



Determinants of trust in the flu vaccine for African Americans and Whites



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ABSTRACT

Trust is thought to be a major factor in vaccine decisions, but few studies have empirically tested the role of trust in adult immunization. Utilizing a 2015 national survey of African American and White adults ($n = 1630$), we explore multiple dimensions of trust related to influenza immunization, including generalized trust, trust in the flu vaccine, and trust in the vaccine production process. We find African Americans report lower trust than Whites across all trust measures. When considering demographic, racial, and ideological predictors, generalized trust shows statistically significant effects on both trust in the flu vaccine and trust in the vaccine process. When controlling for demographic, racial, and ideological variables, higher generalized trust was significantly associated with higher trust in the flu vaccine and the vaccine process. When controlling for generalized trust, in addition to the baseline covariates, psychosocial predictors (i.e. risk perception, social norms, knowledge) are significant predictors of trust in flu vaccine and trust in the vaccine process, with significant differences by race. These findings suggest that trust in vaccination is complex, and that significant differences in trust between White and African American adults may be contributing to disparities in influenza immunization.

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1. Introduction

Experts agree that public trust is necessary for the success of immunization programs, yet few studies have thoroughly explored the determinants of trust in vaccines. Two major research organizations have published research agendas related to vaccine trust. The international, interdisciplinary think-tank, “Motors of Trust in Vaccination” (MOTIV), calls for greater exploration of the factors contributing to trust in vaccines (Larson et al., 2013). The second, from the American Academy of Arts and Science (AAAS), calls for research on the role of trust in vaccine decisions, particularly within “at-risk communities” where social norms may contribute to lower vaccine trust and greater vaccine hesitancy (AAAS, 2014). Reflecting upon both calls, we recognized the need for research on trust as it relates to vaccine disparities, as growing evidence indicates African

Americans experience greater distrust and vaccine hesitancy when compared to their White peers (Quinn et al., 2017). In this manuscript, we utilize national survey data to explore the determinants of trust in both influenza vaccines and trust in the entities and agencies responsible for vaccine development, manufacture, and administration in a representative sample of White and African American adults. Although much of the discourse on trust in vaccines is related to parental trust related to childhood vaccines, we focus on adults, and specifically on racial differences between Black and White adults for two reasons: first, there is a consistent racial disparity in influenza vaccination with African American adults receiving the vaccine at lower rates than Whites, and secondly, African Americans experience a greater burden of chronic diseases that place them at greater risk of serious complications from the flu.

1.1. Trust in vaccines

While there are numerous and competing definitions of trust, we have employed a general definition, based on the common

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agreement that trust involves a voluntary relationship between a trustor and a trustee, where the trustor holds certain expectations about the trustee's future actions (Gilson, 2003). Trust arises in situations of vulnerability, and in a medical context, vulnerability related to illness and disease risks are thought to intensify trust relationships (Hall et al., 2001). We recognize that trusting a flu vaccine encompasses numerous entities, and necessarily involves multiple trust relationships.

Major theoretical work surrounding vaccine trust comes from the World Health Organization's (WHO) Strategic Group of Experts on Vaccination (SAGE). SAGE hypothesizes that trust is a major factor in vaccine hesitancy, contributing to vaccine delay and refusal (MacDonald, 2015). Trust influences vaccine hesitancy at many levels, including "trust in the effectiveness and safety of vaccines, the system that delivers them, including the reliability and competence of the health services and health professionals and the motivations of policy-makers who decide on the needed vaccines" (MacDonald, 2015, 4162). Recognizing this complexity, we chose to investigate trust in the flu vaccine and trust in the vaccine process as two separate, but related, outcomes.

SAGE also acknowledges that trust varies by vaccine type and across populations (Larson et al., 2011). This research is specifically focused on seasonal influenza vaccines and the research population includes African American and White adults. The majority of vaccine research investigating trust is focused on parental trust and its role in shaping parents' decisions to immunize their children with childhood vaccines (AAAS, 2014). Adults consider different factors when making decisions about immunization for themselves than when deciding for their children (Quinn et al., 2016). Unlike many childhood vaccines with specific age recommendations, seasonal influenza vaccine is recommended broadly to all children (over six months) and adults. Flu is also unique because a new vaccine is released each year, requiring annual immunization to be maximally effective. Public perception of the flu also varies widely, contributing to mixed perception of risks: some think the flu "isn't that bad" while others understand it could be deadly (Quinn et al., 2016). In qualitative research, we found many adults describe thinking about the flu vaccine differently than vaccines in general (Quinn et al., 2016).

The SAGE framework also identifies a "matrix" of determinants that shape vaccine hesitancy across three levels: contextual, individual/group, and vaccine specific. Contextual influences are the broadest including historic, socio-cultural, environmental, economic, and political factors. Individual and group influences include personal perceptions, beliefs, and attitudes related to vaccines as well as the influence of one's peer environment. Vaccine influences include aspects specific to an individual vaccine including modes of administration, costs, and vaccination schedule (Larson et al., 2015). As such, we recognized the need to explore a wide range of potential predictors for trust.

In the United States, the vaccine process involves institutions responsible for development, approval, and manufacture of flu vaccines including pharmaceutical companies, the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), as well as the localized healthcare systems and providers responsible for vaccine administration. National polling data shows that despite having high levels of trust in federal health agencies overall, trust levels have recently declined, and trust in pharmaceutical companies is at an all-time low (Harris Poll, 2015; Gallup Poll, 2016). A recent study confirmed 65% of American adults trust the CDC and 63% trust the FDA (Kowitz et al., 2017). Trust in the role these institutions play in the vaccine process is less studied. Qualitative investigation revealed widespread mistrust in the motives that drive pharmaceutical companies, as well as some skepticism

regarding the competence of government agencies in developing appropriate influenza vaccines (Quinn et al., 2016). Research from the 2009–2010 H1N1 pandemic found public trust in government agencies had a significant impact on willingness to accept a novel influenza vaccine (Freimuth et al., 2014; Quinn et al., 2013).

More research has been focused on interpersonal trust between patient and providers (Kehoe and Ponting, 2003). Patients will often report different levels of trust towards their own provider, which may be based on personal experiences and patient personality, than towards health care providers as a general class, which may be more reflective of trust in the health care system as a whole (Hall et al., 2001). Some factors known to influence trust in providers include competence and beneficence (belief that providers' motives are aligned with patients' best interests), patient satisfaction, health outcomes, and patient-provider power dynamics (Thom and Campbell, 1997). A study by Musa and colleagues found patients with high levels of trust in physicians were more likely to utilize preventive health services, including influenza vaccination (Musa et al., 2009). A more recent study of parents concluded lower trust in health care providers was associated with lower odds of HPV vaccination (Fu et al., 2017).

Rather than consider institutions and providers separately, a broader look at the vaccine process encompasses the interactions between the two. Studies have shown feelings of shared values between patient and provider can reinforce institutional trust (Gilson, 2003; Kehoe and Ponting, 2003). The reverse has also been observed, as trust at a larger system can serve as a foundation in a new trust relationship with an individual provider (Hall et al., 2001). These relationships are also influenced as individuals respond differently to the competency of an agency/actor and the motives driving that agency/actor, differentiating between trust in competence and trust in beneficence (Ahern and Hendryx, 2003; Siegrist, 2010; Siegrist et al., 2003; Twyman et al., 2008).

In addition to considering the components of the vaccine process separately, we assessed trust in the vaccine itself. Black and Rappoli argue that the erosion of trust in vaccines is a problem, "transcending pharmaceutical companies producing vaccines or the public health agencies recommending them", suggesting individual levels of trust in pharmaceutical companies, in federal and state public health agencies, and in health care providers are secondary to the overall level of trust in vaccines (2010, 3). Because there has been little consistency in the way researchers have measured trust in vaccines, we explored these types of vaccine-related trust to see if people discriminate among them and if there are patterns of racial differences.

1.2. Generalized trust

In addition to assessing trust in the flu vaccine and the vaccine process, we recognized the need to assess a baseline measure of generalized trust. It is common to make a distinction between interpersonal trust (between known individuals) and impersonal trust (between strangers) (Gilson, 2003). Some scholars have formalized this distinction, broadening it to differentiate between generalized and particularized trust (Stolle, 2002). Generalized trust "extends beyond the boundaries of face-to-face interactions" and captures "an abstract preparedness to trust others" (Stolle, 2002, 403), which, in survey research, is often simplified into the notion that "most people" can be trusted (Carl and Billari, 2014). Particularized trust assesses trust in something specific, such as a flu vaccine, or their relationship with the doctor who provides the vaccine (Carl and Billari, 2014).

1.3. Racial differences in trust

In this investigation, we explored the determinants of trust related to influenza immunization, utilizing data from a nationally representative survey of White and African American adults. We chose to focus on trust overall, but also to identify racial differences in trust. This is based on the racial disparity in influenza immunization that has been observed consistently over the past decade. Most recently, the CDC estimate only 39% of non-Hispanic Black adults were immunized for influenza, compared to 47% of non-Hispanic White adults in the 2015–16 flu season (CDC, 2016). There is strong evidence suggesting racial differences in trust play a role in the perpetuation of this disparity (Quinn et al., 2016).

Sociological evidence demonstrates that in general, African Americans are significantly less trusting than Whites, likely due to historical and contemporary experiences of discrimination and racialized social norms (Smith, 2010). Medical distrust is also widespread in the Black community, stemming from a long history of medical racism and abuses and reinforced through ongoing experiences of discrimination in health care (Freimuth et al., 2001; Gamble, 1997). Numerous studies have confirmed the impact medical racism and events like the Tuskegee Syphilis Study have had on trust in medical research (McCallum et al., 2006), on trust in physicians (Benkert et al., 2006), and on trust in the health care system more broadly (Boulware et al., 2003), but none to date have had a specific focus on vaccine decisions. Minority status and high levels of distrust also are associated with increased acceptance of conspiracy theories (Ford et al., 2013; Goertzel, 1994; Quinn, 1997).

Traditionally, research on racial disparities in vaccines has focused on a narrow range of psychosocial predictors including demographics, barriers to access, and vaccine attitudes. When these factors fail to fully account for the disparities, trust is often invoked as a potential explanatory factor, but often without empirical support (Chen et al., 2007). Several qualitative studies have explored the role of trust in vaccine disparities, relying on focus groups or interviews with small groups from a single racial group (Daniels et al., 2004; Harris et al., 2006; Wray et al., 2007). In our qualitative research, we found that while factors including poverty and insurance status were important factors in vaccine decisions, participants were more likely to cite barriers to care as a secondary reason for not getting vaccination, while issues related to vaccine confidence and vaccine trust were a more immediate concern (Quinn et al., 2016). While qualitative research provides valuable insights, studies empirically testing racial differences in vaccine trust are much rarer and are needed to fully understand the impact of trust.

The need to empirically explore the relationships between race, trust, and vaccine acceptance led to these research questions:

1. Do African Americans and Whites differ in their level of generalized trust, as well as in their levels of trust in the flu vaccine and trust in the vaccine process?
2. What is the differential role of demographics, racial factors, and ideological beliefs in predicting generalized trust, trust in the flu vaccine and trust in the vaccine process across African Americans and Whites?
3. What is the differential role of generalized trust in predicting trust in the flu vaccine and trust in the vaccine process across African Americans and Whites?
4. Controlling for demographics, racial factors, ideological beliefs and generalized trust, what is the differential role of psychosocial variables in predicting trust in the flu vaccine and trust in the vaccine process across African Americans and Whites?

2. Study design and setting

2.1. Sample

We contracted with GfK Custom Research, LLC to conduct our survey with a target sample of 800 non-Hispanic African American and 800 non-Hispanic White, non-institutionalized adults. GfK selected the sample from its KnowledgePanel, a probability-based web panel designed to be representative of the U.S. The survey took place in March 2015. GfK provided a data file with design-based weights to account for recruitment, and panel-based and study-specific post-stratification weights benchmarked against the 2014 Current Population Survey. Post-stratification weights were available to adjust for nonresponse as well as for under- and over-sampling of specific subpopulations imposed by the sampling design (e.g., by age, education, race, sex); all analyses were weighted to be nationally representative. Missingness ranged from 0% to about 3%, and was accommodated in each analysis as described below.

2.2. Measures

The survey instrument was developed based on extensive qualitative research ($n = 110$) with African Americans and Whites and pre-tested in cognitive interviews ($n = 16$) (Quinn et al., 2016). We also utilized exploratory factor analysis to finalize our measures.

Demographic variables included age, race/ethnicity, gender, income, education, and health insurance status. The independent variables included ideological, racial, and psychosocial factors (Table 1). Outcome variables included the three measures of trust: generalized trust, trust in the vaccine, and trust in the vaccine process. Generalized trust and trust in the flu vaccine were both measured with a single item. To measure trust in the flu vaccine process, we created an infographic (Fig. 1) to explain flu vaccine production, approval, and distribution, and then asked respondents to rate their trust in each of the following separately: the WHO, pharmaceutical companies, the FDA, the CDC, and the individual health care providers.

3. Analyses

To address the first research question, the means of these variables for both groups were compared via t-tests. For the second research question on racial differences with regard to the predictors of trust in vaccine and vaccine process, general linear regressions for each racial group were fitted for the two outcome measures with two sets of predictors respectively, including (1) the demographic, racial, and ideological predictors and (2) generalized trust. The regression coefficients for both groups were compared using the z statistic recommended by Mann et al. (2009), which can be expressed as:

$$z = \frac{b_{AA} - b_W}{\sqrt{SE_{AA}^2 + SE_W^2}},$$

where b_{AA} and b_W are the respective regression coefficients for a particular predictor for African Americans and Whites, and SE_{AA}^2 and SE_W^2 are the squared standard errors for the corresponding parameter estimates. The predictors of generalized trust were also evaluated with demographic, racial, and ideological factors as predictors.

Table 1
Sample demographics and flu vaccination behavior.

	Total (n = 1643)	White (n=834)	African American (n = 809)	Chi-Square Test or t-test
	%	%	%	(Sig.)
Sex				
Male	47.7	50.5	44.7	0.011
Female	62.3	49.5	55.3	
Age				
18–29	16.4	14.9	17.9	0.007
30–44	18.9	18.6	19.3	
45–59	29.0	27.0	31.1	
60+	35.7	39.6	31.6	
Mean Age (SD)	51.2 (17.2)	52.7 (17.8)	49.7 (16.4)	<0.001
Education				
Less than high school	7.4	5.6	9.1	<0.001
High School	31.2	31.4	30.9	
Some College	29.8	26.1	33.5	
Bachelor Degree or higher	31.7	36.8	26.5	
Income				
Less than \$20,000	19.8	11.9	28.1	<0.001
\$20,000 to \$39,999	20.3	17	23.6	
\$40,000 to \$84,999	32.6	34.2	30.9	
\$85,000 or more	27.3	36.9	17.4	
Vaccine Behavior				
Got flu shot	49.0	53.4	44.4	<0.001
Did not get flu shot	51.0	46.6	55.6	

Note. All numbers and percentages are unweighted.

For questions 3 and 4, the differential roles of generalized trust (controlled for demographic, racial, and ideological variables) and psychosocial factors (controlled for demographic, racial, ideological variables, and generalized trust) in predicting trust in the flu vaccine and vaccine process were examined via blockwise regressions. Linear regressions were conducted separately for each racial group. In Block 1, only demographic, racial, and ideological variables were included to obtain the baseline coefficients of determination, R-squared (i.e., the proportion of variance in the dependent variable explained by the independent variables). In Block 2, generalized trust was added to Block 1 and the change in R-squared was assessed. Block 3 added psychosocial factors. The regression coefficients of the additional predictors for Blocks 2 and 3 were compared using the z test described above.

All analyses were conducted using SPSS (version 22) and were weighted to be nationally representative.

4. Results

For Whites, 1329 were sampled and 838 (63.1%) respondents completed the survey. For African Americans, 1599 were sampled and 819 (51.2%) respondents completed the survey. Of the 1657 completed cases, 1643 cases were valid for inclusion in the analyses. The sample included slightly more females (62.3%) than males (47.7%) and the mean age of all respondents was 51.2. About half of the total sample (49%) reported getting an influenza vaccine, with significantly more Whites (53.4%) reporting vaccination when compared to African Americans (44.4%) (Table 2).

Our first research question was to identify racial differences for all measures of trust (Table 3). African Americans reported lower mean scores than Whites for every trust measure; the differences were all statistically significant ($p < 0.05$) with the exception of trust in government.

Our second research question examined the differences between African Americans and Whites in the effects of demographic, racial, and ideological predictors on trust. Racial mean differences for independent variables are reported in Table 4 and regression results are presented in Table 5. For African Americans, household income, social position, and racial consciousness all were

statistically significant predictors of generalized trust. To interpret, African Americans who have higher household income, perceived a higher social position and report lower perceived racial consciousness tend to have higher generalized trust. Although household income was also a positive significant predictor of generalized trust for the White sample, the other significant predictors of generalized trust for Whites, including age, education, and racial fairness, differed from those for African Americans. Whites of older age, higher levels of education and household income report greater generalized trust. For both samples, higher perceived racial fairness contributed to higher generalized trust (i.e., significantly for African Americans and non-significantly for Whites); however, racial fairness was a statistically significantly stronger predictor for Whites than African Americans.

For trust in the flu vaccine, the two groups had several statistically significant predictors in common, including age, household income, racial fairness, and ideology. For both groups, older age, higher household income, greater perceived racial fairness, and more liberal political ideology were associated with more trust in the flu vaccine. One's perceived position on the social ladder only had a statistically significantly positive effect on the White sample. Perceived racial fairness and impact of discrimination were both statistically significant only for African Americans, with perceived racial consciousness having a positive effect and the impact of discrimination having a negative effect on trust in the flu vaccine. The effects of perceived position on the ladder and racial consciousness differed significantly for the two groups. Specifically, results show that the effects of perceived position on a social ladder were in different directions for the two groups (i.e., non-significantly negative for African Americans and significantly positive for Whites) and the effect for Whites was statistically significantly stronger. The effect of racial consciousness was a negative predictor for both groups but was only significant for African Americans.

The two groups also demonstrated differences in the predictive effects of the demographics, racial and ideological predictors on the trust in the vaccine process. The statistically significant predictors for Whites included age, education, racial fairness, racial consciousness, and ideology. Specifically, higher trust in the vaccine

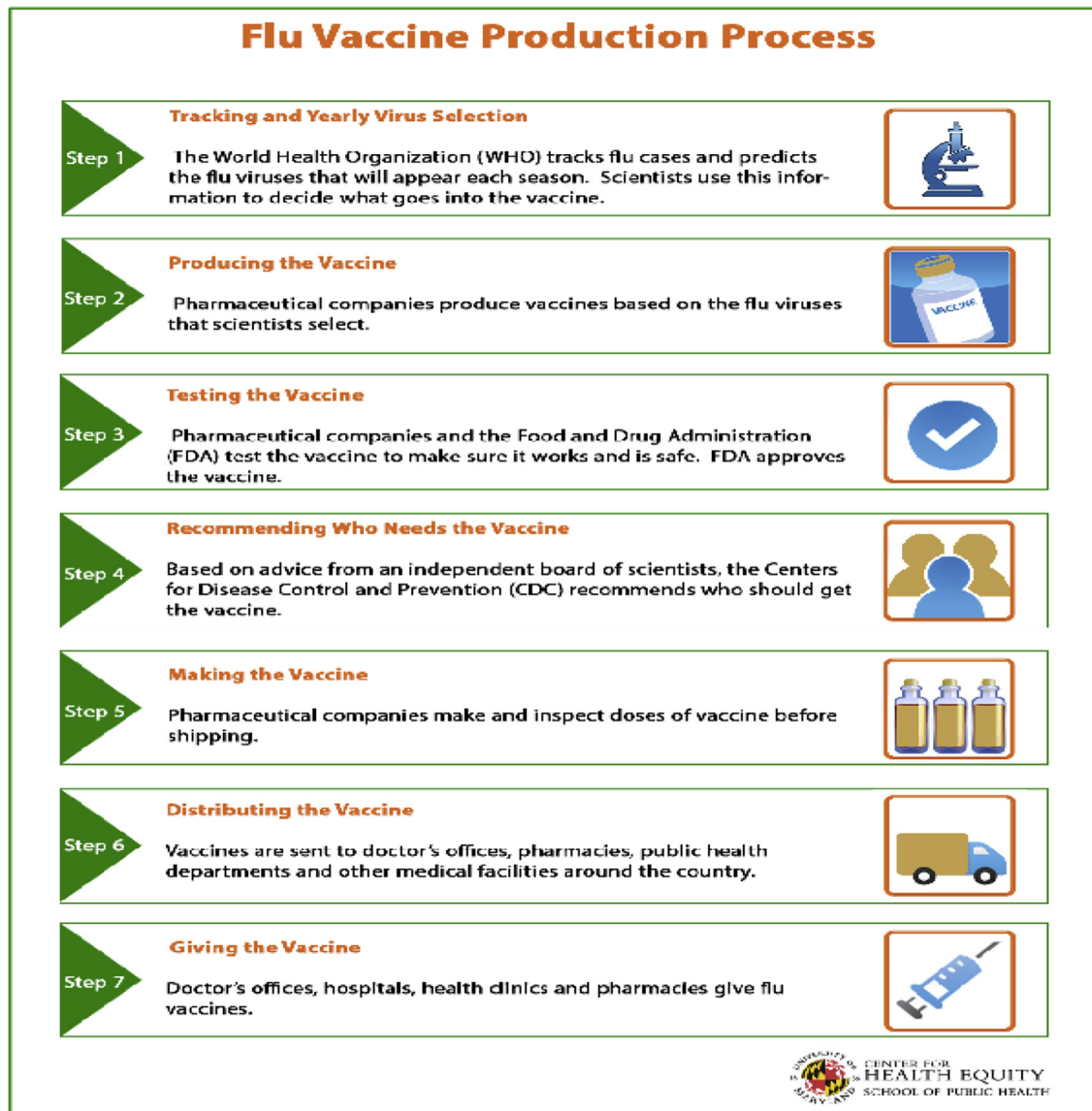


Fig. 1. Flu vaccine production process infographic.

process for Whites was statistically significantly associated with older age, higher education, higher perceived racial fairness, lower perceived racial consciousness and more liberal political ideology. The significant predictors for African Americans also included age, racial fairness, and ideology, in the same directions as for Whites; income and the impact of discrimination were the unique significant predictors for African Americans, with positive effect of increased household income and negative effect of perceived impact of discrimination. In terms of group differences, household income, racial consciousness, and impact of discrimination statistically differed between the two groups. In particular, household income was a statistically stronger positive predictor for African Americans, meaning that people with higher household income tend to have more trust in the vaccine process. Racial consciousness was a statistically significant negative predictor for African Americans only, indicating that higher racial consciousness was associated with lower trust in the flu vaccine process. In addition, the predictive effect of impact of discrimination differed in direction for the two groups. For Whites, low perceived impact of discrimination was associated with higher trust in the flu vaccine but for African

Americans, the impact of discrimination was not significant.

In our third research question, we examined generalized trust as a predictor of trust in the flu vaccine and the vaccine process both. For both African Americans and Whites, generalized trust showed statistically significant effects on both trust in the flu vaccine and trust in the vaccine process. Even though African Americans had significantly lower generalized trust than Whites, no statistical difference was found between the two groups in terms of the relations between generalized trust and trust in the flu vaccine process.

In our fourth research question, we examined the differential roles of generalized trust and the psychosocial factors, respectively, in predicting trust in the flu vaccine for African Americans and Whites. The results of the blockwise regressions are shown in Table 6 and the R-squared for each block are reported in Table 7. For both samples, higher generalized trust was statistically significantly associated with higher trust in the flu vaccine, controlling for the baseline covariates (i.e., demographics, racial factors, and ideology). When holding both baseline covariates and generalized trust constant, a number of psychosocial variables were statistically

Table 2
Survey measures.

Concept/Variable	Type of scale & # of items	Cronbach's alpha	Abbreviated Item Wording
OUTCOMES			
Generalized trust	1	-	Generally speaking, how much do you trust most people
Trust in flu vaccine	1	-	Overall, how much do you trust the flu vaccine
Trust in vaccine process	5	0.925	When it comes to the flu vaccine process, how much do you trust: (1) the world health organization (2) pharmaceutical or drug companies (3) the U.S. Food and Drug Administration (FDA) (4) the Centers for Disease Control and Prevention (CDC) (5) the health professionals who give the flu vaccine. Respondents were given the info graphic in Fig. 1 to understand the process.
Trust in the government	1	-	How much do you trust the government when it comes to flu vaccines
Trust in your doctor	1	-	How much do you trust your own personal doctor when it comes to flu vaccines
Trust in the information from CDC	1	-	How much do you trust the information about the flu that comes from the Centers for Disease Control and Prevention (CDC)
Trust in WHO	1	-	When it comes to the flu vaccine process, how much do you trust the WORLD HEALTH ORGANIZATION
Trust in pharmaceutical companies	1	-	When it comes to the flu vaccine process, how much do you trust PHARMACEUTICAL OR DRUG COMPANIES
Trust in FDA	1	-	When it comes to the flu vaccine process, how much do you trust the U.S. FOOD AND DRUG ADMINISTRATION (FDA)
Trust in CDC	1	-	When it comes to the flu vaccine process, how much do you trust the CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
Trust in health professionals	1	-	When it comes to the flu vaccine process, how much do you trust the HEALTH PROFESSIONALS WHO GIVE THE FLU VACCINE whether you go to a doctor's office, a clinic or a pharmacy
Trust in beneficence	1	-	Overall, how much do you trust that the organizations involved in the flu vaccine make their decisions with the public's best interest in mind
Trust in competence	1	-	Overall, how much do you trust that all of these organizations do a good job when it comes to the flu vaccine
MacArthur Scale of Subjective Social Status (MacArthur, 2008)	1	-	When you think about where you stand relative to others based on your education, financial standing, and career or place in society, do you feel you are
Racial fairness	Mean of 2 items	0.702	1. The government acts in the best interest of people in my racial group 2. People of my race are treated fairly in a healthcare setting
Racial consciousness in health care setting	Mean of 4 items	0.743	1. I think about my race when I am in a healthcare setting 2. Because of my race I have less reason to trust flu vaccine than other groups 3. Racism makes a difference in getting access to certain medicines or treatments 4. The healthcare system favors my race over other groups
Frequency of discrimination	1	-	How often have you experienced racial discrimination in healthcare settings
Impact of discrimination	1	-	How much has racial discrimination interfered with your getting good health care
Political Ideology	1	-	In general, do you think of yourself as (extremely liberal to extremely conservative)
PSYCHOSOCIAL FACTORS			
Perceived disease risk (conditional on actual vaccine behavior)	Mean of 4 items	0.836	1. How likely are you to get the flu (cognitive) 2. How severe do you think the flu would be (cognitive) 3. How much would you worry about the flu (affective) 4. How much regret do you think you would feel if you did get the flu (affective)
Perceived vaccine risk (conditional on actual vaccine behavior)	Mean of 4 items	0.842	1. How likely are you to have side effects of the vaccine (cognitive) 2. How severe do you think the side effects would be (cognitive) 3. How much would you worry about side effects (affective) 4. How much regret do you think you would feel if you did have side effects (affective)
Self-reported knowledge	1	-	How much would you say you know about the flu vaccine
Importance of flu vaccine	1	-	Thinking specifically about the flu vaccine in general, do you think that the flu vaccine is important
Effectiveness of flu vaccine	1	-	Thinking specifically about the flu vaccine in general, do you think that the flu vaccine is effective
Vaccine hesitancy	1	-	Overall, how hesitant are you about getting vaccinations
General Importance of vaccines	1	-	How important do you think vaccines have been overall in preventing disease?
Subjective norm	1	-	Of the people close to you what proportion want you to get a flu vaccine

Table 3
Weighted means and standardized effect size estimates.

	AA	W	\hat{d}
Generalized trust	2.60	3.08	0.52***
Trust in flu vaccine	2.89	3.18	0.25***
Trust in government	2.62	2.68	0.05
Trust in doctor	3.32	3.67	0.30***
Trust in the information from CDC	3.07	3.27	0.18***
Process: Trust in the WHO	3.03	3.23	0.19***
Process: Trust in pharmaceutical companies	2.76	2.92	0.15**
Process: Trust in the FDA	2.92	3.06	0.13*
Process: Trust in the CDC	3.11	3.29	0.16**
Process: Trust in health care professionals	3.17	3.64	0.42***
TRUST2	3.00	3.23	0.24***
Trust in beneficence	3.01	3.25	0.22***
Trust in competence	3.01	3.23	0.22***

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. AA = African American; W = White. \hat{d} = Cohen's estimated standardized effect size.

significant predictors of trust in the flu vaccine. All psychosocial variables demonstrated statistically significant effects on trust in the flu vaccine for Whites, while all but general importance of vaccines and subjective norms were significant for African Americans. With respect to the differential roles of the psychosocial variables for the two samples, perceived disease risk and effectiveness of the flu vaccine significantly differed across groups. The positive effect of disease risk was significantly stronger for African Americans and that of effectiveness of the flu vaccine was significantly stronger for Whites. With the psychosocial variables incorporated in the model, compared to the model with the baseline and the generalized trust predictors only, the R-squared dramatically increased by 276% (i.e., from 0.17 to 0.64) for African Americans and increased by 294% (i.e., from 0.19 to 0.70) for Whites.

With regard to trust in the vaccine process, generalized trust had shown similar effects as predicting trust in the flu vaccine – statistically significantly positive effects with both groups, holding

Table 4
Mean Racial Differences for Independent variables.

	AA	W	\hat{d}
Age	45.33	49.62	0.25***
Gender	0.45	0.49	0.08
Education	9.81	10.36	0.30***
Income	9.84	12.51	0.57***
Ladder	2.08	2.21	0.16**
Racial fairness	2.11	3.00	0.97***
Racial consciousness	1.36	0.90	0.54***
Frequency of discrimination	0.34	0.08	0.62***
Impact of discrimination	0.44	0.11	0.54***
Ideology	2.62	3.29	0.44***
Disease risk	0.99	1.10	0.14**
Vaccine risk	0.98	0.75	0.29***
Self-reported knowledge of the flu vaccine	3.12	3.29	0.15**
Attitudes toward flu vaccine (important)	3.06	3.12	0.07
Attitudes toward flu vaccine (effective)	2.91	2.91	0.01
General vaccine hesitancy	1.98	1.70	0.30***
General Importance of vaccines	3.47	3.66	0.27***
Subjective norm	2.45	2.79	0.22***

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. AA = African American; W = White. \hat{d} = Cohen's estimated standardized effect size.

the baseline covariates constant. For African Americans, when controlling for the baseline covariates and generalized trust, the statistically significant psychosocial predictors of trust in the vaccine process included perceived disease risk, perceived risk of vaccine side effects, effectiveness of the flu vaccine, importance of the flu vaccine, and subjective norms. For Whites, all psychosocial variables except for risk of side effects had statistically significant effects on the outcome. Again, the coefficients of determination, R-squared, were improved by 158% (from 0.19 to 0.49) for African Americans and 122% (from 0.27 to 0.60) for Whites.

5. Discussion

The present study explored racial differences in the predictors of trust related to influenza vaccination using a national sample of African American and White adults. We responded to the critical need for research on the determinants of vaccine trust. Persistent racial disparities in influenza immunization place African Americans at greater risk for influenza and related complications, and trust had been hypothesized as a major factor in driving that disparity. We were able to identify several key demographic, racial and ideological predictors of trust in the flu vaccine and in trust of the vaccine process.

Table 5
Results of linear regressions.

Predictors	Effect on Generalized Trust			Effect on Trust in Flu Vaccine			Effect on Trust in Vaccine Process			
	AA	W	Diff. (z)	AA	W	Diff. (z)	AA	W	Diff. (z)	
Demographics, racial factors, and ideology	Age	0.00	0.01***	-1.77	0.01**	0.01***	-0.83	0.01***	0.01***	1.07
	Gender	-0.08	-0.10	0.31	-0.01	0.14	-1.31	0.03	0.01	0.14
	Education	0.02	0.07***	-1.85	0.02	0.03	-0.20	0.05*	0.02	0.91
	Income	0.02*	0.03***	-0.96	0.02*	0.02*	0.03	0.00	0.03***	-2.03
	Ladder	0.10*	0.04	1.15	-0.01	0.14**	-2.22	0.01	0.04	-0.58
	Racial fairness	0.07	0.19***	-2.23	0.33***	0.27***	0.96	0.28***	0.32***	-0.81
	Racial consciousness	-0.13**	-0.01	-1.92	-0.23***	-0.08	-2.06	-0.26***	-0.04	-3.72
	Frequency of discrimination	0.03	-0.19	1.45	-0.04	0.15	-0.97	-0.01	0.19	-1.31
	Impact of discrimination	0.02	-0.04	0.51	0.13*	0.07	0.41	0.01	-0.21*	2.22
	Ideology	0.02	0.03	-0.29	-0.09***	-0.12***	0.68	-0.07**	-0.09***	0.89
Generalized trust	NA			0.35***	0.41***	-1.01	0.35***	0.39***	-0.66	

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. AA = African American; W = White. The bolded z statistics (less than -1.96 or greater than 1.96) indicate statistically significant difference between African Americans and Whites.

Our first research question examined multiple measures of trust. The results suggest that generalized trust is certainly related to the particular measures of trust in the flu vaccine and vaccine process, but that they are distinct concepts. African Americans have lower levels of all types of trust, which is not surprising given historical and contemporary experiences with racism. In fact, African Americans reported lower levels of trust in every measure of trust in the survey. The largest gaps in trust between African Americans and Whites were for generalized trust and trust in health professionals who administer the vaccine. Both findings are consistent with the literature on race and trust (Benkert et al., 2006; Smith, 2010). While trust scores for African Americans were lower across all three measures, the relationships between generalized trust and both trust in the vaccine and trust in the vaccine process were the same across both races, suggesting a consistent relationship between generalized and specific forms of trust.

These results also suggest that trust in the flu vaccine is unique from trust in vaccines in general. For both African Americans and Whites, trust in the flu vaccine is lower than trust in vaccines in general. Both groups also report low trust in pharmaceutical companies. It may be that the flu vaccine is treated with more skepticism because its effectiveness is generally lower than many other vaccines or that it is recommended every year, which leads to the perception that it is promoted as a profit maker for pharmaceutical companies.

Even though African Americans have significantly lower trust for most of the organizations involved in the vaccine process, the rank order of trust is the same for both groups: health care professionals who give the flu vaccine have the highest trust followed by the CDC, WHO, FDA, and pharmaceuticals. These results are consistent with trust ratings taken during the early stages of the H1N1 pandemic. Freimuth et al. (2014) observed high levels of trust for health care professionals overall, but found that Whites had higher trust ratings of personal health care professionals than African Americans. We also found that although African Americans and Whites had the highest trust in health care professionals in the list of organizations who constitute the vaccine process, African Americans still trusted less than Whites. Although the literature supports the importance of health professionals recommending the vaccine to their patients, it must be done in the context of building a trusting relationship with African American patients. Since pharmaceutical companies are trusted so little, it is vitally important that flu vaccine messages and promotional campaigns come from public health agencies and health care providers rather than the industry.

Table 6
Results of the blockwise regressions.

		Effect on Trust in Flu Vaccine			Effect on Trust in Vaccine Process			
		AA	W	Diff. (z)	AA	W	Diff. (z)	
Block 2	Age	0.01**	0.01***	-0.34	0.01***	0.00*	1.46	
	Gender	0.02	0.18*	-1.39	0.04	0.04	-0.03	
	Education	0.02	0.00	0.33	0.04*	0.01	1.47	
	Income	0.02*	0.01	0.25	0.00	0.02*	-1.90	
	Ladder	-0.03	0.13*	-2.46	-0.01	0.03	-0.77	
	Racial fairness	0.31***	0.21***	1.54	0.26***	0.27***	-0.22	
	Racial consciousness	-0.20***	-0.08	-1.68	-0.23***	-0.04	-3.40	
	Frequency of discrimination	-0.05	0.21	-1.38	-0.02	0.23	-1.73	
	Impact of discrimination	0.13*	0.09	0.34	0.01	-0.20*	2.20	
	Ideology	-0.10***	-0.13***	0.79	-0.07**	-0.10***	0.97	
	Generalized trust	0.27***	0.32***	-0.76	0.24***	0.27***	-0.66	
	Block 3	Age	0.00	0.00	-0.33	0.00	0.00	1.71
		Gender	0.02	0.11*	-1.21	0.07	0.00	0.97
Education		-0.03*	0.00	-1.52	0.02	0.00	1.12	
Income		0.02***	0.00	2.54	0.00	0.01	-1.11	
Ladder		-0.01	0.01	-0.62	0.01	-0.04	1.18	
Racial fairness		0.14***	0.05	1.88	0.13***	0.16***	-0.78	
Racial consciousness		-0.04	-0.02	-0.48	-0.17***	-0.01	-3.51	
Frequency of discrimination		-0.06	-0.01	-0.39	-0.07	0.11	-1.56	
Impact of discrimination		0.11*	0.20*	-1.13	0.02	-0.12	1.86	
Ideology		-0.04*	-0.04**	0.23	-0.06**	-0.05***	-0.38	
Generalized trust		0.18***	0.12***	1.21	0.15***	0.16***	-0.16	
Disease risk		0.39***	0.26***	2.21	0.20***	0.12**	1.42	
Vaccine risk		-0.32***	-0.27***	-0.82	-0.09*	-0.06	-0.58	
Self-reported knowledge of the flu vaccine		0.05*	0.08**	-0.77	0.02	0.07**	-1.27	
Attitudes toward flu vaccine (important)		0.16***	0.11*	0.86	0.04	0.17***	-2.12	
Attitudes toward flu vaccine (effective)		0.26***	0.44***	-2.87	0.29***	0.20***	1.59	
General vaccine hesitancy	-0.21***	-0.12***	-1.79	-0.05	-0.12***	1.46		
General Importance of vaccines	0.07	0.13**	-0.93	0.20***	0.16***	0.69		
Subjective norm	0.03	0.08***	-1.53	0.06**	0.05*	0.73		

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. AA = African American; W = White. The bolded z statistics (less than -1.96 or greater than 1.96) indicate statistically significant difference between African Americans and Whites.

Table 7
R-Squared for the blockwise regressions.

		Effect on Trust in Flu Vaccine		Effect on Trust in Vaccine Process	
		AA	W	AA	W
R-Squared	Block 1	0.13	0.14	0.15	0.21
	Block 2	0.17	0.19	0.19	0.27
	Block 3	0.64	0.70	0.49	0.60

Note. AA = African American; W = White. The predictors for Block 1 include demographics, racial factors, and ideology; Block 2 include all predictors for Block 1 and generalized trust; the Block 3 predictors include the psychosocial factors above and beyond all predictors used for Block 2.

Although the trust literature frequently identifies different dimensions of trust, specifically competence and beneficence or motives (Siegrist et al., 2003), our respondents did not discriminate between the two. Although there were statistically significant differences between African Americans and Whites on the mean scores for both dimensions, the actual mean scores for both groups were almost identical for the two dimensions. Moreover, this is consistent with our cognitive interviews of the questions themselves prior to actual survey administration. Respondents of both races were unable to discriminate between competence and beneficence. However, in our initial qualitative work, Quinn et al. (2016) found that when Whites described lower trust in government about the flu vaccine, they raised questions of competence. When African Americans gave distrust as an explanation, they were concerned more about the motives of government in the context of the flu vaccine. However, we observed a universal distrust of the motives driving pharmaceutical companies. Therefore, further research may be necessary to determine whether these dimensions

can be verified as distinct quantitative concepts in diverse populations. It may be possible that the process itself is confusing to the public, which contributes to the inability to distinguish between the concepts.

The second research question examined whether African Americans and Whites had different demographic, racial, and ideological predictors of generalized trust as well as trust in the flu vaccine and the vaccine process. Certainly, generalized trust was lower for African Americans than for Whites. Only two individual characteristics predict generalized trust for African Americans—increased income and having a chronic condition. For Whites, age, education, income and racial fairness were all significant predictors of generalized trust.

When trust in the flu vaccine is the outcome variable, African Americans and Whites are quite similar. For both groups, older age, higher income, liberal political affiliation, having a personal physician, and having a chronic condition all predict trust in the flu vaccine. The only difference between the groups is that for Whites only, having health insurance predicts trust in the flu vaccine. Predictors for trust in the flu vaccine process differed by race. Trust in the flu vaccine process is predicted by age, education and having a chronic disease for African Americans. For Whites, age and education also are significant predictors, but so are income, political affiliation, and having health insurance. It is interesting that for Whites, having health insurance was associated with trust in the vaccine and the process. This may relate to those with insurance having greater access and therefore, familiarity with their providers and routine services such as the flu vaccine. For African Americans, having insurance was not associated with trust in the vaccine or the process. This is also consistent with previous studies that even with some type of insurance coverage, African Americans still get the

vaccine less frequently.

We also explored the relationship between generalized trust and trust in both the flu vaccine and the vaccine process. For both African Americans and Whites, generalized trust is not highly correlated with either trust in the flu vaccine (0.29 for African Americans, 0.31 for Whites) or with trust in the vaccine process (0.34 for African Americans, 0.37 for Whites). Controlling for demographics, racial factors, and ideology, generalized trust still explains a significant amount of variance in trust in the flu vaccine but the strength of the prediction is not significantly different for African Americans and Whites. These results suggest that it is important for researchers to continue including a measure of generalized trust and using it as a covariate in studies of trust in the flu vaccine.

Our final research question introduced psychosocial predictors such as risk perception, knowledge, social norms, and use of naturalism in lieu of a vaccine as potential determinants of trust. We found that controlling for demographics, racial factors, ideology, and generalized trust, all of the psychosocial variables measured were significant predictors of trust in the flu vaccine and, in fact, the increased R squares suggest that they play an important role. These results are encouraging for those trying to close the immunization disparity gap as these variables can be used strategically in persuasive messages to encourage trust and foster acceptance of flu vaccine. Even though all these psychosocial variables are important, there were meaningful differences between African Americans and Whites. Perceived disease risk was a more powerful predictor for African Americans than for Whites, suggesting messages targeted to African Americans might benefit from a significant focus on disease risk, particularly when African Americans shoulder the burden of disparities in chronic diseases that increase potential risk of serious complications from flu. However, we know from previous research that perceived risk of vaccine side effects is significant for African Americans; therefore, any communication focused on disease risk must also address perceived risk of side effects (Freimuth et al., 2017). For Whites, effectiveness of the flu vaccine was a more important predictor than for African Americans. Obviously, improving the effectiveness of the vaccine would be the most useful approach but public health messages also could acknowledge that while effectiveness of the vaccine is sometimes less than optimal, it still offers some protection from flu.

The psychosocial predictors of trust in the vaccine process followed similar patterns. For Whites, all the psychosocial predictors were significant predictors of trust in the vaccine process except risk of vaccine side effects. For African Americans, the significant psychosocial predictors of trust in the vaccine process were perceived disease risk, risk of side effects, effectiveness and importance of the flu vaccine, and subjective norms. Similarly as for trust in the vaccine itself, the addition of the psychosocial variables significantly increased the variance explained in trust in the vaccine process.

This study reinforces the importance of trust in understanding vaccine behavior and health disparities. It also demonstrates that trust is a complex construct, which needs to be defined carefully when used in research and in message design. While some of the predictors of trust in the flu vaccine are not amenable to change such as demographics and generalized trust, there are psychosocial variables that offer potential guidance for improving promotion of the flu vaccine. However, it is critical that messages be tailored differently for African Americans and Whites. Similarly, messages should not treat these two groups as monoliths. There are important demographic differences within each group. These results suggest that the most critical subgroups for African Americans are younger and lower income individuals and for Whites, younger,

lower income, less educated, and more conservative individuals. Although there are similarities between groups, it is critical to carefully tailor and target flu vaccine messages. Finally, racial factors, such as racial fairness, racial consciousness and the impact of discrimination on access to care, suggest the importance of increasing the cultural competence of health care providers in order to build more trusting relationships with African American patients.

One limitation of our study was its cross sectional nature, which limits our analysis. Given that GfK's KnowledgePanel members can choose which survey to participate in, there may be some unknown bias in the sample. However, the sample is representative of the US population. Although data on influenza vaccination was self-reported, it may reflect recall bias. However, self-reports of flu vaccine have been demonstrated to be relatively accurate among samples of older adults.²⁵ The study's strengths include its representative sample and its development and inclusion of measures that emerged from qualitative data collection and were cognitively tested prior to administration. Finally, our inclusion of novel measures, including racial factors and our complex measures of trust and risk perception, deepen our ability to understand vaccine behavior.

6. Conclusions

In the United States today, there is frequently highly polarized public discourse on vaccines in general, and particularly for children, with anti-vaccine groups setting a negative tone about vaccines. Although much of that discourse focuses on children, it can feed a broader skepticism about vaccines, including the flu vaccine. Racial dynamics are also a critical factor in shaping vaccine trust, with African Americans expressing lower trust in the flu vaccine and the vaccine process than White adults. Given that the long-standing racial disparity in influenza immunization places African American adults at risk for influenza-related morbidity and mortality, strengthening trust in the flu vaccine and the vaccine process is critically important in increasing vaccine uptake. Our results suggest that strategic and targeted messages from health care providers and public health agencies can facilitate improved trust.

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