Distrust Backfires?
Ethnic Inequalities in Vaccine Hesitancy

Miqdad Asaria, Joan Costa-Font, Fatima Docrat and Daniel Sudastaya

Department of Health Policy,
London School of Economics, Houghton Street WC2A 2AE.
Contact: j.costa-font@lse.ac.uk

Abstract

Although vaccine hesitancy has been identified by the WHO as one of the most serious threats to global health, the COVID-19 pandemic has revealed endemic ethnic inequalities in vaccine uptake. This has been especially the case in the United Kingdom where people from certain Black and Asian minority ethnic groups exhibit the highest resistance to vaccination. This paper examines one potential hypothesis, namely that vaccine hesitancy is the result of longstanding individuals' distrust of the health system, alongside other structural forms of inequality such as racism, differences in socio-economic status and access to health care in ordinary times. Drawing on longitudinal evidence from both before and after the pandemic (years 2011 – 2021), we document a significantly higher proportion of respondents from minority ethnic communities exhibit COVID-19 vaccine hesitancy even when controlling for socioeconomic and structural explanations driving the effect of ethnicity. However, such an effect is almost entirely explained by the lower levels of both contemporary and longstanding trust in the health system amongst people from these communities.

Keywords: COVID-19, vaccination, hesitancy, ethnicity, race, minority, trust

JEL: I18, Z1

1. INTRODUCTION

In 2019, pre-COVID pandemic, the World Health Organization (WHO) declared vaccine hesitancy as one of the main threats to global health (WHO, 2019). Vaccine hesitancy is of significant concern when countries require a certain percentage of a population to be immunized for infectious diseases to be controlled[1]. The COVID-19 pandemic has underscored how crucial widespread vaccine coverage is to eradicate the disease. However, an even more important concern is that vaccine hesitancy at a global level is especially higher within ethnic minority groups. There are several potential explanations for such inequalities in vaccine uptake, including their lower education and socio-economic status, structural factors such as racism, as well as growing sentiments of distrust in medical authorities resulting from the growing image of for-profit health and medical services, revelations of unethical medical research in recent history, and increased publicity surrounding health system malpractices (Armstrong et al., 2007). Evidence from the COVID-19 pandemic allows to examine under underlying causes of inequalities in vaccine hesitancy, ultimately explaining their different uptake, which allows for controlling individual specific effects as well as a series of confounders, to examine one potential driver namely a form of inherited healthcare distrust. This is the purpose of this paper.

This paper studies the existence of ethnic inequalities in vaccine hesitancy in the United Kingdom (UK), and examines some of its underpinning drivers, namely distrust in the health system alongside socio-economic barriers to health care. We draw on longitudinal evidence

[1] The level of immunization needed, known as "herd immunity", differs based on the infectiousness of the disease (Wellcome Foundation, 2019). Unfortunately, as vaccine hesitancy has risen, coverage has plateaued since the 2010s with no vaccine covering more than 90% of the population globally (Wellcome Foundation, 2019). Low coverage has led to outbreaks of preventable diseases, such as measles, especially in communities with a high conc vaccine of vaccine-sceptics; presently, vaccine hesitancy could lead to the prolonging of the COVID-19 pandemic.

for more decade than a decade drawing on evidence from a longitudinal dataset, the UK Longitudinal Household Survey (UKLHS), also known as *Understanding Society*, for the period 2011-2021. This is a rich survey oversamples minority groups and include a specific COVID-19 module, and contain important evidence on peoples race specific attitudes, as well as individuals' health system trust immediately before the COVID-19 pandemic, as well as a decade earlier. The latter allows identifying whether the effect of recent and longstanding distrust as an explanation of the ethnic inequalities in vaccine distrust.

We hypothesise that there is nothing about ethnicity that inherently drives vaccine hesitancy, but rather hesitancy is driven by distrust in public institutions in general and the health system consistently with the 'distribution backfiring' hypothesis put forward in the paper. We estimate the relationship between vaccine hesitancy and ethnicity whilst controlling for relationships between vaccine hesitancy and recent as well as longstanding distrust. We hypothesise that the ethnicity variable is no longer significant when controlling for such confounding variables, which suggests ethnicity is capturing heterogeneity in relationships with public institutions. Further, we examine we a driving mechanism whether ethnicity driving ethnicity explains health system distrust.

Our estimates document evidence of an association between ethnicity and vaccine hesitancy, back Caribbean individuals appear to be more vaccine hesitant, and such effect remains after adding controls for socio-economic status and other measures of perceived discrimination, levels of trust in the health system amongst people from minority ethnic communities render ethnic inequality in vaccine attitudes as insignificant[2]. We document that

[2] These results are consistent with the demand for autonomy (Adler, 1927). Consistently, Owens et al. (2014) demonstrate the existence of a control premium, or willingness to pay or forego a monetary sum to retain decision-making autonomy. Similarly, Bartling et al. (2014) document evidence of the value decision rights in addition to their instrumental benefit, and that this preference for control influences delegation decisions.

same ethnicities that are more likely to be vaccine hesitant are indeed more likely to distrust the health system. Hence, reregaining the trust of people who have experienced trauma at the hands of the state and the health system, is disproportionately relevant those from minority ethnic communities, and such phenomenon is a complex, time-consuming, and culturally sensitive process (Thompson et al., 2021). However, tackling endemic institutional and structural racism and the distrust that it engenders amongst minority ethnic communities, as well as being morally imperative, can deliver significant public health benefits both directly in terms of improved adherence to public health recommendations.

The rest of this paper provides the background underpinning COVID-19 vaccination hesitancy in the UK. Section three reports the data used the data and empirical strategy. Next, section four reports the study results. A final section concludes.

2. BACKGROUND

2.1 COVID-19 Vaccine Hesitancy

Dube and MacDonald (2020) claim that surveys regarding COVID-19 vaccine show approximately 25% of respondents are unsure about taking the vaccine, which is a similar proportion to those hesitant of routine immunisations in high-income countries. Various studies have examined the characteristics associated with vaccine hesitancy. Eleven of fifteen studies included in Sallam's (2021) worldwide systematic review found that females are more hesitant than males. Murphy *et al.* (2021) found that hesitant individuals in the UK tended to be younger and in the lowest income brackets and Robertson *et al*. (2021) also found an age correlation in the UK. In the US, Callaghan *et al.* (2021) found that refusal is higher amongst Black individuals, women and conservatives.

Ethnicity appears to be a significant determinant of vaccine hesitancy across the literature with people from minority ethnic communities being more vaccine hesitant. In countries such as the UK, ethnic differences in vaccine uptake also tend to exacerbate socioeconomic inequalities as minority groups tend to be socio-economically worse-off (Campbell and McLean, 2002). Moreover, as ethnic groups are often geographically concentrated, limited vaccine coverage in areas below the "herd immunity" threshold can cause pockets of outbreaks. This can be problematic as regions with low vaccine uptake are also typically underserved by medical and healthcare infrastructure and may consequently struggle to properly contain outbreaks.

A December 2020 survey of UK respondents found that COVID-19 vaccine hesitancy was highest among Black, Bangladeshi, and Pakistani respondents which is consistent with actual influenza and pneumococcal vaccine-uptake data (Razai *et al.*, 2021). A study by Nguyen *et al.* (2021) found that ethnic minorities had higher hesitancy compared to White respondents. Odds ratios for vaccine hesitancy were 2.84 for Black participants, 1.66 for South Asian and 1.84 for Middle Eastern. Similarly, their US study found odds ratios of 3.15 for Black participants and 1.42 for Hispanics relative to White, non-Hispanics (Nguyen *et al.*, 2021). Another US study found that vaccine hesitancy was 74% for Black population group but 62.7% for White group with the highest decline in vaccine hesitancy for White group between September and December 2020 (Doherty *et al.*, 2021).

2.2 Minority Vaccine Hesitancy

Inequalities in vaccine hesitancy by ethnicity are well-documented in the literature; however, there has been less exploration to reasons why heterogeneity exists. Here we review

some of the arguments linking distrust and vaccine hesitancy – central to our hypothesis in this paper.

2.2.1 Racism and distrust in the health service

People from minority ethnic communities may struggle to view public institutions as agents acting in their best interests, particularly where they are perceived to be institutionally racist (Mclean *et al.*, 2003). Racism in the NHS has risen in prominence in policy discourse, with a recent headline describing it as a "festering abscess" (Lund, 2020). A 2020 paper found that Black women in England were four times more likely to die in childbirth than White women and Asian women were twice as likely (Jeraj, 2021). Guys and St Thomas NHS Hospital Trust commissioned a report into medical skepticism of Black people in London and found high levels of distrust "based on the innumerable injustices perpetrated against Black and other minoritised communities in the pursuit of medical advancement over the course of many centuries" (TSIP, 2021). A prominent example being that of the Tuskegee Syphilis Study scandal where Black men were intentionally denied treatment for syphilis in order to observe the natural history of the disease (TSIP, 2021). The Tuskegee experiments are often mentioned by focus groups in research studies exemplifying their salience in the collective consciousness of people from minority ethnic groups (Strully *et al.*, 2021). These collective traumas not only affect direct victims but also permeate the common memory of generations of minorities. bell hooks claims that until these traumas are recognized, Black individuals will continue to see healthcare as oppressive rather than healing (hooks, 2003; Pain *et al.*, 2020).

Minority groups link traumatic experiences to feelings of disempowerment and lack of trust in the healthcare system (TSIP, 2021). Overcoming this distrust is required for vaccine uptake, as vaccine uptake depends on public confidence in vaccines and in the system that

produces them (Khan *et al.*, 2021). Trust can be split into two components: trust in motives and trust in competence. A US study found that White individuals implicitly trust government but question competency, whereas Black individuals report a deep-rooted distrust of motives (Jamison *et al.*, 2019). The erosion of trust in motives of public institutions arising from a legacy of discrimination is difficult to rebuild. This trust rebuilding effort does not appear to be a priority in the UK, if anything the trust of people from minority communities in the motives of public institutions is being further eroded by the government's racist populist posturing with regards to immigration and the discriminatory racial profiling of people from minority communities by the police.

2.2.2 Distrust and misinformation

Numerous studies find racial disparity in use of information sources, such as Grisso *et al.* (1999) who studied menopausal women and found Black women are more likely than White women to seek treatment information from friends/family. Individuals from minority communities do not trust sources of official information and face inequalities in access to information. While doctors are typically the most trusted source of information, people from these groups are less likely to trust information from doctors and more likely to report negative experiences with healthcare system (Fareed *et al.*, 2021). As a consequence of this marginalised communities tend to value interdependent relationships and rely more on social networks (Marshall, 2001), emphasized by Campbell and McLean (2002) who report a "culture of solidarity" amongst Asian people in the UK. If individuals trust community based information more than information provided by government or mainstream media, they update their prior beliefs in the direction of the community based information (Barrera *et al.*, 2017). Thus, distrust affects ways in which people view the credibility of government sources and they may rely on shared identity as a heuristic, trusting friends and family more than public servants (Adida *et al.*, 2017). This is evident in Guys and St Thomas report where Black respondents answered

that friends and family, particularly WhatsApp groups, are common sources of COVID-19 information and that they do not engage with official leaflets (Comuzi, 2020).

Misinformation is a significant challenge during the COVID-19 pandemic with WHO claiming the pandemic has worsened the infodemic challenge (Khan *et al.*, 2021). Anti-vaxxers have exploited uncertainty and deliberately spread misinformation about vaccine safety, (Hildreth and Alcendor, 2021) through the proliferation of fake or negatively-framed communications (Bateman *et al.*, 2020). These myths diffuse through social networks gaining traction where existing levels of distrust in government are high. As an example people from minority ethnic groups in the UK are twice as likely to believe the AstraZeneca vaccine causes blood clots than White individuals (ESRC, 2021).

3.Data and Empirical Strategy

3.1 Data

To test our hypothesis, we use the unique Understanding Society dataset that contains longitudinal records of over 40,000 households in the UK. The dataset collects information regarding health, work and social life to inform UK policymaking. Understanding Society has nine published annual waves as well as six COVID-19 waves collected every three months (University of Essex, 2019). COVID-19 waves collect data on the experiences of UK population during the pandemic and can be linked to previous waves (University of Essex, 2021). We have used the Wave 2 (2011), Wave 9 (2019) and COVID-19 waves from November 2020, January 2021 and March 2021 in our analysis.

The longitudinal dataset is particularly useful for our analysis because it allows linking data from one year to the next and to the COVID-19 period using personal identifiers (University

of Essex, 2021). This unique element of the dataset allows for pre-COVID attitudes to public institutions to be controlled for. For example, we can see the relationship between distrust of government a decade before the pandemic on vaccine hesitancy in 2020Additionally, Understanding Society dataset is especially relevant for our exploration as it oversamples minority ethnic respondents. It collects information from the UK General Population Sample (GPS) as well as an Ethnic Minority Boost Sample (EMBS) and Immigrant and Ethnic Minority Boost Sample (IEMBS) (University of Essex, 2019). That said, despite the richness of the dataset, it does have limitations. Given ethnicity is time-invariant, fixed effects analysis was not employed in our analysis; thus, potential unobservables, such as personality could still bias our estimates[3].

The 2021 survey is a nationally representative survey data from 12,035 participants were collected for wave 6 of the 'Understanding Society' COVID-19 web survey from November 24th to December 1st, 2020. Participants were asked how likely or unlikely they would be to receive a vaccine if offered one, as well as the main reason for their hesitation. Overall, vaccination intention was high (82% likely/very likely). Vaccine hesitancy higher among women (21.0% vs 14.7%), younger age groups (26.5% in 16-24-year-olds vs 4.5% in 75+), and those with less education (18.6% with no qualifications vs 13.2% with a degree).Vaccine hesitancy was especially high among the Black (71.8%), Pakistani/Bangladeshi (42.3%), Mixed (32.4%), and non-UK/Irish White (26.4%) ethnic groups. Gender, education, and ethnicity were all independently associated with vaccine hesitancy in fully adjusted models. Vaccine hesitancy odds ratios were 12.96 in the Black/Black British ethnic group, 2.31 in

[3] While a wave of the data does have variables for the Big 5 personality metrics, the sample of respondents was small and not representative of the dataset; thus, could not be used.

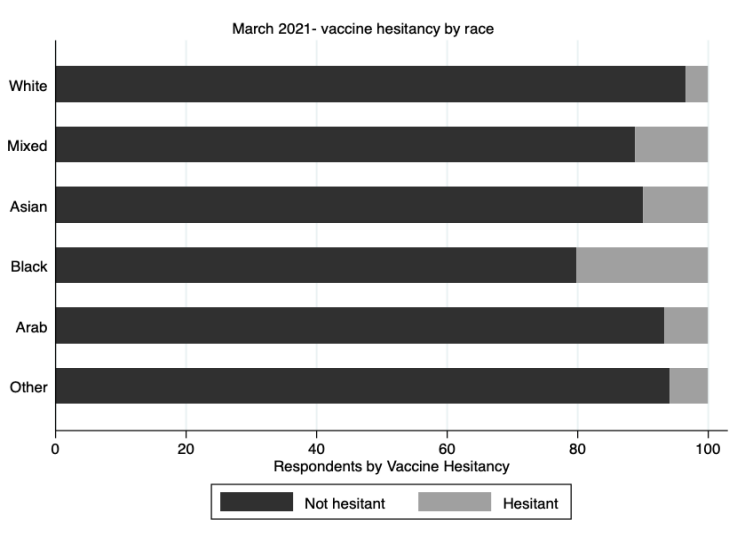
Pakistani/Bangladeshi ethnic groups (compared to White British/Irish ethnicity), and 3.24 for people with no qualifications compared to degree educated.

3.2 Descriptive Evidence

We begin our data analysis by exploring descriptive evidence of differences in vaccine hesitancy across ethnic groups. Figure 1 examines the group differences in vaccine hesitancy among ethnic groups. Estimates suggest evidence that Black population are the most hesitant. Already in March 2021, over 20% of Black respondents reported that they were unlikely or very unlikely to take the vaccine. Mixed and Asian respondents were also found to be more hesitant than the White population. Formal testing suggests statistically significant differences in vaccine hesitancy between white and blacks.

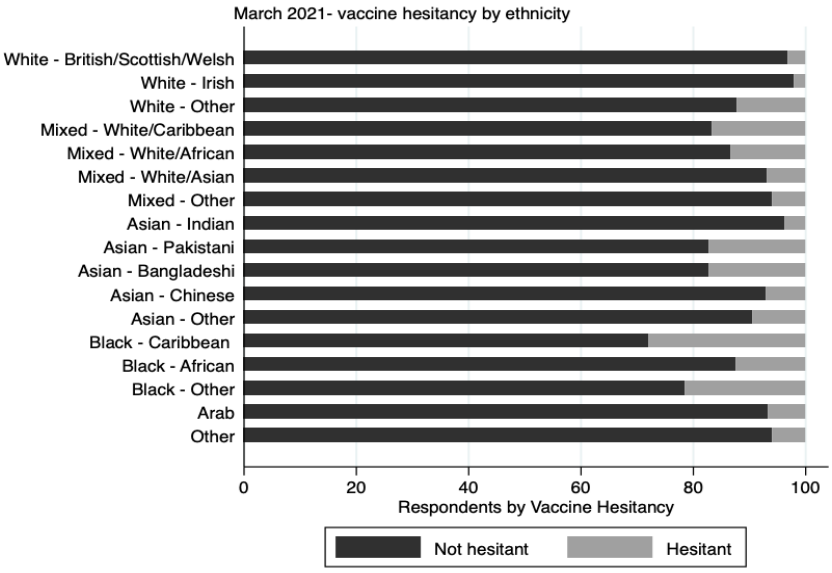
Figure 2 provides further disaggregated evidence of variation within racial groups with Black-Caribbeans more hesitant than Black-Africans and Pakistani/Bangladeshi Asians more hesitant than Indian Asians. That is, variation is driven by individuals' origin as opposed to their ethnicity. We find evidence that white other is more vaccine hesitant than white respondents, and especially white-mixed Caribbean consistently with the explanation of country of extraction effects of individuals respondents irrespectively of race.

Figure 1: Vaccine hesitancy by ethnicity



Source: Understanding Society, several years.

Figure 2: Vaccine hesitancy by ethnicity and origin



Source: Understanding Society, several years.

3.3 Empirical Strategy

For this study, we rely on three different specifications. A first specification, our baseline regression, examines the extent to which ethnicity explains the probability of an individuals to be vaccine hesitant. The vaccine hesitancy variable captures March 2021 responses and equals one for those who have not gotten the vaccine and do not intend to, and zero for those have received the vaccine or have not but intend to. We report results from the linear probability model in our estimates for ease of interpretation. As a robustness check we also ran the same specifications as probit models and found the resulting coefficients to be qualitatively identical. We consider different specification with and without controls. Controls include socio-demographic controls such as gender, marital status and age (*x1*) and socio-economic covariates such as income, education, and employment status (*x2*):

$$P(vaccine\ hesitancy = 1|x) = \beta 0 + \beta 1 i.ethnicity_i + \beta 2 x1_i + \beta 3 x2_i + e_i \quad (1)$$

Next, we include reasons for hesitancy such as distrust. Distrust is proxied through pre-pandemic mistrust in government, mistrust in NHS and experience of racial attacks, as follows: .

$$P(vaccine\ hesitancy = 1|x) = \beta 0 + \beta 1 i.ethnicity_i + \beta 2 trauma_{i.2019} + \beta 3 x_i + e_i (2)$$

Finally, we extend the model adding ten year lagged measures of institutional distrust with the health system and government. Including these lagged effects allows for analysis of impact of deep-rooted and lingering distrust on present-day vaccine hesitancy as below:

$$P(vaccine\ hesitancy = 1|x) = \beta 0 + \beta 1 i.ethnicity_i + \beta 2 trauma_{i.2011} + \beta 3 x_i + e_i (3)$$

Alternative estimates using probit models reveal consistent estimates and will be provided upon request.

4. RESULTS

4.1 Baseline Results and Heterogeneity

First, we present results of a naive model including only ethnicity in Table 1. When vaccine hesitancy is regressed solely on ethnicity, Mixed, Pakistani, Bangladeshi, Caribbean and African groups are significant at the 1% level. Caribbean respondents are about 25 percentage point (pp) more likely to be vaccine hesitant than White respondents, Pakistanis and Bangladeshis are 14pp more likely and Africans are 9pp more likely to be vaccine hesitant. However, these estimates can be driven by the influence of socio-demographic and socio-economic status.

To account for the effect of population composition and socio-economic status, Table 1 add several socio-demographic controls to our estimates. When gender, marital status and age are controlled for, Caribbean remains significant at the 5% level while Pakistani and Mixed are significant at the 10% level. Caribbean respondents are about 12pp more likely to be vaccine hesitant than their White counterparts. As expected, older population groups are less vaccine hesitant than younger population groups as they belong to a higher risk group. When controls that account for socio-economic factors, such as education level, employment status and household income, are included being from a Black Caribbean community remains significant at the 5% level.

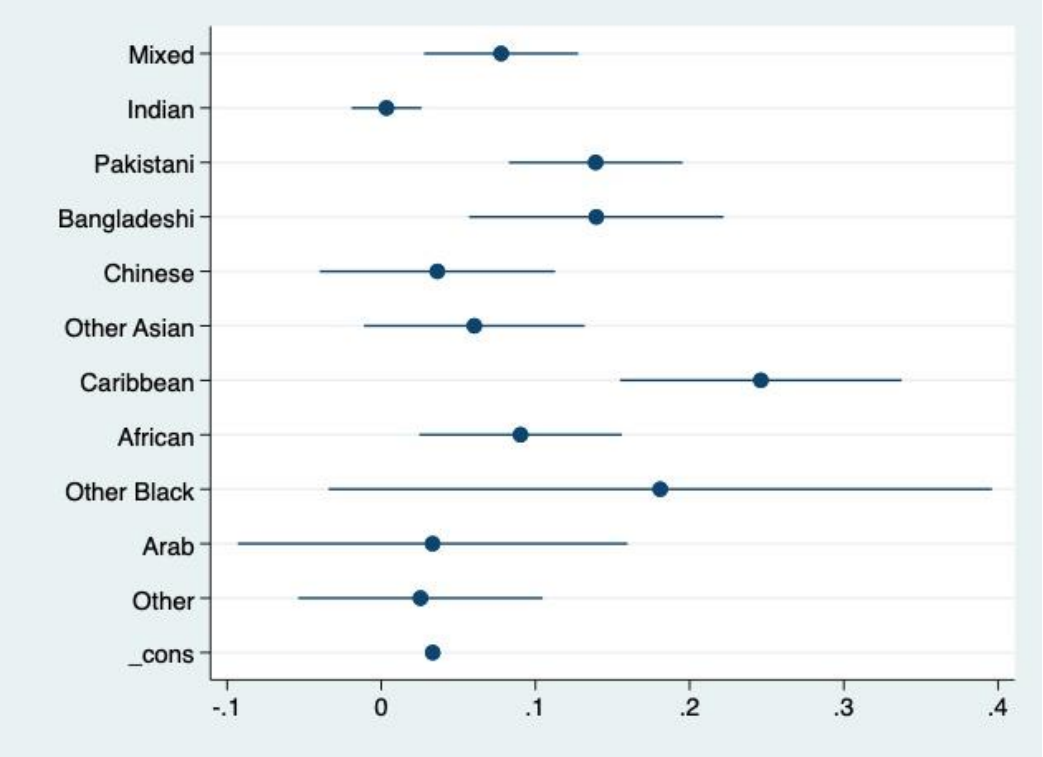
Table 1: Baseline regression estimates

VARIABLES	(1) Simple	(2) Socio-demographic controls	(3) Socio-economic controls
Ethnicity - Mixed	0.0778***	0.0621*	0.0755*
	(0.0255)	(0.0369)	(0.0447)
Ethnicity - Indian	0.00340	-0.0272	-0.0182
	(0.0116)	(0.0279)	(0.0389)
Ethnicity - Pakistani	0.139***	0.0855*	0.0541
	(0.0287)	(0.0471)	(0.0631)
Ethnicity - Bangladeshi	0.139***	0.0325	0.0644
	(0.0421)	(0.0502)	(0.0643)
Ethnicity - Chinese	0.0364	0.0629	0.109
	(0.0389)	(0.0714)	(0.0954)
Ethnicity - Other Asian	0.0604*	0.0633	0.114
	(0.0365)	(0.0578)	(0.0877)
Ethnicity - Caribbean	**0.246*** **	**0.119** **	**0.151** **
	(0.0466)	**(0.0601)**	**(0.0695)**
Ethnicity - African	0.0904***	0.0330	0.0124
	(0.0335)	(0.0675)	(0.0897)
Ethnicity - Other Black	0.181*	0.292	0.454
	(0.110)	(0.279)	(0.355)
Ethnicity - Arab	0.0333	0.00956	-0.107**
	(0.0645)	(0.103)	(0.0461)
Ethnicity - Other	0.0255	-0.0382***	-0.0333**
	(0.0404)	(0.0103)	(0.0141)
Socio-demographic controls	NO	YES	YES
Socio economic controls	NO	NO	YES
Observations	9,823	6,516	4,268
R-squared	0.031	0.047	0.056

*** p<0.01, ** p<0.05, * p<0.1
Notes: Coefficient values from linear probability outputs are presented with standard errors in parentheses. Base category is White population group. Socio-demographic controls include gender, religion, marital status, and age. Other covariates include highest education level, income, and employment status.

Coefficient plot in Figure 3 below shows the ethnicity coefficients and uncertainty around coefficients, given by the width of confidence intervals. It is apparent that being Caribbean, Pakistani or Bangladeshi is different from zero as the confidence interval does not cover zero.

Figure 3: Coefficient plot of ethnicities on vaccine hesitancy



Notes: Base category is White population group

When the sample is restricted to 18-60 years old and the sociodemographic and inequality controls are included, Caribbean and Mixed remain statistically significant at the 10% level.

4.2 Reasons for hesitancy: distrust

Table 2 controls for other reasons for hesitancy such as pre-pandemic distrust in government, distrust in NHS and experience of racial attack. As expected, when including such reasons for hesitancy, particularly distrust in the NHS, ethnicity is no longer significantly associated with increased vaccine hesitancy. Understanding Society allows for COVID-19 waves to be appended to a decade of previous responses. In an additional specification, we have included lagged variables from 2011 to understand whether long-standing distrust may have an impact on hesitancy. Importantly, our results suggest that even when we solely control for long-lasting distrust, the relationship between ethnicity and increased vaccine hesitancy disappears.

Table 2: Distrust and vaccine hesitancy

VARIABLES	(1) Contemporary Distrust	(2) Longlisting Distrust
Ethnicity - Mixed	0.0186	0.0539
	(0.0290)	(0.0423)
Ethnicity - Indian	0.0220	-0.0468
	(0.0320)	(0.0332)
Ethnicity - Pakistani	0.0848	0.0727
	(0.0523)	(0.0584)
Ethnicity - Bangladeshi	0.0236	0.0251
	(0.0554)	(0.0600)
Ethnicity - Chinese	-0.0353***	0.0510
	(0.00859)	(0.0832)
Ethnicity - Other Asian	0.0315	0.0529
	(0.0445)	(0.0759)
Ethnicity - Caribbean	**0.0530**	**0.0268**
	(0.0562)	**(0.0563)**
Ethnicity - African	-0.0446***	0.0484
	(0.0135)	(0.101)
Ethnicity - Other Black	-0.0345**	-0.0364***
	(0.0148)	(0.0116)
Ethnicity - Arab	-0.0553	0.0776
	(0.0360)	(0.165)
Ethnicity - Other	-0.0369***	-0.0268**
	(0.0101)	(0.0107)
Govt. mistrust	0.00727	
	(0.00461)	
NHS mistrust	0.0196***	
	(0.00405)	
Racial attacks	-0.00401	
	(0.0183)	
Low COVID risk	-0.0244	
	(0.0152)	
2011 Govt. mistrust		0.0122***
		(0.00472)
2011 NHS experience		-0.00765
		(0.0124)
Socio-demographic controls	YES	YES
Observations	5,932	5,090
R-squared	0.029	0.038

*** p<0.01, ** p<0.05, * p<0.1

Notes: Coefficient values from linear probability estimates are presented with standard errors in parentheses. Base category is the White population group. Socio-demographic controls include gender, marital status and age.

4.3 Mechanisms

In this regression, we regressed the distrust mechanism on ethnicity to understand whether it works through ethnicity to effect vaccine hesitancy. That is, we regress the mechanism of distrust on ethnicity to understand whether it works through ethnicity on vaccine hesitancy as reported in equation (4) below:

$$P(NHS_mistrust = 1|x) = \beta 0 + \beta 1 i.ethnicity_i + e_i \quad (4)$$

Estimates in Table 3 suggest that people of Caribbean, Indian and Bangladeshi display a significantly lower level of trust in the NHS as compared to White people, consistent with the distrust explanation put forward in this paper. This is consistent with the literature and first-hand accounts of negative experiences of minority groups with health care workers.

Table 3: Ethnicity effects of distrust with the National Health System (NHS)

VARIABLES	(1) NHS Distrust
Ethnicity - Mixed	0.0948*
	(0.0551)
Ethnicity - Indian	0.122**
	(0.0584)
Ethnicity - Pakistani	0.0400
	(0.0827)
Ethnicity - Bangladeshi	0.219***
	(0.0818)
Ethnicity - Chinese	-0.136
	(0.116)
Ethnicity - Other Asian	0.0687
	(0.0841)
Ethnicity - Caribbean	0.165**
	(0.0648)
Ethnicity - African	0.0844
	(0.100)
Ethnicity - Other Black	-0.165
	(0.363)
Ethnicity - Arab	-0.276
	(0.238)
Ethnicity - Other	-0.115
	(0.141)
Socio-demographic controls	YES
Socio-economic controls	NO
Observations	6,268
R-squared	0.013

*** p<0.01, ** p<0.05, * p<0.1

Notes: Coefficient values from regression output are presented with standard errors in parentheses. Base category is White population group. Socio-demographic controls include gender, religion, marital status and age. Other covariates include highest education level, income, and employment status.

5. CONCLUSION

We study the association between vaccine hesitancy with minority group ethnicity. We document evidence that the Black population is most vaccine hesitant and reveal a 10-17pp higher probability of being vaccine hesitant that white populations. However, our estimates suggest that such association between ethnicity and vaccine hesitancy is potentially a red herring as minority groups are not inherently less likely to take the vaccine, but more distrustful of the health system. Consistently, the effect of ethnicity disappears when both long lasting and contemporary NHS distrust is controlled for. That is, distrust works through ethnicity as Black respondents have a higher probability of being distrustful of the NHS than their White counterparts. Distrust of government from 2011 is significant, albeit at the 10% level, providing evidence of the association between enduring traumas and hesitancy.

Our findings are robust to specifications and sub-sets of the data; however, there are limitations to this study. The number of observations declines when reasons for hesitancy are controlled for and if this data is not missing at random, missing observations could impact the external validity of this study. However, our findings concur qualitative reports of vaccine hesitancy in the UK grounding our conclusions (Comuzi, 2020).

Vaccine hesitancy is a complex challenge facing the UK health system and is best dealt with through a multi-pronged approach to increase motivation for vaccination as well as ease practical issues of accessibility, as per the WHO model (Gayle *et al.*, 2020). Our results suggest that the health authorities should expand their inclusion of minority groups in the journey of design and development of health programs to make then trusted and invested process-partner (Strully *et al.*, 2021). For example, Crawshaw *et al.*, 2021 find that involving minority

communities in vaccine trials and co-developing approaches to address their concerns dispels the notion that the vaccine is imposed and creates local buy-in. Further research in intervention design is required to reduce the perceived alienation of ethnic minorities (Darko, 2021).

REFERENCES

Adida, C. *et al.* (2017) 'Reducing or reinforcing in-group preferences? An experiment on information and ethnic voting', *Quarterly Journal of Political Science*, 12(4), pp. 437–477. doi: 10.1561/100.00017018.

Ajzen, I. (2020) 'The theory of planned behavior: Frequently asked questions', *Human Behavior and Emerging Technologies*, 2(4), pp. 314–324. doi: https://doi.org/10.1002/hbe2.195

Adler, A. 1927. "Individual psychology." Journal of Abnormal and Social Psychology 22(2):116–122.

Armstrong, K K L. Ravenell, S McMurphy, M Putt (2007), "Racial/Ethnic Differences in Physician Distrust in the United States", *American Journal of Public Health* 97, no. 7 : pp. 1283-1289.

Bartling B., and U. Fischbacher. 2012. Shifting the Blame: On Delegation and Responsibility. The Review of Economic Studies 79 (1) 67-87

Barrera, O. *et al.* (2017) *Facts, Alternative Facts, and Fact Checking in Times of Post-Truth Politics*. Available at: https://econpapers.repec.org/RePEc:cpr:ceprdp:12220.

Bateman, W. *et al.* (2020) 'COVID-19 Vaccination: Reducing vaccine hesitancy Review & Recommendations ', (December).

Bécares, L. *et al.* (2012) 'Ethnic density effects on health and experienced racism among Caribbean people in the US and England: A cross-national comparison', *Social Science and Medicine*, pp. 2107–2115. doi: 10.1016/j.socscimed.2012.03.046.

Berinsky, A. J. (2017) 'Rumors and Health Care Reform: Experiments in Political Misinformation', *British Journal of Political Science*, 47(2), pp. 241–262. doi: 10.1017/S0007123415000186.

Bielecki, K. *et al.* (2019) 'Low uptake of nasal influenza vaccine in Polish and other ethnic minority children in Edinburgh, Scotland', *Vaccine*. Elsevier Ltd, 37(5), pp. 693–697. doi: 10.1016/j.vaccine.2018.11.029.

Callaghan, T. *et al.* (2021) 'Correlates and disparities of intention to vaccinate against COVID-19', *Social science & medicine (1982)*. 2021/01/04. Elsevier Ltd., 272, p. 113638. doi: 10.1016/j.socscimed.2020.113638.

Campbell, C. and McLean, C. (2002) 'Ethnic identities, social capital and health inequalities: factors shaping African-Caribbean participation in local community networks in the UK', *Social Science and Medicine*, 55, pp. 643–657.

Carter, R. T., Kirkinis, K. and Johnson, V. E. (2019) 'Relationships Between Trauma Symptoms and Race- Based Traumatic Stress', *Traumatology*, 26(1), pp. 11–18. doi: 10.1037/trm0000217.

Comuzi (2020) *Vaccine Knowledge*.

Cook, J. *et al.* (2020) *Debunking Handbook*.

Crawshaw, A. F. *et al.* (2021) 'What must be done to tackle vaccine hesitancy and barriers to COVID-19 vaccination in migrants?', *Journal of Travel Medicine*, 28(4), pp. 1–4. doi: 10.1093/jtm/taab048.

Darko, J. (2021a) ‘Life & Times: Addressing the elephant in the room: COVID-19 vaccine hesitancy in Black and Asian communities’, *British Journal of General Practice*, 71(705), p. 170. doi: 10.3399/BJGP21X715433.

Darko, J. (2021b) ‘Life & Times: Using inclusive language around vaccine hesitancy’, *British Journal of General Practice*, 71(706), p. 221. doi: 10.3399/bjgp21X715817.

Dave, C. and Wolfe, K. W. (2003) *On confirmation bias and deviations from bayesian updating*. Available at: https://www.researchgate.net/profile/John_Duffy3/publication/229013128_On_confirmation_bias_and_deviations_from_Bayesian_updating/links/0046351c994d3dc7cb000000.pdf%5Cnpapers3://publication/uuid/B693CF40-D82C-43A8-B565-404C381D9C66.

Doherty, I. A. *et al.* (2021) ‘COVID-19 Vaccine Hesitancy in Underserved Communities of North Carolina.’, *medRxiv*, pp. 1–30. doi: 10.1101/2021.02.21.21252163.

Dubé, E. and MacDonald, N. E. (2020) ‘How can a global pandemic affect vaccine hesitancy?’, *Expert Review of Vaccines*, pp. 899–901. doi: 10.1080/14760584.2020.1825944.

ESRC (2021) *Coronavirus: vaccine beliefs as the rollout ramps up*.

Fareed, N. *et al.* (2021) ‘Socioeconomic Factors Influence Health Information Seeking and Trust Over Time: Evidence From a Cross-Sectional, Pooled Analyses of HINTS Data’, *American Journal of Health Promotion*. doi: 10.1177/08901171211018135.

Gayle, H. *et al.* (2020) *Framework for equitable allocation of COVID-19 vaccine, The National Academies Press*. doi: 10.17226/25917.

Grisso, J. A. *et al.* (1999) ‘Racial differences in menopause information and the experience of hot flashes.’, *Journal of general internal medicine*. United States, 14(2), pp. 98–103. doi: 10.1046/j.1525-1497.1999.00294.x.

Hildreth, J. E. K. and Alcendor, D. J. (2021) ‘Targeting covid-19 vaccine hesitancy in minority populations in the us: Implications for herd immunity’, *Vaccines*. doi: 10.3390/vaccines9050489.

hooks, bell (2003) *Teaching community : a pedagogy of hope*. New York: Routledge.

Jamison, A. M., Quinn, S. C. and Freimuth, V. S. (2019) ‘“You don’t trust a government vaccine”: Narratives of institutional trust and influenza vaccination among African American and white adults’, *Social Science and Medicine*. Elsevier, 221(December 2018), pp. 87–94. doi: 10.1016/j.socscimed.2018.12.020.

Jeraj, S. (2021) ‘Doing the work to end health inequalities caused by systemic racism’, *The British Medical Journal*, 373(April), pp. 1–2. doi: 10.1136/bmj.n821.

Khan, M. S. *et al.* (2021) ‘Rethinking vaccine hesitancy among minority groups’, *The Lancet*, pp. 1863–1865. doi: 10.1016/S0140-6736(21)00938-7.

Lund, E. M. (2020) ‘Even more to handle_ Additional sources of stress and trauma for clients from marginalized racial and ethnic groups in the United States during the COVID-19 pandemic’, *Counselling Psychology Quarterly*.

Marshall, H. H. (2001) ‘Cultural influences on the development of self-concept: Updating our thinking’, *Young Children*, 56(6), pp. 19–25.

De Maynard, V. A. (2009) ‘Dissociation in black or black-british people of african and african-caribbean descent in the united kingdom’, *International Journal of Mental Health*, pp. 37–73. doi: 10.2753/IMH0020-7411380203.

McDowall, A. *et al.* (2020) *Signposting Resources in the Wake of George Floyd’s Death*.

Mclean, C., Campbell, C. and Cornish, F. (2003) ‘African-Caribbean interactions with mental health services in the UK: experiences and expectations of exclusion as (re)productive of health inequalities’, *Social Science and Medicine*, 56, pp. 657–669.

Murphy, J. *et al.* (2021) ‘Psychological characteristics associated with COVID-19 vaccine

hesitancy and resistance in Ireland and the United Kingdom.', *Nature communications*, 12(1), p. 29. doi: 10.1038/s41467-020-20226-9.
Nguyen, L. H. *et al.* (2021) 'Racial and ethnic differences in COVID-19 vaccine hesitancy and uptake', *medRxiv*, pp. 1–49.
Nyhan, B. and Reifler, J. (2015) 'Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information', *Vaccine*. Elsevier Ltd, 33(3), pp. 459–464. doi: 10.1016/j.vaccine.2014.11.017.
Olusanya, O. A. *et al.* (2021) 'Addressing Parental Vaccine Hesitancy and Other Barriers to Childhood/Adolescent Vaccination Uptake During the Coronavirus (COVID-19) Pandemic', *Frontiers in Immunology*, 12(March), pp. 1–7. doi: 10.3389/fimmu.2021.663074
Owens, D., Grossman, Z., and R. Fackler (2014). The Control Premium: A Preference for Payoff Autonomy."American Economic Journal: Microeconomics 6(4):138–161

Pain, R., Rezwana, N. and Sahdan, Z. (2020) 'Trauma, gender and space: Insights from Bangladesh, Malaysia and the UK', *Routledge Handbook of Gender and Feminist Geographies*, (Herman 1997), pp. 287–296.
Razai, M. S., Chaudhry, U. A. R., *et al.* (2021) 'Covid-19 vaccination hesitancy', *The British Medical Journal*, 373, pp. 1136–1139. doi: 10.1136/bmj.n1138.
Razai, M. S., Osama, T., *et al.* (2021) 'Covid-19 vaccine hesitancy among ethnic minority groups', *The British Medical Journal*, 372, pp. 1–2. doi: 10.1136/bmj.n513.
Robalo, P. and Sayag, R. (2018) 'Paying is believing: The effect of costly information on Bayesian updating', *Journal of Economic Behavior and Organization*. Elsevier B.V., 156, pp. 114–125. doi: 10.1016/j.jebo.2018.09.016.
Robertson, E. *et al.* (2021) 'Predictors of COVID-19 vaccine hesitancy in the UK household longitudinal study', *Brain, Behavior, and Immunity*. Elsevier Inc., 94(March), pp. 41–50. doi: 10.1016/j.bbi.2021.03.008.
Rooks, R. N. *et al.* (2012) 'Health information seeking and use outside of the medical encounter: Is it associated with race and ethnicity?', *Social Science and Medicine*. Elsevier Ltd, 74(2), pp. 176–184. doi: 10.1016/j.socscimed.2011.09.040.
SAGE (2021) 'Factors influencing COVID-19 vaccine uptake among minority ethnic groups', *Scientific Advisory Group for Emergencies*, pp. 1–15.
Sallam, M. (2021) 'COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates', *Vaccines*, 9(2). doi: 10.3390/vaccines9020160.
Schwartz, H. A. *et al.* (2013) 'Personality, Gender, and Age in the Language of Social Media: The Open-Vocabulary Approach', *PLOS ONE*. Public Library of Science, 8(9), pp. 1–16. doi: 10.1371/journal.pone.0073791.
Streefland, P., Chowdhury, A. M. and Ramos-Jimenez, P. (1999) 'Patterns of vaccination acceptance.', *Social science & medicine (1982)*. England, 49(12), pp. 1705–1716. doi: 10.1016/s0277-9536(99)00239-7.
Strully, K. W. *et al.* (2021) 'Strategies to Address COVID-19 Vaccine Hesitancy and Mitigate Health Disparities in Minority Populations', *Frontiers in Public Health*, 9(April), pp. 1–7. doi: 10.3389/fpubh.2021.645268.
Thompson HS, Manning M, Mitchell J, et al. Factors Associated With Racial/Ethnic Group-Based Medical Mistrust and Perspectives on COVID-19 Vaccine Trial Participation and Vaccine Uptake in the US. *JAMA Netw Open*. 2021;4(5):e2111629.
TSIP (2021) *Medical Scepticism / Distrust Community Research*.
University of Essex (2019) 'Understanding Society Waves 1-9 User Guide', pp. 1–119. Available at: https://www.understandingsociety.ac.uk/.
University of Essex (2021) 'Understanding Society COVID-19 User Guide', *Understanding*

Society. doi: 10.1007/978-1-349-15392-3.
Wellcome Foundation (2019) *Wellcome Global Monitor 2019*. Available at: https://wellcome.org/reports/wellcome-global-monitor/2018.
WHO (2019) *Ten threats to global health in 2019*. Available at: https://www.who.int/emergencies/ten-threats-to-global-health-in-2019.
Wittenberg, C. and Berinsky, A. J. (2012) *Misinformation and Its Correction, Psychological Science in the Public Interest*. doi: 10.1177/1529100612451018.

APPENDICES

Appendix A: Construction of derived variables

- *Race:* ethnic categories combined to White, Black Asian, Arab, and Mixed
- *Government mistrust:* variable created to capture those who believe government does not care about its citizens (constructed in 2011 and 2019 pre-pandemic)
- *Vaccine hesitancy:* binary variable for those who have not received the vaccine by March 2021 AND would not take the vaccine when offered
- *NHS mistrust:* variable created to capture those who did not give serology rights to NHS due to mistrust (2019 pre-pandemic)
- *NHS experience:* binary variable for those who have a condition that would expose them fairly regularly to NHS (2011)
- *Experience of racial attacks:* binary variable for racial attacks are fairly common or very common in neighbourhood (constructed in 2011 and 2019 pre-pandemic)
- *Homogeneity of friendship group:* binary variable for all or more than half of friendship group belongs to respondents race (constructed in 2011 and 2019 pre-pandemic)
- *Perceived risk of contracting COVID-19:* binary variable for perceiving a low risk of getting COVID-19
- *Main news source:* categories of relying primarily on personal experience, word of mouth/friends and family, local and national newspapers, TV/radio, internet, government publications, and books/school (constructed in 2011 and 2019 pre-pandemic)
- *Religion:* religious categories combined to non-religious, Christian, Muslim, Hindu/Sikh/Buddhist (to increase sample size), Jewish, and Other
- *Marital status:* marital status combined to Single, Married/Civil-partnership, and Separated/Divorced/Widowed

- *Working:* binary variable for those who are self-employed, in paid employment, government training, unpaid family business, apprenticeship, or doing something else
- *Age categories:* age divided into categories of 16-34, 35-49, 50-64, 65-79, >80
- *First generation migrant:* variable created to capture those not born in the UK
- *Second generation migrant:* variable created to capture those whose mother and/or father were not born in the UK