contagion rather than the frequency of social contact (Karinen et al., 2019). Several other perspectives additionally contend that pathogen avoidance is associated with ethnic outgroup prejudice because of heuristic associations between ethnic outgroups and disease (Faulkner et al., 2004; Schaller et al., 2003; van Leeuwen & Petersen, 2018). Thus, there may be important contextual factors that can clarify the relationship between pathogen threat and outgroup bias.

One contextual factor that may affect intergroup biases related to pathogen threat is a pathogen threat linked to a specific ecology. As Ebola was linked to Africa and Zika to Latin America, the 2020 threat of COVID-19 was linked to Asia. Although past research on the behavioral immune system and outgroup bias suggests that COVID-19 threat may prompt biases against racial and ethnic outgroups, the literature does not have a clear singular prediction for which targets may be targeted by such a bias. Indeed, at least three possible patterns are theoretically plausible.

Potential Patterns of Bias in the Context of COVID-19 Threat

Theoretical perspectives within the behavioral immune system literature diverge to put forth at least three potential patterns of bias that may be observed among American participants in the face of a pathogen threat linked to China (see Table 1). First, there may be evidence for an outgroup-general bias; people may demonstrate avoidance of targets from all racial or ethnic outgroups. For example, White Australian participants with vulnerable immune systems (compared to those without immune system vulnerabilities) were more likely than control participants to assume non-White targets regardless of race were more likely to be contagious than White targets (Oaten et al., 2017). Other research has demonstrated that chronic and situational concerns about pathogen threat are associated with general ethnocentrism and xenophobia (Kim et al., 2016; Navarrete & Fessler, 2006). In the face of the Ebola threat in 2014, people who felt more vulnerable to Ebola were more likely to demonstrate general xenophobia (Kim et al., 2016). Although those researchers measured specific prejudice against West Africans and undocumented immigrants, factor analyses supported a single latent variable that included the specific prejudice targets and general ethnocentrism. In the context of COVID-19 threat, the outgroup-general hypothesis would thus result in equivalent bias against Black, Latino, and Asian targets.

Second, there may be evidence for a foreign-specific bias; people may demonstrate avoidance of targets from racial or ethnic groups that are subjectively foreign but not to a racial outgroup that is not perceived as foreign. For example, the use of the same paradigm as Oaten et al. (2017) in America resulted in a different pattern than in Australia: pathogen avoidance motives were linked to biases against Latino and Asian targets, but not Black targets (Makhanova et al., 2020). This difference may be because Australians, but not Americans, perceive Black targets as foreign. Furthermore, the degree to which people perceive a given foreign group as unfamiliar versus familiar is important for eliciting biases linked to pathogen avoidance motives (Faulkner et al., 2004). Finally, peripheral support for this hypothesis comes from numerous studies that have specifically

Table 1 Potential patterns of bias that may be associated with the threat of COVID-19

Potential pattern of bias	Target group		
	Asian	Latino	Black
Outgroup-general: bias against all racial or ethnic minority groups (e.g., Oaten et al., 2017)	x	x	x
Foreign-specific: bias against target groups perceived as foreign (e.g., Faulkner et al., 2004; Makhanova et al., 2020)	x	x	
Ecology-specific: bias against target groups heuristically linked to the ecology of the pathogen threat	x		

examined anti-immigrant biases in the context of chronic and situational concerns about pathogen threat (Aarøe et al., 2017; Brown et al., 2019; Huang et al., 2011; Ji et al., 2019; Karinen et al., 2019). In the context of COVID-19 threat, the foreign-specific hypothesis would thus result in bias against Latino and Asian targets, but not Black targets.

Third, there may be evidence for an ecology-specific bias; people may demonstrate avoidance of targets specifically from an ecology associated with a given pathogen threat. This prediction stems from perspectives contending that pathogen avoidance is associated with ethnic outgroup prejudice because of heuristic associations between ethnic outgroups and disease (Faulkner et al., 2004; Schaller et al., 2003; van Leeuwen & Petersen, 2018). If cognitive associations between disease and particular groups are important for responses prompted by the behavioral immune system, there are important corollaries to this general hypothesis. First, pathogen avoidance should prompt greater biases against targets with stronger (versus weaker) heuristic links to disease. Second, associations between pathogen avoidance and biases against specific ethnic outgroups should be dynamic rather than static because people readily form new cognitive associations and existing associations can change in salience. Furthermore, heuristic biases that are malleable and sensitive to relevant social information would be more adaptive than biases that are not attuned to contextual information.

Although these specific predictions have not been tested, some research is suggestive of the importance of situational heuristic effects for prompting bias against outgroups. For example, cultural beliefs have been shown to affect other patterns of bias observed in the context of pathogen threat (Duncan & Schaller, 2009; Wu et al., 2015, 2019). Moreover, people concerned with pathogens for whom the link between immigration and disease was made salient (versus the link between immigration and non-disease threat) demonstrated negative attitudes toward immigration and greater desire to erect border walls (Brown et al., 2019). Furthermore, the association between pathogen avoidance and negative attitudes toward immigrants depends on whether the immigrants are from a pathogen-rich ecology rather than an unspecified ecology (Ji et al., 2019). A study conducted during the Ebola outbreak found that individual differences in perceived vulnerability to Ebola (a disease heuristically linked to Africa) were positively associated with xenophobia, operationalized as a latent variable that included prejudice against West African and several indicators of general ethnocentrism (Kim et al., 2016). However, no prior research has examined how an ecology-specific pathogen threat can differentially affect biases against multiple ethnic outgroups. In the context of COVID-19 threat, the ecology-specific hypothesis would result in bias against Asian targets, but not Black or Latino targets.

Current Research

To explore which pattern of bias—outgroup-general, foreign-specific, or ecology-specific—would emerge in the context of a looming pathogen threat, I conducted two studies in February and early March of 2020 to examine how a real, rather than hypothetical, pathogen threat affected cognitive biases against targets from different racial groups. Across both studies, I explored how the upregulated salience of the threat of COVID-19 would affect biases against targets that are White, Black, Latino, and Asian.

Study 1

Study 1 experimentally manipulated the salience of the COVID-19 threat and examined effects on perceived contagion risk from individual targets belonging to different racial groups (Asian, Latino, Black, or White).

Method

All levels of independent variables and all dependent measures that were analyzed for this article's target research question are reported in the "Method" sections of both studies. Additionally, all exclusions and reasons for making exclusions are outlined. All study materials and relevant data for both studies are available on OSF: https://osf.io/vxdu3/

Participants

Participants ($N=527$) were recruited via Prime Panels (Chandler et al., 2019). Fifty-six participants were excluded because their answers to free-response questions indicated nonhuman or nonattentive responding (i.e., nonsensical answers) that has been attributed to participants from worker farms and used as exclusion criteria in prior research (Karinen et al., 2019). Additionally, 77 participants were excluded because they spent fewer than 10 s on the page with the article prime (cut off used in prior research; Makhanova et al., 2019), and 19 participants were excluded because they explicitly stated they did not believe the article they read was real. Thus, the final sample consisted of 375 participants. Participants were on average 40 years old ($M=40.39$, $SD=13.54$). The majority of participants self-identified as female ($n=254$; 67.7%); 119 participants self-identified as male (31.7%), one as transgender, and one as other. Most participants were White ($n=288$, 76.8%), 46 were Black or African American (12.3%), 24 were Latino (6.4%), 9 were Asian or Pacific Islander (2.4%), 3 were Native American, 3 were multiracial, 1 self-identified as other, and 1 participant did not wish to report their race or ethnicity. Participants reported being around the

midpoint for political orientation ($M = 5.31$, $SD = 2.66$) on a 10-point scale (1 = Very liberal; 10 = Very conservative) and for religiosity ($M = 5.25$, $SD = 3.16$) on a 10-point scale (1 = Not religious at all; 10 = Very religious).

Procedure and Materials

Data were collected in mid-February of 2020, approximately 3 weeks before the World Health Organization made the official pandemic announcement regarding COVID-19. Participants were randomly assigned to one of two conditions: COVID-19 threat ($n = 194$) or storm threat ($n = 181$). The COVID-19 article was adapted from past research that has primarily heighted pathogen threat with information about real (e.g., H1N1) or fictitious flu pandemics (Makhanova et al., 2020; Miller & Maner, 2012). The control article described dangers posed by a severe storm season that was likewise adapted from prior research. The articles are available in the supplemental materials.

The key dependent measure involved participants' assessments about the contagion risk posed by neutral face targets. This measure was adapted from prior research demonstrating that Australian participants with rheumatoid arthritis (an illness that suppresses the immune system) reported being more likely to catch a disease from targets who were non-Caucasian (i.e., African, Asian, and Indian) (Oaten et al., 2017). In the present research, participants were told that they would see photographs of individuals who were instructed to hold a neutral facial expression, but that some of these individuals were ill at the time the photo was taken, and the researchers wanted to examine if participants could identify those individuals using their gut instincts. Then, participants saw 12 male faces (3 White, 3 Black, 3 Latino, 3 Asian) in random order; stimuli were drawn from the Chicago Face Database (Ma et al., 2015) and were the same set used in past research (Makhanova et al., 2020). Participants were not given any information about the origin of the targets. For each target face, participants answered how likely they were to catch a disease from this person on a 7-point scale (1 = Not at all likely; 7 = Very likely). Ratings of the three faces in each category were averaged.

Results

Preliminary Analyses

First, I used independent sample *t* tests to examine whether the perceived contagion risk posed by the four target groups was influenced by condition. Consistent with the hypothesis that situational salience of pathogen threat activates psychological strategies associated with vigilance to possible sources of contagion, participants in the COVID-19 threat condition (compared to those in the weather threat condition) reported being more likely to catch a disease from all target groups (see Table 2). With the final sample size, sensitivity analyses conducted in G*Power indicated that the study had 80% power to detect between-group differences with the effect size $d = 0.29$.

Table 2 Mean differences between conditions for perceptions of contagion risk

Target group	Weather *M* (*SD*)	Coronavirus *M* (*SD*)	*t*	*p*	*Cohen's d*
White	3.41 (1.39)	3.85 (1.48)	2.94	.003	0.31
Black	3.13 (1.33)	3.57 (1.44)	3.01	.003	0.32
Latino	3.34 (1.32)	3.80 (1.47)	3.15	.002	0.33
Asian	3.27 (1.39)	3.90 (1.52)	4.21	<.001	0.43

As an initial step to begin examining whether effects of condition were stronger for one group compared to other groups, perceived contagion risk for each target group was regressed onto condition as well as the perceived contagion risk for the other three groups. Controlling for perceived contagion risk from other groups, condition no longer predicted perceived contagion risk for White targets, $b = 0.10$, $SE = 0.10$, $t(370) = 0.92$, $p = 0.358$, 95% CI [−0.11, 0.30], semi-partial $r = 0.03$; Black targets, $b = -0.04$, $SE = 0.07$, $t(370) = -0.55$, $p = 0.584$, 95% CI [−0.18, 0.10], semi-partial $r = -0.01$; or Latino targets, $b = -0.02$, $SE = 0.07$, $t(370) = -0.32$, $p = 0.752$, 95% CI [−0.16, 0.11], semi-partial $r = -0.01$. The only target group for which condition remained a significant predictor when controlling for perceived contagion risk from other groups was the Asian target group, $b = 0.24$, $SE = 0.09$, $t(370) = 2.74$, $p = 0.006$, 95% CI [0.07, 0.41], semi-partial $r = 0.08$.

Primary Analyses

To assess which pattern of bias emerged in the data, I used a mixed-model 2 (between-subject: condition) × 4 (within-subject: target group) GLM that compared the effect of condition on three planned contrasts consistent with each pattern of bias. Although the omnibus test for the differential effect of condition on the four groups was not significant, $F(3,371) = 1.59$, $p = 0.191$, I nevertheless followed up to examine the theoretically derived a priori contrasts outlined in the introduction (e.g., Ruxton & Beauchamp, 2008). First, to examine the outgroup-general hypothesis, I used a contrast comparing the average of the three non-White targets (Black, Latino, and Asian) to the White targets. Condition did not differentially affect the perceived contagion risk posed by these two groups, $F(1,373) = 0.41$, $p = 0.522$. Additionally, in a 2 × 3 GLM with just the three non-White target types, condition appeared to differentially affect the three target types, $F(2,746) = 2.99$, $p = 0.050$.

Second, to examine the foreign-specific hypothesis, I used a contrast comparing Latino and Asian targets to White and Black targets. Condition did not differentially affect the perceived contagion risk posed by these two groups, $F(1,373) = 2.00$, $p = 0.158$.

Finally, I tested the ecology-specific hypothesis by using a contrast comparing Asian targets to the average of the other three targets (Latino, Black, and White). Results supported the prediction that perceived contagion risk of Asian targets was more strongly affected by the article manipulation than were the other three targets, $F(1,373) = 4.22$, $p = 0.041$. This key contrast was not further moderated by participant race (0 = White, 1 = Non-White), $F(1,371) = 0.05$, $p = 0.823$, but remained significant in analyses controlling for participant race, $F(1,372) = 4.27$, $p = 0.039$. As ancillary exploratory analyses, I examined whether other models with a similar contrast structure yielded significant results. Latino targets were not more strongly affected by the article manipulation than were the other three targets, $F(1,373) = 0.45$, $p = 0.505$. Black targets were not more strongly affected by the manipulation than were the other three targets, $F(1,373) = 1.21$, $p = 0.271$.

Discussion

Participants who read about the threat of COVID-19, relative to those who read about the threat of severe storms, demonstrated greater perception of contagion risk for *all four* target groups. However, findings provided some initial support for the ecology-specific hypothesis relative to the outgroup-general or foreign-specific hypotheses. That is, biases prompted by the behavioral immune system may be influenced by heuristic information associated with a salient pathogen threat.

The initial support for the ecology-specific bias hypothesis is tentative given the results of the statistical analyses and several methodological limitations. First, there were only three targets for each group and all targets were male. Second, because the task directly asks participants to gauge contagion risk from targets, responses may have been more strongly influenced by demand-related biases in the present design (i.e., when presented after an article manipulation that explicitly discusses contagion risk) than in the original study that used this dependent measure (i.e., when no priming was used because research focused on an individual difference; Oaten et al., 2017). To address these limitations, Study 2 used a different dependent measure of social bias and expanded the number and gender of targets.

These limitations notwithstanding, it is additionally worth comparing the current results with those of two studies that used a highly similar design but were conducted 3 months prior and primed participants with the threat of a novel flu (a pathogen threat not associated with a foreign ecology). In these studies, only a main effect of condition emerged with no differences between racial groups (see Supplemental Materials). Thus, the ecology-specific threat posed by COVID-19 appears to prompt a different pattern of bias on this measure than an ecology-general threat.

Study 2

To replicate and extend Study 1, I examined how the threat of COVID-19-affected biases in social categorization. To the extent that people have more negative attitudes toward outgroup members compared to ingroup members even in nominal groups (Tajfel et al., 1971), categorizing targets as outgroup members is a basic sociocognitive process that may facilitate the development of prejudicial attitudes and discriminatory behavior. Indeed, whereas categorizing targets as ingroup members demonstrates perceived similarity and liking, categorizing targets as outgroup members is reflective of othering and greater social distance. Past research used a modified minimal group paradigm to demonstrate that pathogen avoidance motives were associated with outgroup categorization of targets heuristically associated with disease (e.g., elderly targets; Makhanova et al., 2015). Study 2 used the same paradigm to examine whether the threat of COVID-19 is associated with the likelihood of Asian, Black, Latino, and White targets being categorized as minimal outgroup members.

Method

Participants

Participants were drawn from the undergraduate subject pool. Although I intended to recruit a larger sample, 185 people completed the survey before the university shut down due to COVID-19. This event served as the stopping rule for data collection. Data collection began on March 4, 2020, and ended on March 11, 2020 (the day the World Health Organization announced the pandemic, the university closed on March 12, 2020). Nineteen participants were excluded from analyses because they either incorrectly identified their assigned personality type or spent fewer than 10 s reading their assigned article. Thus, the final sample consisted of 167 participants. Participants were on average 20 years old ($M = 19.94$, $SD = 2.46$). Slightly more than half of the participants self-identified as female ($n = 98$, 58.7%) and 69 self-identified as male (41.3%). Most participants were White ($n = 133$, 79.6%), 7 were Black or African American (4.2%), 13 were Latino (7.8%), 8 were Asian or Pacific Islander (4.8%), 1 was Native American, and 5 identified as multiracial. In terms of political orientation, participants reported being around the midpoint ($M = 5.54$, $SD = 2.24$) on a 10-point scale (1 = Very liberal;

10 = Very conservative). Participants indicated being fairly religious ($M = 6.51$, $SD = 2.74$) on a 10-point scale (1 = Not religious at all; 10 = Very religious).

Procedure and Materials

After completing an online informed consent page, participants completed an ostensible personality questionnaire which consisted of 40 questions (all study materials are available in the Supplemental Materials). Supposedly on the basis of their answers to these questions, participants were randomly assigned to either the "Green" or "Orange" personality type. Participants were told that there were two possible personality types but were not given any other information. Specifically, they saw the following information: "At this point in the study, we cannot tell you just yet what these personality types represent. We will give you more information when you are done with the study. The reason for this is because there is evidence that people have strong intuitions or gut feelings about these personality types, even without knowing information. For this study, we are specifically interested in these intuitions."

Under the guise that the researchers were interested in cognitive processes of people with these personality types, participants were next asked to read a recent news article. Participants were randomly assigned to read an article about either the threat of severe weather storms ($n = 83$) or of the Coronavirus ($n = 84$). To encourage participants to reflect on the article, they were asked an open-ended question "What thoughts came to mind when reading the article? What precautions do you think you will take to reduce the risk of this threat to you and your family?".

Next, participants were reminded of their assigned personality type before beginning the categorization task which served as the main dependent measure of sociocognitive bias. Participants were told that they would see photographs of people and they would have to use their intuition to guess whether the person was in their same personality type or in the other personality type. Participants saw 40 photographs (5 White men, 5 White women, 5 Black men, 5 Black women, 5 Latino men, 5 Latina women, 5 Asian men, and 5 Asian women). All faces were drawn from the Chicago Face Database (Ma et al., 2015). Within each group (e.g., White men), I first excluded all faces that were pre-rated lower than 0.85 on race prototypicality. Next, faces were excluded if they were 2 standard deviations (SD) above the mean for age, 1 SD above or below the mean on attractiveness, and 1 SD above the mean for ratings of being disgusted, happy, threatening, trustworthy, or unusual. From the resulting list, five targets were chosen for each group. I collapsed across target sex and created a total for how many targets (out of 10) from each racial group participants categorized as belonging to the minimal outgroup. Participants were not given any information about the origin of the targets.

Table 3 Mean differences between conditions for outgroup categorizations in Study 2

Target group	Weather *M* (*SD*)	Coronavirus *M* (*SD*)	*t*	*p*	*Cohen's d*
White	5.52 (1.81)	5.37 (1.94)	−0.52	.608	−0.08
Black	4.65 (1.66)	4.27 (1.70)	−1.45	.150	−0.23
Latino	5.46 (1.80)	5.64 (1.70)	0.68	.495	0.10
Asian	4.94 (2.14)	5.68 (2.35)	2.12	.035	0.33

Results

Again, the preliminary analyses used independent sample *t* tests to examine whether the number of outgroup categorizations for targets in each racial group was influenced by condition. Participants in the COVID-19 threat condition were more likely to categorize Asian targets as minimal outgroup members compared to participants in the control condition (see Table 3).[1]

As in Study 1, I used a mixed-model 2 (between-subject: condition) × 4 (within-subject: target group) GLM that compared the effect of condition on the planned contrasts examining whether condition differentially affected the four target types (White, Black, Latino, and Asian). The omnibus test did not reach traditional levels of significance, $F(3,163) = 2.64$, $p = 0.051$. First, to examine the outgroup-general hypothesis, I used a contrast comparing the average of the three non-White targets (Black, Latino, and Asian) to the White targets. As in Study 1, condition did not differentially affect the perceived contagion risk posed by these two groups, $F(1,165) = 0.98$, $p = 0.325$. Among the three non-White target types, condition appeared to differentially affect the three target types, $F(2,330) = 3.51$, $p = 0.031$.

Next, I examined the foreign-specific hypothesis by using a contrast comparing Latino and Asian targets to White and Black targets. The effect of condition was significantly stronger for outgroup categorization of Latino and Asian targets relative to the White and Black targets, $F(1,165) = 7.44$, $p = 0.007$. Given the results of this contrast and the fact that the pathogen threat condition facilitated descriptively higher outgroup categorization of Asian and Latino targets but descriptively lower outgroup categorization of White and Black targets, these data provide some support the foreign-specific hypothesis. However, subsidiary analyses suggest that these results may be driven by the categorization of Asian targets specifically. In addition to the results of the preliminary *t* test analyses, Latino targets were not categorized as

[1] Sensitivity analyses revealed that we had 80% power to detect an effect size of $d = .44$ when testing a two-tailed hypothesis with our sample size.

outgroup members more frequently than White and Black targets, $F(1,165) = 2.41$, $p = 0.124$, but Asian targets *were* categorized as outgroup members more frequently than White and Black targets, $F(1,165) = 6.12$, $p = 0.014$.

Finally, I tested the ecology-specific hypothesis by using a contrast comparing Asian targets to the average of the other three targets (Latino, Black, and White). Results supported the prediction that perceived contagion risk of Asian targets was more strongly affected by the article manipulation than were the other three targets, $F(1,165) = 4.50$, $p = 0.035$ (see Fig. 1). This key contrast was not further moderated by participant race (0 = White, 1 = Non-White), $F(1,163) = 0.17$, $p = 0.685$, but became marginally significant in analyses controlling for participant race, $F(1,164) = 3.89$, $p = 0.050$. Based on the observed effect size ($f = 0.25$), sensitivity analyses showed that I had 69% power to detect this groups by target interaction.

As ancillary exploratory analyses, the results of the other two contrasts from the same model were not significant: Latino compared to White and Black: $F(1,165) = 2.41$, $p = 0.123$; White compared to Black, $F(1,165) = 0.31$, $p = 0.582$. No other models with a similar contrast structures yielded similar results. Latino targets were not more strongly affected by the article manipulation than were the other three targets, $F(1,165) = 0.15$, $p = 0.704$. There was a trend in the opposite direction such that Black targets were *less likely* to be categorized as the minimal outgroup following the manipulation than were the other three targets, $F(1,165) = 3.97$, $p = 0.048$.

General Discussion

Across two studies, I examined whether the threat of a novel pathogen linked to a specific ecology (i.e., COVID-19 emerging from China) was associated with differential patterns of social bias and explored which of three possible patterns of social bias (outgroup-general, foreign-specific, or ecology-specific) emerged following the experimental upregulation of COVID-19 threat. Participants in the COVID-19 condition, compared to those in the non-pathogen threat condition, were more likely to assume all targets were contagious but this effect appeared to be especially pronounced for Asian targets versus Latino, Black, and White targets (Study 1) and were more likely to categorize Asian targets as minimal outgroups relative to Latino, Black, and White targets (Study 2). Results provide preliminary support for the ecology-specific pattern of bias, rather than bias against all targets perceived as foreign or targets from any minority group. Moreover, because of the context-specific hypotheses and within-subject assessment of bias against multiple groups, these studies are a valuable contribution to the ongoing attempts to clarify the link between pathogen avoidance and outgroup bias (Karinen et al., 2019; van Leeuwen & Petersen, 2018).

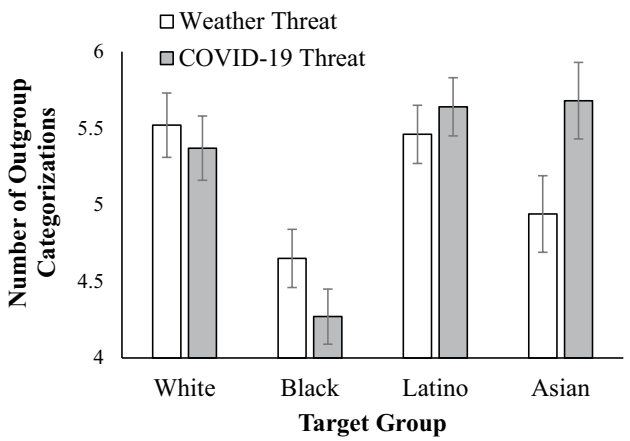

Fig. 1 Minimal outgroup categorization as a factor of target ethnicity and experimental condition. Error bars are *SE*

Findings suggest that patterns of bias prompted by pathogen avoidance motives may shift dynamically across contexts as the heuristic associations between pathogen threat and specific social groups fluctuate in strength. The threat of COVID-19, at the time when it was associated with a specific ecology, prompted biases specific to people associated with that ecology. Notably, no Asian-specific biases emerged 3 months earlier when participants were primed with the threat of a new flu that was not linked to a specific ecology (see Supplemental Materials). These dynamic changes highlight the importance of assessing the strength of heuristic associations in future research examining biases stemming from pathogen avoidance. For example, people who associate obesity with poor health may demonstrate stronger biases against obese targets when they are concerned with pathogens relative to people who do not associate obesity with poor health. Moreover, differences in heuristic associations and stereotypes may explain some cultural inconsistencies, such as why, for US participants, pathogen disgust is associated with bias against healthy Indian targets, but for Indian participants, pathogen disgust is unassociated with bias against healthy White targets (van Leeuwen & Petersen, 2018).

The present studies leveraged several methodological strengths. First, the salience of a pathogen threat was experimentally manipulated. Experimentally manipulating pathogen threat is essential for isolating disease-related biases against target groups because groups can be associated with different perceptions of threats and opportunities depending on context (Neuberg & Schaller, 2016; Neuberg et al., 2011). A second strength was the fact that biases were measured against multiple groups simultaneously. This within-subject approach allowed for direct comparisons of the effects of pathogen threat on bias against the different groups. Finally, rather than relying on self-report questionnaires which are subject to social desirability concerns, the present studies utilized tasks that examine sociocognitive biases using paradigms

that are more automatic: projecting contagion risk onto neutral faces (Oaten et al., 2017) and categorizing targets as social ingroup or outgroup members (Makhanova et al., 2015).

Although on the one hand a strength, the use of sociocognitive measures is also a limitation of the present research. Though these cognitive biases may precipitate overt biases, discriminatory behavior, and social avoidance, the present research did not assess any downstream behaviors. Other studies conducted during the early months of the pandemic did, however, demonstrate this link. For example, experimental upregulation of COVID-19 threat (versus a non-pathogen threat or a control condition) prompted greater support for a travel ban for China and Italy—countries associated with a high risk of COVID-19—but not Canada or Mexico (Moran et al., 2021). Future research would benefit from continued emphasis on how the shifting context of a pathogen threat (i.e., which groups are linked with heightened risk of pathogen transmission at a given time) affects biased cognition and behavior against targets from some ethnic groups but not others. A particularly interesting question may be about effects of persistent associations between COVID-19 and China. That is, at the "tail end" of the pandemic, when the biggest pathogen threat is posed by people in one's local ecology rather than China, it may still be the case that people who retained a strong cognitive association between COVID-19 and China would continue to exhibit anti-Asian biases when COVID-19 threat is salient. On the other hand, people who no longer have this association would no longer exhibit anti-Asian biases.

The present findings found relatively more support for the ecology-specific pattern of bias relative to the foreign-specific pattern of bias. In Study 2, for example, the between-group analyses for outgroup categorization were only significantly different for the Asian targets. However, other research has documented spillover in prejudice and discrimination onto other groups consistent with the foreign-specific pattern of bias (Lu et al., 2021). In the context of a hypothetical roommate search, participants for whom COVID-19 was made salient (compared to those for whom COVID-19 was not made salient) reported less interest in living with an East Asian roommate, but also with a South Asian roommate and with a Hispanic roommate. Biases against all three groups were underpinned by reduced perceptions of responsibility and cultural compatibility. One difference between those data and data presented in this manuscript is time of data collection. Lu et al. (2021) collected their data in August 2020, a few months after data collection for the two studies reported in this manuscript. Thus, it may be that as the pandemic progressed and the virus was more wide-spread in the USA, groups perceived as culturally different may have become more targeted by COVID-19-related concerns than at the very beginning of the pandemic when there were very few known cases in the USA. Perhaps, if Study 2 was repeated in August, I would have found similar support for the foreign-specific pattern of bias.

A second difference between Study 2 and the study conducted by Lu et al. (2021) is the population. Whereas Lu (2021) had a nationally representative sample, the present data were collected in Northwest Arkansas. In Northwest Arkansas, people may have higher levels of anti-Latino bias than the national average. Indeed, among Study 2 participants in the weather threat condition, Latino targets were more likely to be categorized as outgroup members than Asian targets. Thus, this pre-existing bias may have precluded me from finding effects of an experimental upregulation of COVID-19 concerns. Taken together, the findings from both studies highlight that COVID-19 threat was associated with more anti-Asian bias. However, COVID-19 threat did not only produce ecology-specific patterns of bias across all contexts. More research that uses within-subject designs to examine all three patterns of data is necessary before any strong conclusions could be drawn about the effects of an ecology-specific pathogen threat on biases against racial and ethnic minority groups and whether different patterns of bias emerge at different time points within a pandemic.

The current research was limited in scope and consequently did not examine to what extent the observed biases may have been underpinned by perceptions of foreignness. Although participants were not given any information about whether the targets were born in the USA, immigrated to the USA, or lived in another country, participants could nevertheless have assumed that some targets were not American. Consequently, if participants associated some targets with a foreign ecology that is pathogen-rich, that association may have underpinned observed biases (e.g., Ji et al., 2019). The present research did not directly examine whether participants associated certain targets or groups with being un-American. In future research, it may be fruitful to examine explicit and implicit associations between targets and American identity. Assessed before the experimental manipulation, pre-existing associations between targets and being un-American would likely strengthen the link between situational activation of pathogen threat and bias against the target group. Assessed after the experimental manipulation, a stronger association between targets and being un-American may be a mechanism for the effect of situational activation of pathogen threat on bias against the target group (e.g., Lund & Miller, 2014).

Notably, the present research does not speak to any mechanisms through which heuristic associations may affect bias. For example, heuristic associations may affect the perceived value of social targets which in turn affects social biases and behavior (see Tybur et al., 2020). Furthermore, the articles used in the present studies cannot adjudicate on the specificity of the heuristic association necessary for biases to emerge. The article could have activated a specific

Asian-Disease association or a more general Asian-Bad association. Future research should thus examine what types of heuristic associations affect biases in the context of pathogen threat and through what cognitive mechanisms do these associations affect biases.

Overall, these present experiments provide findings that have relatively high external validity. Reading an article about the threat of COVID-19, a new pathogen originating in China, led participants to perceive Asian targets as posing greater contagion risk than targets of other ethnicities and to increase social distance between themselves and Asian targets by preferentially categorizing them as outgroup members. Although data collection efforts were cut short due to the beginning of the pandemic, these results nevertheless provide important information about the patterns of bias that may be observed in the context of a pathogen threat linked to a specific ecology.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40806-022-00321-4.

Author Contribution This is a solo-authored manuscript; the author performed all steps of the research process.

Availability of Data and Material All study materials and relevant data for both studies are available on OSF: https://osf.io/vxdu3/

Code Availability The author will provide the syntax for all analyses upon request.

Declarations

Ethics Approval The study was performed in line with the principles of the American Psychological Association and was approved as exempt by the University of Arkansas Institutional Review Board (09/27/2019; 1909214490).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent for Publication Not Applicable.

Competing Interests The author declares no competing interests.

References

Aarøe, L., Petersen, M. B., & Arceneaux, K. (2017). The behavioral immune system shapes political intuitions: Why and how individual differences in disgust sensitivity underlie opposition to immigration. *American Political Science Review, 111*(2), 277–294. https://doi.org/10.1017/S0003055416000770

Ackerman, J. M., Hill, S. E., & Murray, D. R. (2018). The behavioral immune system: Current concerns and future directions. *Social and Personality Psychology Compass, 12*(2), e12371. https://doi.org/10.1111/spc3.12371

Ackerman, J. M., Vaughn Becker, D., Mortensen, C. R., Sasaki, T., Neuberg, S. L., & Kenrick, D. T. (2009). A pox on the mind: Disjunction of attention and memory in the processing of physical disfigurement. *Journal of Experimental Social Psychology, 45*(3), 478–485. https://doi.org/10.1016/j.jesp.2008.12.008

Brown, M., Keefer, L. A., Sacco, D. F., & Bermond, A. (2019). Is the cure a wall? Behavioral immune system responses to a disease metaphor for immigration. *Evolutionary Psychological Science, 5*(3), 343–356. https://doi.org/10.1007/s40806-019-00191-3

Chandler, J., Rosenzweig, C., Moss, A. J., Robinson, J., & Litman, L. (2019). Online panels in social science research: Expanding sampling methods beyond mechanical turk. *Behavioral Research Methods, 51*, 2022–2038.

Duncan, L. A., & Schaller, M. (2009). Prejudicial attitudes toward older adults may be exaggerated when people feel vulnerable to infectious disease: Evidence and implications. *Analyses of Social Issues and Public Policy, 9*(1), 97–115.

Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes & Intergroup Relations, 7*(4), 333–353. https://doi.org/10.1177/1368430204046142

Fessler, D. M. T., Clark, J. A., & Clint, E. K. (2015). Evolutionary psychology and evolutionary anthropology. In D. M. Buss (Ed.), *The Handbook of Evolutionary Psychology* (pp. 1029–1046). Wiley.

Fincher, C. L., & Thornhill, R. (2008). Assortative sociality, limited dispersal, infectious disease and the genesis of the global pattern of religion diversity. *Proceedings of the Royal Society B: Biological Sciences, 275*(1651), 2587–2594. https://doi.org/10.1098/rspb.2008.0688

Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Sciences, 35*(2), 61–79. https://doi.org/10.1017/S0140525X11000021

Huang, J. Y., Sedlovskaya, A., Ackerman, J. M., & Bargh, J. A. (2011). Immunizing against prejudice: Effects of disease protection on attitudes toward out-groups. *Psychological Science, 22*(12), 1550–1556. https://doi.org/10.1177/0956797611417261

Ji, T., Tybur, J. M., & van Vugt, M. (2019). Generalized or origin-specific out-group prejudice?: The role of temporary and chronic pathogen-avoidance motivation in intergroup relations. *Evolutionary Psychology, 17*(1), 147470491982685. https://doi.org/10.1177/1474704919826851

Karinen, A. K., Molho, C., Kupfer, T. R., & Tybur, J. M. (2019). Disgust sensitivity and opposition to immigration: Does contact avoidance or resistance to foreign norms explain the relationship? *Journal of Experimental Social Psychology, 84*, 103817. https://doi.org/10.1016/j.jesp.2019.103817

Kim, H. S., Sherman, D. K., & Updegraff, J. A. (2016). Fear of Ebola: The influence of collectivism on xenophobic threat responses. *Psychological Science, 27*(7), 935–944. https://doi.org/10.1177/0956797616642596

Lu, Y., Kaushal, N., Huang, X., & Gaddis, S. M. (2021). Priming COVID-19 salience increases prejudice and discriminatory intent against Asians and Hispanics. *Proceedings of the National Academy of Sciences, 118*(36), e2105125118.

Lund, E. M., & Miller, S. L. (2014). Is obesity un-American? Disease concerns bias implicit perceptions of national identity. *Evolution and Human Behavior, 35*(4), 336–340.

Ma, D. S., Correll, J., & Wittenbrink, B. (2015). The Chicago face database: A free stimulus set of faces and norming data. *Behavior Research Methods, 47*(4), 1122–1135. https://doi.org/10.3758/s13428-014-0532-5

Makhanova, A., Miller, S. L., & Maner, J. K. (2015). Germs and the outgroup: Chronic and situational disease concerns affect intergroup categorization. *Evolutionary Behavioral Sciences, 9*(1), 8–19. https://doi.org/10.1037/ebs0000028

Makhanova, A., Plant, E. A., & Maner, J. K. (2020). Capturing fluctuations in pathogen avoidance: The Situational Pathogen Avoidance

scale. *Evolutionary Psychological Science*. https://doi.org/10.1007/s40806-020-00256-8

Makhanova, A., Plant, E. A., Monroe, A. E., & Maner, J. K. (2019). Binding together to avoid illness: Pathogen avoidance and moral worldviews. *Evolutionary Behavioral Sciences, 13*(2), 182–204. https://doi.org/10.1037/ebs0000141

Miller, S. L., & Maner, J. K. (2012). Overperceiving disease cues: The basic cognition of the behavioral immune system. *Journal of Personality and Social Psychology, 102*(6), 1198–1213. https://doi.org/10.1037/a0027198

Moran, J. B., Goh, J. X., Kerry, N., & Murray, D. R. (2021). Outbreaks and outgroups: three tests of the relationship between disease avoidance motives and xenophobia during an emerging pandemic. *Evolutionary Psychological Science*, 1–11.

Navarrete, C. D., & Fessler, D. M. T. (2006). Disease avoidance and ethnocentrism: The effects of disease vulnerability and disgust sensitivity on intergroup attitudes. *Evolution and Human Behavior, 27*(4), 270–282. https://doi.org/10.1016/j.evolhumbehav.2005.12.001

Neuberg, S. L., Kenrick, D. T., & Schaller, M. (2011). Human threat management systems: Self-protection and disease avoidance. *Neuroscience & Biobehavioral Reviews, 35*(4), 1042–1051. https://doi.org/10.1016/j.neubiorev.2010.08.011

Neuberg, S. L., & Schaller, M. (2016). An evolutionary threat-management approach to prejudices. *Current Opinion in Psychology, 7*, 1–5. https://doi.org/10.1016/j.copsyc.2015.06.004

Oaten, M. J., Stevenson, R. J., & Case, T. I. (2017). Compensatory up-regulation of behavioral disease avoidance in immunocompromised people with rheumatoid arthritis. *Evolution and Human Behavior, 38*(3), 350–356. https://doi.org/10.1016/j.evolhumbehav.2016.11.006

O'Shea, B. A., Watson, D. G., Brown, G. D. A., & Fincher, C. L. (2020). Infectious disease prevalence, not race exposure, predicts both implicit and explicit racial prejudice across the United States. *Social Psychological and Personality Science, 11*(3), 345–355. https://doi.org/10.1177/1948550619862319

Petersen, M. B. (2017). Healthy out-group members are represented psychologically as infected in-group members. *Psychological Science, 28*(12), 1857–1863. https://doi.org/10.1177/0956797617728270

Ruxton, G. D., & Beauchamp, G. (2008). Time for some a priori thinking about post hoc testing. *Behavioral Ecology, 19*(3), 690–693.

Schaller, M., Park, J., & Faulkner, J. (2003). Prehistoric dangers and contemporary prejudices. *European Review of Social Psychology, 14*(1), 105–137. https://doi.org/10.1080/10463280340000036

Schaller, M., & Park, J. H. (2011). The behavioral immune system (and why it matters). *Current Directions in Psychological Science, 20*(2), 99–103. https://doi.org/10.1177/0963721411402596

Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social categorization and intergroup behaviour. *European Journal of Social Psychology, 1*(2), 149–178. https://doi.org/10.1002/ejsp.2420010202

Tybur, J. M., Lieberman, D., Fan, L., Kupfer, T. R., & de Vries, R. E. (2020). Behavioral immune trade-offs: Interpersonal value relaxes social pathogen avoidance. *Psychological Science, 31*(10), 1211–1221. https://doi.org/10.1177/0956797620960011

Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: Evolved function and structure. *Psychological Review, 120*(1), 65–84. https://doi.org/10.1037/a0030778

van Leeuwen, F., & Petersen, M. B. (2018). The behavioral immune system is designed to avoid infected individuals, not outgroups. *Evolution and Human Behavior, 39*(2), 226–234. https://doi.org/10.1016/j.evolhumbehav.2017.12.003

Wu, Q., Tan, C., Wang, B., & Zhou, P. (2015). Behavioral immune system and ingroup derogation: the effects of infectious diseases on ingroup derogation attitudes. *PLoS ONE, 10*(3), e0122794.

Wu, Q., Yang, S., & Zhou, P. (2019). Disease threat and the functional flexibility of ingroup derogation. *Frontiers in Psychology, 10*, 2030.