

**Factors influencing likelihood of COVID-19 vaccination: A survey of Tennessee adults**

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**Purpose.** To examine the vaccine-related beliefs and behaviors associated with likely hesitancy toward vaccination against coronavirus disease 2019 (COVID-19) among nonelderly adults.

**Methods.** A cross-sectional survey was conducted in June 2020. Responses were sought from Tennessee adults 18 to 64 years of age who were not healthcare providers. The survey instrument focused on vaccine-related beliefs, prior and planned influenza and pneumococcal vaccine use, and attitudes toward receiving a COVID-19 vaccination. Inferential statistics assessed survey responses, and logistic regression determined predictors of the likelihood of COVID-19 vaccination.

**Results.** A total of 1,000 completed responses were analyzed (a 62.9% response rate), and respondents were mostly White (80.1%), insured (79.6%), and/or actively working (64.2%); the sample was well balanced by gender, age, income, and political leaning. Approximately one-third (34.4%) of respondents indicated some historical vaccine hesitancy, and only 21.4% indicated always getting a seasonal influenza vaccination. More than half (54.1%) indicated at least some hesitancy toward vaccination against COVID-19, with 32.1% citing lack of evidence of vaccine effectiveness as the leading reason. COVID-19 vaccine hesitancy was more likely among those with more moderate (odds ratio [OR], 2.51; 95% confidence interval [CI], 1.749-3.607) or conservative (OR, 3.01; 95% CI, 2.048-4.421) political leanings, Black Americans (OR, 1.80; 95% CI, 1.182-2.742), and residents of nonmetropolitan areas (OR, 1.99; 95% CI, 1.386-2.865).

**Conclusion.** Subgroups of the population may prove more challenging to vaccinate against COVID-19, requiring targeted approaches to addressing hesitancy to ensure more-vulnerable populations are adequately covered.

**Keywords:** adult vaccination, COVID-19, pandemic management, social determinants, vaccine hesitancy

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Before the middle of the 20th century, diseases like whooping cough, polio, measles, and rubella infected hundreds of thousands of infants, children, and adults in the United States, resulting in thousands of deaths every year.<sup>1</sup> Today, vaccines, antibiotics, screening and testing guidelines, and scientific improvements in the diagnosis of infectious diseases have saved lives and are improving quality of life. Vaccines are considered among the most cost-effective disease prevention measures; however, vaccine-preventable infectious diseases remain a major cause of illness, disability, and death in the United States, and actual adult vaccination rates for pneumococcal and influenza vaccines failed to meet goals set by the Healthy People 2020 initiative.<sup>2-8</sup> Consequently, the US Department of Health and Human Services created the National Adult Immunization Plan (NAIP) to increase vaccination rates in adults between 2010 and 2020.<sup>9</sup> Additionally, suboptimal vaccination led researchers to focus on barriers and hesitations to adult vaccines to increase uptake, including those both structural (eg, access, cost) and behavioral (eg, vaccine hesitancy) barriers. Efforts to understand and overcome behavioral barriers to uptake of coronavirus disease 2019 (COVID-19) vaccines will be crucial to the acceptance of these vaccines, as preconceived opinions around safety and necessity of COVID-19 vaccines will heavily influence the success of this pandemic-driven vaccination campaign.<sup>10,11</sup>

Vaccine hesitancy is defined as a motivational state of being conflicted about or opposed to being vaccinated.<sup>12</sup> Specific frameworks, such as the World Health Organization (WHO) Increasing Vaccination Model, show that social influences and what people think and feel affect motivation to get vaccinated.<sup>12,13</sup> Increased vaccine hesitancy may stem from fear and possible exaggerations of perceived risk of adverse outcomes that later may become

perpetuated by social media.<sup>14,15</sup> Findings from COVID-19 research outside the United States have indicated that vaccine hesitancy is a potential barrier to COVID-19 vaccine uptake.<sup>16-18</sup> Specifically, potential adverse effects and perceived low vaccine effectiveness are potential contributors to future hesitancy, and uptake may be less likely among non–healthcare workers.<sup>17,18</sup> Importantly, willingness to be vaccinated was found to differ among healthcare workers with and without exposure to patients with COVID-19, which suggests the perceived severity of or exposure to the disease may play a role in vaccine-seeking behaviors even among healthcare providers.<sup>16</sup>

Historically, the United States has had suboptimal rates of uptake of multiple vaccines recommended in adults. For instance, the Healthy People 2020 vaccination goals for adults 18 years of age or older were 70% and 60% for influenza vaccine and pneumococcal vaccine (recommended for high-risk individuals), respectively; however, the most recently reported vaccination rates were closer to 45% and 24%, respectively.<sup>4,8,9</sup> Like COVID-19, influenza is associated with high risks of morbidity and mortality and was responsible for 490,600 hospitalizations and 34,200 deaths in the United States in the 2018-2019 influenza season.<sup>19</sup> Pneumococcal disease is similarly impactful, contributing to approximately 150,000 hospitalizations and over 50,000 deaths annually.<sup>20</sup> Importantly, Fisher and colleagues<sup>21</sup> found that not receiving influenza vaccination in the past year was an independent predictor of vaccine hesitancy. Recently, the Centers for Disease Control and Prevention (CDC) explained that getting an influenza vaccination during the current (2020-2021) season was more important than ever to decrease transmission of influenza and preserve a healthcare system already strained from the impact of COVID-19.<sup>22</sup> Moreover, the protective effects of the pneumococcal vaccine against respiratory diseases

may ultimately alleviate the healthcare system burden of managing pneumonia-related admissions.

As of October 2020, the total number of US cases of COVID-19 was over 7 million and the total number of deaths exceeded 200,000.<sup>23</sup> Despite the dire consequences of developing the disease, some US adults claim they will not be immunized once vaccines are available. Recent studies showed that only 57% to 69% of surveyed populations would accept COVID-19 vaccination if it were offered.<sup>21,24-26</sup> Trends in these studies suggest that Black Americans, those with conservative political leanings and/or lower educational attainment, and younger adults are more hesitant to accept a COVID-19 vaccine.<sup>21,24-26</sup> Moreover, concerns about safety, the extent and length of vaccine effectiveness, the country of vaccine developmental origin, and the entities providing endorsements have all been observed to influence willingness to receive COVID-19 vaccination.<sup>26,27</sup>

As information on COVID-19 changes, it will be important to continue monitoring reasons for hesitancy and identify US populations that are most hesitant. Unprecedented measures are being taken to quickly and safely provide access to COVID-19 vaccination; however, it is clear that public health officials and policymakers will need to craft careful vaccination messaging to increase uptake.<sup>21,24-26</sup> In light of such a need, the purpose of the study reported here was to describe barriers and potential hesitancy associated with future uptake of COVID-19 vaccines by examining nonelderly adults' vaccine-related beliefs and behaviors. For pharmacists and other providers, irrespective of practice site, these data will point to subgroups of the population, particularly those at high risk for COVID-19 and predisposed to hesitancy, in which enhanced and deliberate attention may be required to improve COVID-19 vaccination rates. Moreover, the study results provide data on vaccine-related beliefs and potential behaviors of nonelderly adults that point to determinants of

hesitancy that can be addressed by a range of healthcare providers, including pharmacists, to improve vaccine-related motivation.

## Methods

**Participants.** Data were collected using the QuestionPro online questionnaire platform (QuestionPro, Austin, TX) from June 3 through 18, 2020. QuestionPro has a repository of potential respondents for a range of surveys and solicits subjects electronically from that pool (based on known demographics) using criteria provided by the surveyors. We sought a distribution of responses that matched the demographics of Tennessee in terms of age (18-24 years, 14%; 25-44 years, 50% and 45-64 years, 36%), gender (51% female), race (78% White, 17% Black), and ethnicity (5% Hispanic), and the survey was open until distribution and target sample size ( $n = 1,000$ ) were met.<sup>28</sup> To be eligible for survey participation, respondents needed to be 18 to 64 years old, reside in Tennessee, and not be a practicing healthcare provider. The age range was chosen to facilitate a focus on a nonelderly population, for whom separate COVID-19 vaccine guidance is likely, and also to allow for analysis of a subset of this group that is at high risk for certain vaccine-preventable infectious diseases. Respondents were incentivized through use of QuestionPro's proprietary reward system, to which each individual had previously agreed, and with a set fee quoted to the study team. Potential respondents reviewed a consent statement prior to beginning the survey. A university institutional review board approved the study.

**Survey instrument.** A range of demographic information was collected for each respondent, including age, gender, race, household income, educational attainment, zip code of residence, employment status, health insurance status, political leanings, and religion. The survey items for these areas specified commonly applied response options that

were decided upon by the study team prior to survey launch. Residential status was determined using National Center for Health Statistics (NCHS) Urban-Rural Classification Schemes according to respondent zip code of residence.<sup>29</sup> Estimates of the number of medications taken and visits to a physician office over the past 12 months were requested. A series of items focused on 2 specific vaccines recommended for at least a subset of the adult population. First, respondents were asked to detail their recent influenza vaccine-related behaviors, including indicating in which of the past 5 influenza seasons they were vaccinated, and the leading reason for opting to do so or not. Information on perceived risk of contracting influenza and plans for vaccinating against the disease in the current year was also requested. Similarly, for a subgroup of the population meeting eligibility criteria, behaviors surrounding the pneumococcal vaccine were also included, such as historical vaccination, recommendations from providers, perceived risk of disease, and plans for vaccinating in the year ahead. This subgroup reflected those with particular conditions placing them at high risk for invasive pneumococcal disease and, therefore, recommended for pneumococcal vaccine administration by the Advisory Committee on Immunization Practices (ACIP)<sup>30</sup>; importantly, there is significant overlap between risk of invasive pneumococcal disease and risk of significant morbidity and mortality from COVID-19.<sup>31</sup>

The majority of the survey instrument focused on beliefs about vaccines and barriers to vaccination, assessed using the validated Vaccine Hesitancy Scale (VHS) developed by the WHO SAGE Working Group on Vaccine Hesitancy.<sup>32</sup> The language used in the scale (originally designed to identify vaccine-hesitant parents, a purpose for which it was demonstrated to have construct and criterion validity) was adapted for use in adults in order to address their own vaccine-related beliefs rather than emphasizing those of a parent.<sup>33</sup> VHS items focused on historical hesitancy or resistance (1 item), perceptions of the



vaccine behaviors of others, personal vaccine beliefs (10 items scored by level of agreement, with response options ranging from strongly disagree to strongly agree), reasons for hesitancy or refusal tied to each vaccine of interest (up to 6 items), external influences on vaccination based on the hesitancy matrix, potential barriers to vaccination (eg, cost, travel, clinic access), and prior vaccine-related behaviors.<sup>34</sup>

Using 5-point, Likert-type scales, respondents were asked to indicate their perceived risk of contracting COVID-19 (“no risk” to “extremely high risk”) and the likelihood of their seeking a vaccine when available (response options ranged from “absolutely will not” to “absolutely will”). VHS items were again used to inquire about the influence of COVID-19 on vaccine-related beliefs and potential barriers to vaccination, including offering open-ended responses related to influencers on COVID-19 vaccine hesitancy. The final instrument was reviewed by a multidisciplinary team, including 2 pharmacists, a physician, and a health services researcher.

**Analysis.** Descriptive statistics were calculated for all variables, followed by bivariate analysis ( $\chi^2$  tests) of historical hesitancy and COVID-19 vaccine willingness across demographic, beliefs, and vaccine behavior variables. Spearman’s rho was calculated to assess the relationship between ordinal variables. To examine predictors of historical and future COVID-19 hesitancy, multivariable logistic regressions were constructed by entering demographic and behavioral variables into the models, with a specified bivariate *P* of <0.20. Two models were constructed to calculate adjusted odds ratios (AORs) for associations between each of the candidate predictor variables and the 2 outcomes of interest: (1) historical vaccine hesitancy (a yes/no item), and (2) the likelihood of COVID-19 vaccination. The vaccination likelihood outcome used collapsed values of an original 5-point, Likert-type variable into either likely acceptance (“absolutely will” or “probably will”) or likely hesitance

("unsure," "probably will not," and "absolutely will not"). Independent variables considered (before bivariate assessment) to predict these outcomes included age, gender, race, household income, political leaning, residential area (metropolitan vs nonmetropolitan), educational attainment, health insurance, perceived risk of COVID-19 infection, and previous influenza vaccination. Model performance was assessed by Hosmer-Lemeshow tests and area under the receiver operating characteristic curve analysis. All analyses were completed using IBM SPSS, version 26 (IBM Corporation, Armonk, NY) with an  $\alpha$  of  $<0.05$  defining statistical significance.

## Results

**Respondent characteristics.** Complete, valid responses were collected for 1,000 nonelderly adult Tennessee residents meeting eligibility criteria (1,589 viewed the survey), for a response rate of 62.9%. As intended, the respondents were well distributed by age, race, gender, and residential area to reflect the approximate underlying characteristics of the state, with balance also represented in the political leanings and household incomes reported (Table 1). In addition, the population submitting completed responses was mostly insured, with a majority indicating they were employed at least part-time (63.9%), and a large share (41.4%) had an associate's degree or higher education.

**Vaccine beliefs.** Overall, respondents indicated generally positive attitudes toward vaccination in terms of benefit, importance, effectiveness, and safety. However, 45.7% voiced concerns about adverse effects, the population was split on the reliability and trustworthiness of vaccine-related information, and many (31.7%) felt that newer vaccines are riskier than older vaccines. Within subgroups, support for getting vaccinated tended to increase with age, income, and educational attainment; however, differences were noted by

race, with Black Americans' beliefs differing significantly from those of other minority respondents and White respondents (Figure 1).

Approximately one-third of respondents (34.4%) indicated some level of historical hesitancy to vaccines, despite a majority (85.4%) agreeing that vaccines protect against serious diseases and 73.7% believing others like them (eg, peers, family) get all recommended vaccines. Logistic regression, adjusting for respondent characteristics, indicated those more likely to have been hesitant were politically moderate (AOR, 1.51; 95% confidence interval [CI], 1.032-2.210) or conservative (AOR, 1.92; 95% CI, 1.291-2.863), nonmetropolitan area residents (AOR, 1.47; 95% CI, 1.040-2.069), and those employed only part-time (AOR, 1.87; 95% CI, 1.206-2.904), as compared with liberal nonelderly adults, metropolitan area residents, and full-time employees, respectively.

**Vaccination behaviors.** More than half of the respondents (62.9%) reported having received at least 1 influenza vaccination over the previous 5 influenza seasons; however, less than one-quarter (21.4%) did so in all 5 years, and only a minority were vaccinated in more than 1 season (36.3%). Among those vaccinated, a provider recommendation (from a doctor or pharmacist) was the most widely reported reason for seeking influenza vaccination (43.0%); a perceived lack of need was the leading barrier to seeking vaccination (68.2%). Approximately half (49.2%) perceived themselves to be at low or no risk for influenza in the coming year, and almost half of all respondents (49.3%) indicated they probably or absolutely would get an influenza vaccination in the current year. Most (57.3%) indicated that COVID-19 had not altered their influenza vaccination plans for the coming year, but some suggested the pandemic had made them somewhat or more likely to get vaccinated against influenza (27.9%). Slightly more than half (53.8%) who indicated some

alteration in plans (ie, being less or more likely to get vaccinated against influenza) suggested that media coverage impacted their decision somewhat or a lot.

Greater than one-third (36.9%) of the sample indicated having a condition placing them at high risk for invasive pneumococcal disease, yet half of these respondents (49.7%) perceived themselves to be at no or low risk for pneumonia in the current year. Most (61.9%) did not recall a provider previously recommending a pneumococcal vaccine to them; however, most who did recall such a recommendation (68.6%) did get vaccinated, with a physician's recommendation being the leading reason for doing so (88.6%). A perceived lack of need was the reason for declining vaccination in the past (reported by 31.5%), and this was also the most common reason for not planning to receive a pneumococcal vaccine in the year ahead (indicated by 42.1% being not previously vaccinated). In the subgroup not previously vaccinated against pneumococcal disease, 22.4% of respondents indicated they were somewhat or much less likely to seek a pneumococcal vaccine during the current year due to COVID-19, with most (60.3%) reporting no change in plans. Additionally, media coverage appeared to have only marginal influence on this decision: Among those indicating they were more or less likely to be vaccinated against pneumococcal disease during the current year, 23.2% reported a lot of influence on this decision was due to media coverage of COVID-19.

**COVID-19 and vaccination.** Based on current health status and behaviors, slightly more than half (52.6%) of the respondents indicated they believed themselves to be at no or low risk for developing COVID-19 in the year ahead, with few (9.1%) perceiving themselves to be at high or extremely high risk. Slightly more than half (54.1%) indicated either uncertainty or some level of hesitancy toward getting a COVID-19 vaccine (24.5% indicated they would absolutely or probably not get vaccinated once a vaccine was

available). No differences in the proportions of those likely to get vaccinated by pneumococcal disease risk status were observed: 47.7% of high-risk individuals and 52.3% of those not at high risk indicated they planned to get vaccinated ( $\chi^2 = 0.783$ ,  $P = 0.376$ ). The proportions of those likely to get vaccinated tended to increase with perceived COVID-19 risk ( $r = 0.321$ ), educational level ( $r = 0.130$ ), household income ( $r = 0.123$ ), the number of influenza vaccinations received in the previous 5 years ( $r = 0.400$ ), and likelihood of being vaccinated against influenza in the upcoming season ( $r = 0.562$ ) ( $P < 0.001$  for all comparisons).

Of those reporting historical vaccine hesitancy, a majority (77.7%) were also hesitant to be vaccinated against COVID-19, while 41.7% of those without previous hesitancy indicated they were unsure or likely unwilling to be vaccinated against COVID-19. Among those already willing to be vaccinated against COVID-19, the leading reason for doing so was the seriousness of the illness (reported by 46.5% of those likely to be vaccinated), while vaccine cost was the most likely barrier (reported by 52.4% of those likely to be vaccinated) (Figure 2). Three leading reasons for being hesitant toward COVID-19 vaccination emerged: lack of sufficient effectiveness evidence (32.1%), perceived lack of disease risk (24.6%), and vaccine safety concerns (23.2%). Also, similar to the results for overall vaccine hesitancy, beliefs about vaccination were significantly different between respondents willing and those unwilling to be vaccinated against COVID-19, and patterns of responses (ie, measured levels of agreement) were similar across beliefs between groups categorized by historical hesitancy (Figure 3).

When asked to report on the influence of COVID-19 on vaccine-related beliefs, respondents indicated limited change (ie, “unchanged” was the most frequent response for 9 of 10 posed statements). The lone exception to that trend was for the statement “Being

vaccinated is important for the health of others in my community”; 44.5% of respondents indicated they agreed more with that statement at the time of the survey than they would have 6 months previously. The largest negative shift was related to the reliability of vaccine-related information, with 13.2% reporting that they currently believed less in the trustworthiness of vaccine information than they did 6 months previously (Figure 4).

Logistic regression, with adjusting for respondent characteristics and behaviors, identified several predictors of likely COVID-19 vaccine hesitancy (Table 2). Those less likely to seek COVID-19 vaccination included Black Americans (AOR, 1.56; 95% CI, 1.002-2.427), political moderates (AOR, 2.41; 95% CI, 1.650-3.517) and conservatives (AOR, 2.91; 95% CI, 1.944-4.355), nonmetropolitan residents (AOR, 1.92; 95% CI, 1.315-2.807), and those not recently vaccinated (AOR, 5.70; 95% CI, 3.810-8.519) or only infrequently vaccinated (AOR, 2.22; 95% CI, 1.510-3.259) against seasonal influenza. Additionally, the odds of hesitancy tended to increase by age until age 55 years.

## Discussion

To provide insight into population-specific vaccine hesitancies and barriers, we surveyed nonelderly Tennessee adults about their beliefs toward pneumococcal, influenza, and then-anticipated COVID-19 vaccines. Responses identified key barriers to nonelderly adult vaccine uptake that will likely contribute to poor COVID-19 vaccination coverage rates. We found just over half of the surveyed population reported hesitancy or uncertainty toward receiving COVID-19 vaccination, and almost a quarter of the population indicated they absolutely or probably would not receive vaccination. The proportions of respondents reporting hesitancy or unwillingness to receive a COVID-19 vaccine were higher than those reported in studies conducted at other points in the pandemic. Similar research in April

2020 and May 2020 found that 41.4%, 31%, and 33% of the surveyed populations had some level of hesitance or unwillingness to receive a COVID-19 vaccine.<sup>21,24,25</sup> A more recently published assessment reported hesitancy at approximately 32%.<sup>26</sup> This trend emphasizes the importance of monitoring beliefs and hesitations toward COVID-19 vaccines as they change over the course of the pandemic. Such hesitancy may also shift according to the perceived risk of infection at the time that vaccines are widely available. In this research, few respondents (<10%) indicated they were high or extremely high risk for becoming infected, with higher proportions of those at high risk for invasive pneumococcal disease also indicating higher perceived risk of COVID-19. These observations are similar to those in other studies examining perceived risk, wherein 10% to 13% of individuals reported they were likely or very likely to get sick from COVID-19, with some increase in the perceived likelihood of illness observed over time in longitudinal assessment.<sup>35-37</sup> As the pandemic progresses and public interpretation of risk changes due to epidemiological information and the availability of health resources, providers will need to take into consideration the conclusions their patients have made in terms of the relative value of vaccination given their personally held opinions of the likelihood of infection.

Identifying factors that cause hesitancy and populations at highest risk for hesitancy can help policymakers and providers promote COVID-19 vaccination, and the study results reported here provide further evidence of the major role that social determinants of health play in vaccine hesitancy.<sup>38</sup> The study identified several predictors of decreased likelihood to receive COVID-19 vaccination, including Black race, moderate or conservative political beliefs, residence in a nonmetropolitan area, and lower recent uptake of the seasonal influenza vaccine. We found a significant difference between responses of Black and White Americans when they were asked about their beliefs toward vaccination in general, and

similar studies have also found a difference in the acceptability of COVID-19 vaccine among Black Americans.<sup>21,24,25</sup> This finding is concerning because of the disproportionately high rates of COVID-19–related morbidity and mortality in Black American populations vs White Americans.<sup>39-42</sup> The long history of maltreatment of Black Americans by the medical establishment likely contributes to the overall vaccine hesitancy of this population and is exacerbated by the expedited nature of the development of COVID-19 vaccines.<sup>43,44</sup> Time should be invested to understand the persistent distrust of the healthcare system that exists within the Black community, and approaches to vaccine promotion will need to strike a careful balance between respect for the lived experience of this community and the heightened demonstrated need to provide individual protection.

Stark differences in the likelihood of vaccination in less liberal and more rural areas may be a signal of other concerns that must be accounted for when preparing for COVID-19 vaccination implementation. Recent estimates suggest that more conservative individuals and those residing in rural parts of the country are less likely to take preventive measures, such as mask wearing, yet are more comfortable engaging in activities involving increased social interaction.<sup>45</sup> Considered in light of our findings, these behaviors may have disastrous consequences for less densely populated, conservative communities that may resist adoption of current and future preventive measures. The herd immunity threshold of the virus causing COVID-19, SARs-CoV-2, is estimated at 55% to 82%, the achievement of which will require concerted efforts in all corners of the country and across political lines.<sup>25</sup> In preparation for involvement in COVID-19 vaccine administration, pharmacists and other providers need to consider the significant role of personal and community beliefs that influence the acceptance of medical recommendations and subsequent actions taken to prevent the spread of infectious diseases.



Unique to the 2020-2021 influenza season, the need to manage both influenza and the ongoing burden of COVID-19 could be detrimental to an already strained healthcare system. Our results highlight the need to expand efforts to promote COVID-19 vaccines beyond those previously used to market influenza vaccination, which fell short of established goals. Increasing the proportion of adults who receive appropriate vaccination recommendations has been named a high-priority health issue to be addressed in the Healthy People 2030 initiative.<sup>46</sup> In line with that recommendation, while influenza is often the focus of many providers, the need to address unmet pneumococcal vaccination goals is deserving of increased attention. Current CDC guidelines emphasize the need to vaccinate high-risk adults (ie, those 18-64 years old with select conditions) against invasive pneumococcal disease, and the importance of protecting this population through vaccination is echoed by the guidance provided in CDC's COVID-19 vaccination plan.<sup>30,31,47</sup> Teaching pharmacists to give high-quality vaccination recommendations has the potential to help patients overcome vaccine hesitations and may increase uptake of influenza, pneumococcal, and anticipated COVID-19 vaccines.

The study's findings should be considered in light of its limitations. First, the study involved use of a convenience sample of nonelderly Tennessee adults, and the findings may not be representative of nonelderly adults in other states. Common to insights derived from all survey data, the insight provided here is reflective of the views of individuals willing to take the survey, and their perspectives may differ from those of individuals unwilling or not contacted to participate in the survey. However, it is important to note, the demographics of those responding did mirror the distribution of characteristics in Tennessee, as intended, and our results echoed much of the findings provided by earlier nationwide assessments of COVID-19-related views and beliefs. As Tennessee and other neighboring states, including

Arkansas, Mississippi, Alabama, and Georgia, have had some of the highest COVID-19 case rates (per 100,000 residents) in the nation, insight provided here may be instructive to other states with heightened case numbers.<sup>23</sup> Second, while multiple factors were considered in identifying the odds of COVID-19 vaccination, it is likely that a range of influencers on potential vaccination exist but were not observed. However, unlike earlier surveys, our instrument included validated, vaccine-related items, which adds to the strength of the insight provided. Finally, the survey was fielded in June 2020, and the COVID-19 pandemic is a fluid crisis, the circumstances of which change constantly. Therefore, while important to planning for vaccination efforts, the insight provided here is subject to change with the status of the pandemic.

## **Conclusion**

Our findings reinforce the concern that uptake of COVID-19 vaccine is likely to be met with significant reluctance. Importantly, the current findings highlight the challenges likely to be faced during vaccine implementation among rural, more conservative, and Black communities. Pharmacists across the country need to understand and prepare to address the challenges that will accompany COVID-19 vaccination efforts, and these preparations should also include plans to stress recommendations for other adult vaccinations. As pharmacists continue to be one of the most accessible healthcare professionals to the public and can play a significant role in dealing with the COVID-19 pandemic, they need to position themselves to participate in new professional opportunities in public health. For example, pharmacists can be involved in everything from vaccine supply and storage to the

administration and monitoring of vaccinations. Specific responsibilities include but are not limited to promoting vaccinations to patients and fellow healthcare colleagues, involvement in the vaccination supply chain, protocol implementation for vaccination administration, reporting of adverse effects, and providing patient counseling and drug information to healthcare professionals and patients.

#### **Disclosures**

The authors have declared no potential conflicts of interest.

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Figure 1. Respondent vaccine beliefs by race. Agreement defined as response of “agree” or “strongly agree” to statement. Asterisk denotes  $P = 0.932$ ; for all other items,  $P < 0.0001$ .

Figure 2. Potential barriers to COVID-19 vaccination among those willing to be vaccinated.

Figure 3. Differences in vaccine beliefs by COVID-19 vaccine willingness.  $P < 0.0001$  for all comparisons.

Figure 4. Changes in vaccine-related beliefs during preceding 6 months.

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## Key Points

- The majority of respondents to a survey of nonelderly adults in Tennessee indicated some level of hesitancy toward vaccination against COVID-19.
- Black Americans, those residing in nonmetropolitan areas, and nonelderly adults with more moderate or conservative political leanings may exhibit higher levels of COVID-19 vaccine hesitancy.
- Pharmacists need to be prepared to buffer COVID-19 vaccine hesitancy, with special attention paid to subgroups predisposed to lower levels of trust in the government and medical community, less healthcare access, and racial health and healthcare disparities.

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Table 1. Respondent Characteristics (*n* = 1,000)

Characteristic	No. (%) <sup>a</sup>
<b>Age range, y</b>	
18-24	170 (17.0)
25-34	217 (21.7)
35-44	248 (24.8)
45-54	181 (18.1)
55-64	184 (18.4)
<b>Gender</b>	
Female	528 (52.8)
Male	470 (47.0)
<b>Race</b>	
White	801 (80.1)
Black	145 (14.5)
Other	54 (5.4)
<b>Education</b>	
High school graduate or less	325 (32.5)
Some college	260 (26.0)
College graduate	298 (29.8)
Advanced degree	117 (11.7)
<b>Employment</b>	
Full-time	479 (47.9)
Part-time	128 (12.8)
Seasonal	32 (3.2)
Retired	87 (8.7)
Not working	271 (27.1)
<b>Health Insurance</b>	
Employer-based or individual plan	537 (53.7)
Medicare	129 (12.9)
Medicaid	92 (9.2)

TriCare or VA	34 (3.4)
Uninsured	204 (20.4)
Household income	
<\$50,000	490 (49.0)
\$50,000-\$100,000	320 (32.0)
>\$100,000	146 (14.6)
Political leaning	
Very conservative	180 (18.0)
Slightly conservative	166 (16.6)
Moderate	432 (43.2)
Slightly liberal	124 (12.4)
Very liberal	96 (9.6)
Residential classification <sup>b</sup>	
Large central metro	242 (24.2)
Large fringe metro	178 (17.8)
Medium metro	268 (26.8)
Small metro	107 (10.7)
Micropolitan	118 (11.8)
Non-core	80 (8.0)
Health services utilization, mean (SD) per patient	
Physician visits <sup>c</sup>	2.2 (3.70)
Medications <sup>d</sup>	2.9 (19.16)
Influenza vaccination <sup>e</sup>	364 (36.4)

Abbreviation: VA, Veterans Affairs.

<sup>a</sup>All data are number (percentage) of respondents unless otherwise indicated.

<sup>b</sup>Classifications are those of National Center for Health Statistics.<sup>25</sup>

<sup>c</sup>Over last 12 months.

<sup>d</sup>Currently used medications.

<sup>e</sup>For most recent influenza season.

Table 2. Predictors of COVID-19 Vaccine Hesitancy ( $n = 936$ )

Predictor	Odds Ratio (95% CI)	P Value
Age range, y		
18-24	[Reference]	
25-34	1.98 (1.214-3.234)	0.006
35-44	1.79 (1.108-2.895)	0.017
45-54	2.04 (1.278-3.517)	0.004
55-64	1.35 (0.811-2.234)	0.251
Gender		
Male	[Reference]	
Female	1.30 (0.964-1.742)	0.086
Race		
White	[Reference]	
Black	1.56 (1.002-2.427)	0.049
Other	0.57 (0.270-1.018)	0.057
Household Income		
\$50,000 or less	1.34 (0.840-2.144)	0.219
\$50,001-\$100,000	0.94 (0.601-1.479)	0.798
\$100,001 or more	[Reference]	
Political leaning		
Liberal	[Reference]	
Moderate	2.41 (1.650-3.517)	<0.0001
Conservative	2.91 (1.944-4.355)	<0.0001
Residential area		
Metropolitan	[Reference]	
Nonmetropolitan	1.92 (1.315-2.807)	0.001
Educational attainment		
High school graduate or less	1.48 (0.859-2.552)	0.158
Some college	0.95 (0.556-1.626)	0.854
College graduate	1.06 (0.639-1.769)	0.814

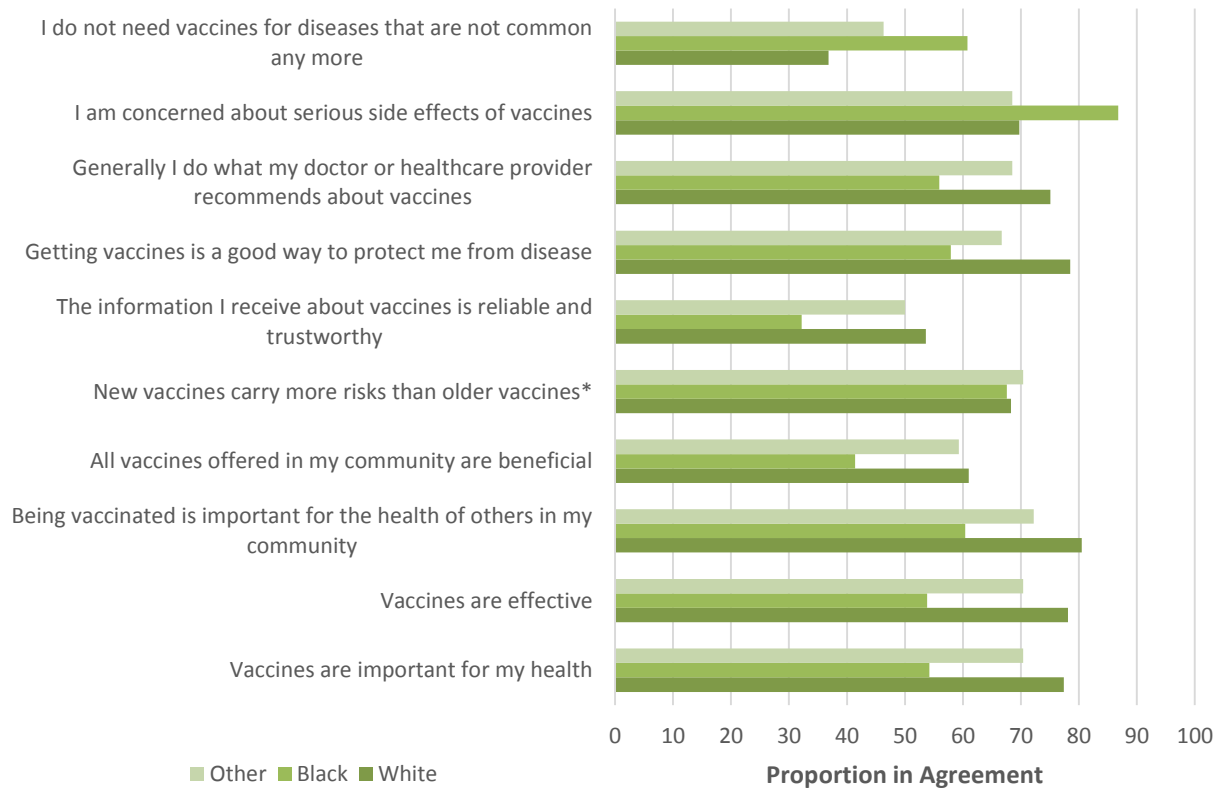
Advanced degree	[Reference]	
Health Insurance		
Medicaid	0.93 (0.536-1.603)	0.785
Medicare	1.15 (0.715-1.860)	0.558
Uninsured	0.86 (0.564-1.317)	0.493
Marketplace plan	0.88 (0.534-1.438)	0.601
Military/VA	0.83 (0.363-1.914)	0.668
Employer-sponsored	[Reference]	
Influenza vaccination during previous 5 years		
Every year	[Reference]	
Some years	2.22 (1.510-3.259)	<0.0001
None	5.70 (3.810-8.519)	<0.0001

Abbreviations: CI, confidence interval; VA, Veterans Affairs.

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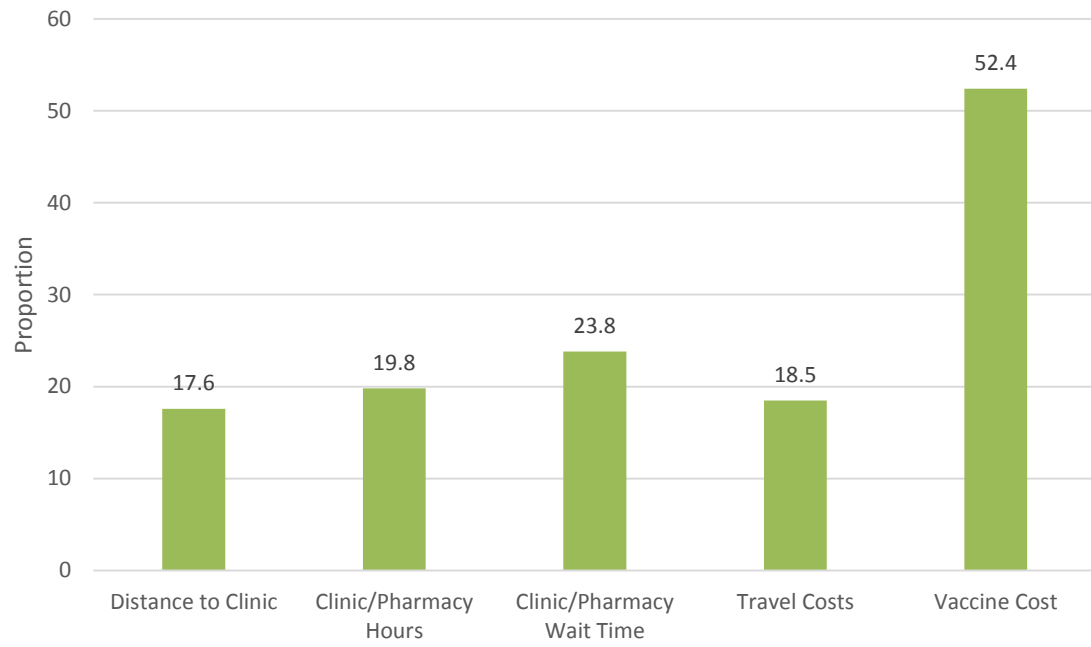


[fig 1]



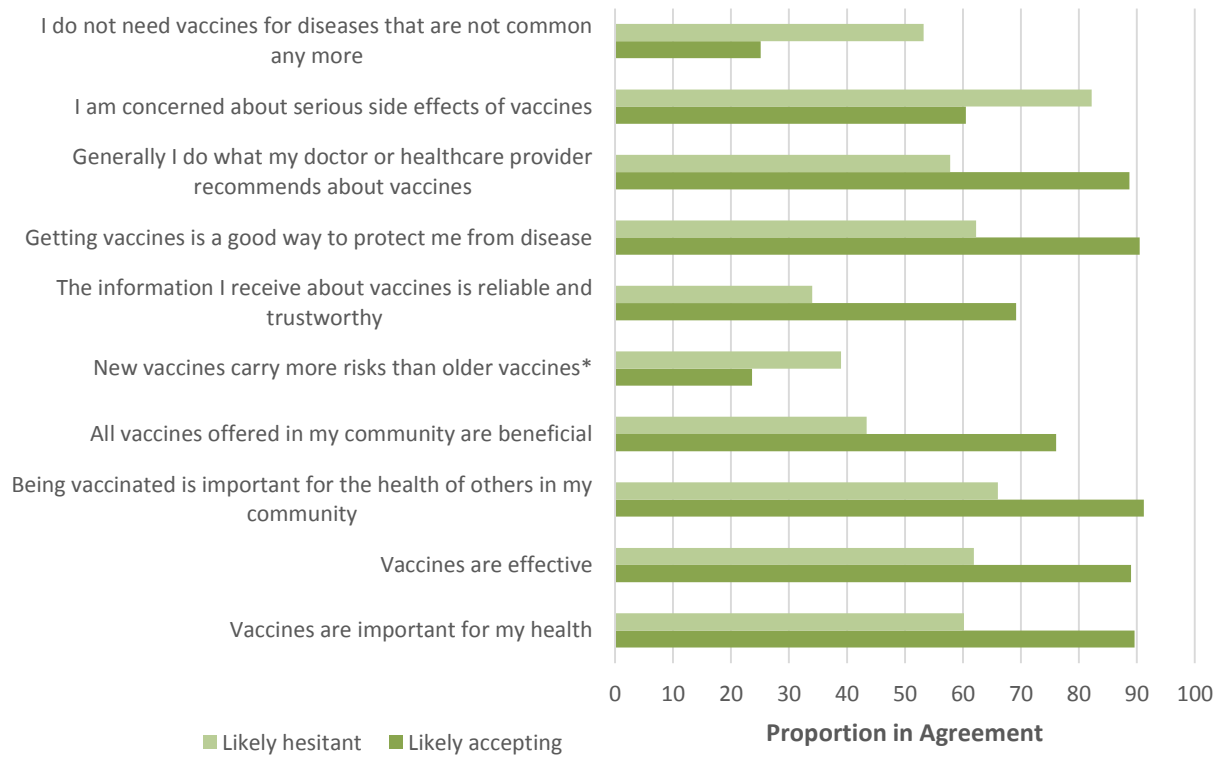
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[fig 2]



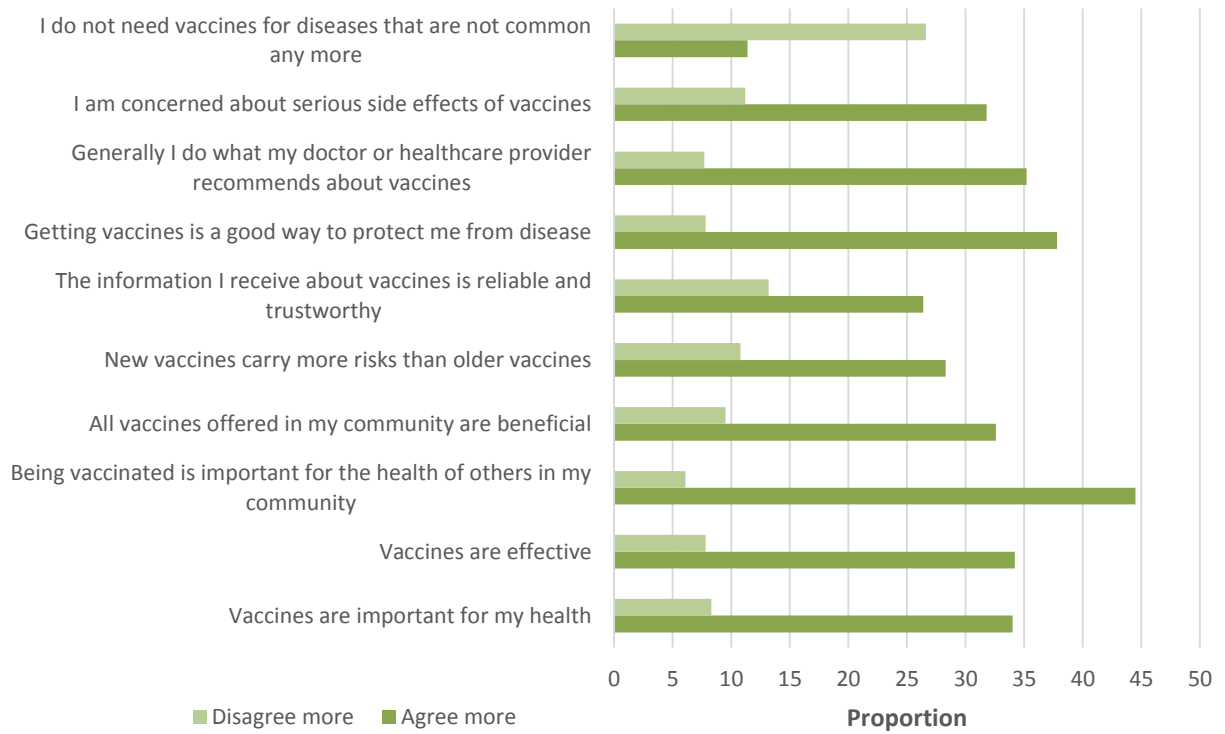
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[fig 3]



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[fig 4]



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