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ORIGINAL CONTRIBUTION

COVID-19 vaccine hesitancy among patients in two urban emergency departments

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Abstract

Background: Widespread vaccination is an essential component of the public health response to the COVID-19 pandemic, yet vaccine hesitancy remains pervasive. This prospective survey investigation aimed to measure the prevalence of vaccine hesitancy in a patient cohort at two urban emergency departments (EDs) and characterize underlying factors contributing to hesitancy.

Methods: Adult ED patients with stable clinical status (Emergency Severity Index 3–5) and without active COVID-19 disease or altered mental status were considered for participation. Demographic elements were collected as well as reported barriers/concerns related to vaccination and trusted sources of health information. Data were collected in person via a survey instrument proctored by trained research assistants.

Results: A total of 1,555 patients were approached, and 1,068 patients completed surveys (completion rate = 68.7%). Mean (±SD) age was 44.1 (±15.5) years (range = 18–93 years), 61% were female, and 70% were Black. A total of 31.6% of ED patients reported vaccine hesitancy. Of note, 19.7% of the hesitant cohort were health care workers. In multivariable regression analysis, Black race (odds ratio [OR] = 4.24, 95% confidence interval [CI] = 2.62 to 6.85) and younger age (age 18–24 years—OR = 4.57, 95% CI = 2.66 to 7.86; age 25–35 years—OR = 5.71, 95% CI = 3.71 to 8.81) were independently associated with hesitancy, to a greater degree than level of education (high school education or less—OR = 2.27, 95% CI = 1.23 to 4.19). Hesitant patients were significantly less likely to trust governmental sources of vaccine information than nonhesitant patients (39.6% vs. 78.9%, $p < 0.001$); less difference was noted in the domain of trust toward friends/family (51.1% vs. 61.0%, $p = 0.004$). Hesitant patients also reported perceived vaccine safety concerns and perceived insufficient research.

Conclusions: Vaccine hesitancy is common among ED patients and more common among Black and younger patients, independent of education level. Hesitant patients report perceived safety concerns and low trust in government information sources but less so friends or family. This suggests that strategies to combat hesitancy may need tailoring to specific populations.

KEYWORDS
COVID-19, emergency medicine, public health, vaccination

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has claimed the lives of more than 600,000 Americans since March 2020, and incidence in the U.S. is rising with the appearance of the strain known as the delta variant.[1] The severity of the pandemic underscores the importance of successful administration of FDA-authorized vaccines; however, vaccine hesitancy poses a significant threat to these efforts. In 2019 the World Health Organization characterized vaccine hesitancy among the "Top Ten Threats to Global Health."[2] Vaccine hesitancy may be especially prevalent among specific populations, including racial and ethnic minorities who have been disproportionately impacted by the pandemic and are made more vulnerable to continued viral transmission by lower vaccination rates.[3]

An important opportunity to address vaccine hesitancy lies in emergency departments (EDs) that serve minority and underresourced communities that may experience either increased levels of vaccine hesitancy and/or restricted access to vaccination. Such EDs often represent communities with high COVID-19 disease burdens and limited health care access. As such, EDs may represent valuable sites for vaccine education and even direct vaccination efforts.[4-6] While recent studies have assessed hesitancy and barriers to uptake in the general population,[7-11] there are limited data from ED patient populations. Quantitative data on vaccine hesitancy in ED patient cohorts and health information perspectives of ED patients are especially important because the ED often represents the primary point of health care contact for many such patients. We sought to quantify and characterize vaccine hesitancy among a cohort of ED patients in two urban academic medical centers and to assess perceived barriers and trusted sources of health information.

METHODS

Between January 29, 2021, and May 11, 2021, patients were enrolled in the EDs of the Hospital of the University of Pennsylvania (HUP) and Penn Presbyterian Medical Center (PPMC), both tertiary academic hospitals in Philadelphia. All adult patients without evident critical illness were considered for eligibility. Exclusion criteria included: (1) age < 18 years, (2) triage Emergency Severity Index (ESI) category of either 1 (immediate resuscitation) or 2 (emergent condition), (3) laboratory-confirmed COVID-19 disease at ED presentation, (4) altered mental status or impairments otherwise precluding their ability to consent, and (5) active droplet or isolation precautions. University of Pennsylvania Institutional Review Board approval was granted to conduct this study with written informed consent from study participants.

After informed consent, a questionnaire was administered and proctored in person by trained research staff. Subjects' responses were documented in real time via an electronic, HIPAA-compliant clinical database (REDCap, Vanderbilt University). Thirty-one responses for which a majority of the survey fields were left incomplete were excluded from subsequent statistical analyses. Upon completion of the study questionnaire, participants were given a COVID-19 vaccine resource document providing abbreviated information on the development, mechanism, and availability of each of the FDA-approved vaccines.

The study questionnaire solicited personal and household demographic elements as well as other COVID-19–pertinent indicators such as perceived immunocompromised status, personal and close-contact COVID-19 diagnosis history, and for those with a laboratory-confirmed positive result whether treatment included hospitalization. Vaccine hesitancy was assessed, defined by answering "no" to the question, "If one of the FDA-approved COVID-19 vaccines becomes readily available to you, would you be willing to receive it?" Participants were also presented Likert-scale prompts to assess potential barriers to vaccine uptake and/or factors influencing hesitancy, organized into three overarching groups: seven statements assessing confidence in vaccine science, five statements assessing trusted health/vaccine information sources, and six statements assessing spheres of influence affecting vaccine decision making. Likert prompts were ranked on a 5-point scale, each including a neutral opinion choice (3). Statements in the confidence in vaccine science group were ranked from 1 (strongly agree) to 5 (strongly disagree). Those in the trusted health/vaccine information sources group were ranked from 1 (strongly trust) to 5 (strongly distrust) and those in the spheres of influence affecting vaccine decision-making group were ranked from 1 (strongly influence to accept vaccination) to 5 (strongly discourage from accepting a vaccine).

Survey questions, including their organization and wording, were designed leveraging existing survey-based vaccine hesitancy research instruments and their findings[7-11] and then subjected to beta testing in a preliminary ED cohort before finalization of the instrument. All study staff received training in questionnaire administration, and data were periodically reviewed by designated lead coordinators as a quality assurance mechanism.

Summary statistics (frequencies and percentages) are presented for respondent characteristics (e.g., gender, race, age, education). For each survey question (including demographics), only the percentage of respondents who answered the survey question was tabulated, excluding question left blank or answered unsure. To compare respondents willing to receive the vaccine versus those who were hesitant, Fisher's exact test was used. For analysis purposes, Likert-scale questions were dichotomized and Fisher's exact tests were performed to assess differences in confidence in vaccine science, trusted information sources, and spheres of influence between vaccine willing and hesitant groups. To assess which demographic factors independently predict vaccine hesitancy, multivariable logistic regression models were developed. A probability <0.05 was considered statistically significant. All analyses were performed using statistical software (SAS version 9.4, SAS Institute). Manuscript preparation was conducted following the EQUATOR-indexed guidelines for survey studies, specifically the Consensus-Based Checklist for Reporting of Survey Studies (CROSS).[12]

RESULTS

A total of 1,555 patients were approached for participation. Of the 1,111 respondents who provided informed consent, 1,068 (96%) sufficiently completed study questionnaires, yielding an overall completion rate of 68.7%. The respondents were 61% female and 70% Black, with a mean (±SD) age of 44.1 (±15.5) years. Terminal education level high school or below was reported by 46% of respondents; 43% reported at least partial college education and 11% reported post–college level education. Fifty-five percent of subjects were enrolled at the PPMC ED, and 45% in the HUP ED. Cohort demographics are shown in Table 1.

Vaccine hesitancy was reported by 31.6% of the total cohort. When dichotomized by presence or absence of hesitancy (Table 2), the hesitant group was more likely to be <35 years of age compared to those willing to receive a vaccine (52.3% vs. 31.0%, $p < 0.001$), Black (85.1% vs. 63.6%, $p < 0.001$), female (66.4% vs. 58.8%, $p = 0.01$), and have a terminal education level high school or below (55.7% vs. 41.7%, $p < 0.001$). Presence of additional members of the household was also associated with hesitancy, with the measured difference between hesitant and willing groups diverging further as the number of additional household members increased (6% difference with one to two additional members vs. 10% difference with three or more, $p = 0.007$). Insurance type was also associated with vaccine hesitancy, with those on government insurance plans reporting greater hesitancy than those on private or commercial plans (57.9% vs. 42.1%, $p < 0.001$). Neither an established relationship with a primary care provider nor a laboratory-confirmed positive COVID-19 test result in the respondent or a respondent's immediate family member were associated with hesitancy. Of note, health care workers were equally represented in both the hesitant and the nonhesitant cohort (19.7% vs. 18.6%, $p = 0.06$).

Multivariable logistic regression modeling (Figure 1) demonstrated increased odds of hesitancy with female gender (odds ratio [OR] = 1.4, 95% confidence interval [CI] = 1.04 to 1.95), Black/African Americans compared to Whites (OR = 4.24, 95% CI = 2.62 to 6.85), younger age (OR = 4.57, 95% CI = 2.66–7.86, and OR = 5.71, 95% CI = 3.71 to 8.81, for 18–24 and 25–35 years respectively), and terminal education level of high school or below (OR = 2.27, 95% CI = 1.23 to 4.19). When stratified by race, among Black respondents, only odds of younger age (18–24 years—OR = 6.5, 95% CI = 3.6 to 12.0; and 25–35 years—OR = 7.2, 95% CI = 4.4 to 11.8) adjusted for gender and education was associated with vaccine hesitancy. For Whites, only high school education (OR = 3.0, 95% CI = 1.2 to 7.6) or lower increased the odds of vaccine hesitancy adjusted for gender and age.

Regarding perspectives toward vaccination science (Table 3), those identified as vaccine hesitant were less likely to agree with the statements "vaccines are effective in preventing disease spread/infection" (52.5% vs. 89.2%, $p < 0.001$) and "face masks work to slow the spread of COVID" (72.4% vs. 91.9%, $p < 0.001$). Conversely, the vaccine-hesitant group were less likely to disagree with the statements "vaccines are founded on false science" (44.1% vs. 82.6%, $p < 0.001$), "vaccines can cause detrimental health issues" (11.1% vs. 46.7%, $p < 0.001$), and "the best way to beat COVID is by having most people get the infection rather than get vaccinated" (56.3% vs. 77.8%, $p < 0.001$). The vaccine-hesitant group exhibited lower levels of trust in information from both government (39.6% vs. 78.9%, $p < 0.001$) and traditional news sources (32.0% vs. 51.4%, $p < 0.001$). Levels of trust in social media were low for both hesitant and willing groups (10.6% vs. 12.4%, $p = 0.39$). Among the vaccine-hesitant group, the most trusted source of health information was friends and family (51.1%).

TABLE 1 Study cohort demographics and overall hesitancy

Characteristic	Total *n* (%)
Age (y)	
Mean (±SD)	44.1 (15.5)
18–24	107 (10.0)
25–35	294 (27.5)
36–55	360 (33.7)
56–75	272 (25.5)
76+	35 (3.3)
Gender	
Female	644 (61.2)
Male	399 (37.9)
Nonbinary	10 (0.9)
Race	
Black	722 (70.4)
White	225 (21.9)
Asian/Pacific Islander	32 (3.1)
Mixed/other	47 (4.6)
Highest level of education	
Primary/at least some high school	458 (46.0)
College	427 (42.9)
College and advanced degree	110 (11.1)
ED distribution of subjects	
HUP	428 (44.8)
PPMC	526 (55.1)
Insurance type	
Government	447 (49.0)
Commercial/private	466 (51.0)
Employment status	
Employed: health care worker	190 (18.9)
Employed: non–health care	366 (36.6)
Unemployed: actively seeking employment	111 (11.1)
Unemployed: not actively seeking employment	334 (33.4)
COVID-19 vaccine hesitancy	
Hesitant	337 (31.6)

Note: All numbers in parentheses are percentages unless stated otherwise.

Abbreviations: HUP, Hospital of the University of Pennsylvania; PPMC, Penn Presbyterian Medical Center.

TABLE 2 Demographics by vaccine hesitancy

Demographics	Vaccine hesitant	Willing to receive vaccine	*p*-value
Total patients	337 (31.6)	731 (68.4)	
ED site			
HUP	136 (46.1)	292 (44.3)	0.62
PPMC	159 (53.9)	367 (55.7)	
Gender			
Female	217 (66.4)	427 (58.8)	0.01
Male	110 (33.6)	289 (39.8)	
Nonbinary	0 (0.0)	10 (1.4)	
Race			
Black	274 (85.1)	448 (63.6)	<0.001
White	27 (8.4)	198 (28.1)	
Asian/Pacific Islander	4 (1.2)	28 (4.0)	
Mixed/other	17 (5.3)	30 (4.3)	
Medical insurance type			
Government: Medicare/ Medicaid	157 (57.9)	290 (45.2)	<0.001
Private/commercial	114 (42.1)	352 (54.8)	
Age			
18–24	43 (12.8)	64 (8.8)	<0.001
25–35	132 (39.2)	162 (22.2)	
36–55	113 (33.5)	247 (33.8)	
56–75	48 (14.2)	224 (30.6)	
76+	1 (0.3)	34 (4.7)	
Laboratory-confirmed COVID-19, self-reported	32 (9.7)	69 (9.5)	0.91
Immunocompromised status	67 (20.3)	255 (35.1)	<0.001
Has a primary care provider	263 (79.7)	597 (82.3)	0.31
Hospital or clinic visit < 6 months	162 (49.1)	412 (56.8)	0.023
Laboratory-confirmed COVID-19 in family member	45 (14.2)	126 (17.9)	0.17
Employment status			
Employed: health care worker	61 (19.7)	129 (18.6)	0.06
Employed: non–health care worker	123 (39.8)	243 (35.1)	
Unemployed: actively seeking	40 (12.9)	71 (10.3)	
Unemployed: not actively seeking	85 (27.6)	249 (36.0)	
Additional members of household			
0	35 (11.2)	109 (15.2)	0.007
1–2	154 (49.2)	391 (54.7)	
3+	124 (39.6)	215 (30.1)	
Highest level of education			
Primary/at least some high school	172 (55.7)	286 (41.7)	<0.001
College	118 (38.2)	309 (45.0)	
College and advanced degree	19 (6.1)	91 (13.3)	

Note: Data are reported as *n* (%).

Abbreviations: HUP, Hospital of the University of Pennsylvania; PPMC, Penn Presbyterian Medical Center.

Those willing to accept a COVID-19 vaccine were more likely to report being influenced to accept the vaccine by any one of the presented scenarios, including encouragement from their doctor or family, increased vaccine safety data, or positive experience of friends receiving the vaccine (Table 3). The scenarios most influencing the hesitant group to accept a vaccine were "there is new scientific data showing no long-term side effects—6 months or more" (39.5% vs. 75.8%, $p < 0.001$) and "a large study comes out showing no side effects in a large cohort of people you relate with" (38.3% vs. 76.1%, $p < 0.001$). The degree of influence from an admired celebrity's successful vaccination ranked lower than other presented scenarios for both hesitant and willing groups (12.2% vs. 30.9%, respectively, $p < 0.001$).

DISCUSSION

In a study of an ED-based adult patient cohort at two academic medical centers, we found a high degree of vaccine hesitancy, especially among younger and Black patients. Our assessment of health information perspectives among the hesitant suggests that governmental agencies are less well received as information sources compared to friends or family, an important finding that suggests that government informational campaigns may have limited success in reaching such populations. Our work represents the first ED-based study of COVID-19 vaccine hesitancy to explore patient perspectives on vaccination science and trusted information sources. It is important to note that our study was largely conducted before the emergence of the COVID-19 delta variant in the United States; whether the rapid spread of this variant has impacted patient perspectives on vaccination remains unknown.

This work extends the recent findings of Rodriguez et al.,[6] to our knowledge, the only other ED-based survey of vaccine hesitancy. In that study, overall hesitancy was 39% (compared to 31.6% in our cohort) and was also more prevalent among younger and minority patients. The authors found that stated reasons for hesitancy included concerns about safety and lack of vaccine information, which was also found in our cohort. In the work of Rodriguez et al., the employment status of patients is unknown; remarkably, in our cohort health care workers were a sizable

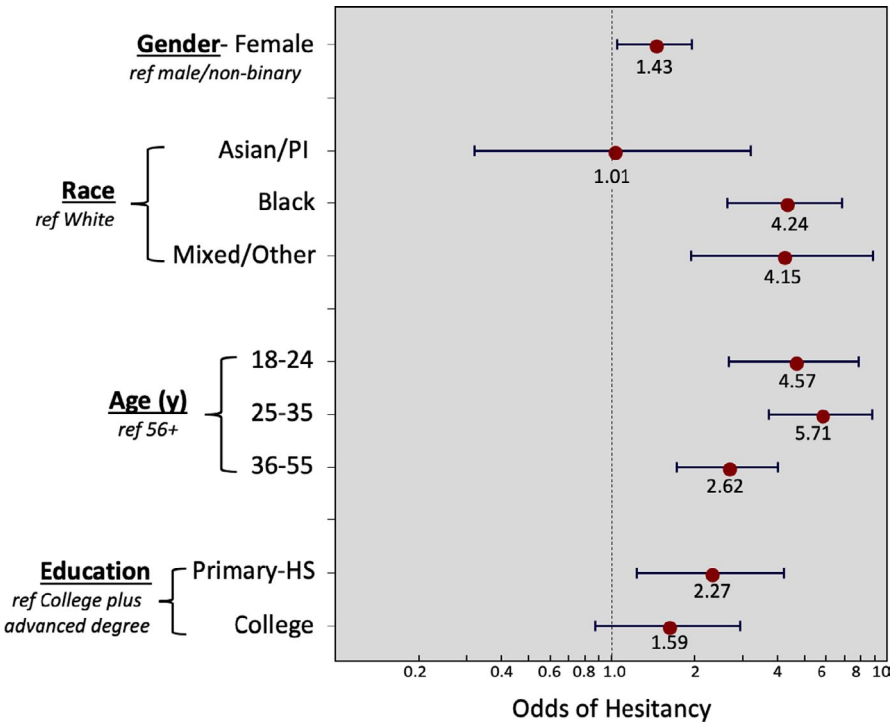

FIGURE 1 Regression modeling of demographics associated with COVID-19 vaccine hesitancy. Odds ratios are shown for each characteristic; reference groups are indicated where applicable. HS, high school; PI, Pacific Islander [Color figure can be viewed at wileyonlinelibrary.com]

portion of the hesitant population (19.7%). We also found no significant association between hesitancy and connection to primary care providers, a finding that differed from the work of Rodriguez et al., who found that lack of availability of primary care was associated with hesitancy.

The incidence and high transmissibility of the COVID-19 delta variant has presented new public health concerns, prompting the reinstatement of mask mandates, social distancing guidelines, and other precautions in some communities. Public health officials have cited unvaccinated and vaccine-hesitant Americans as the primary group responsible for affecting levels of community immunity, presenting increased risk to others, and ultimately determining the future course of the pandemic.[13-16] Our work underscores that hesitancy is a broad problem that affects minority populations and may be rooted in concerns about vaccine safety and other potentially addressable issues. Increased levels of vaccine hesitancy were found in Black respondents, a group subject to disproportionate impact in terms of COVID-19 infection rates and fatalities. Within this group, younger age increased the odds of hesitancy by a significant margin. These data more precisely identify the vaccine-hesitant community in urban ED populations, with the potential to inform and help tailor mitigation efforts for larger populations.

A long history of racial injustice in health care has left Black populations skeptical and with high levels of mistrust in U.S. health systems. The consequences of these inequities have been realized once again during the COVID-19 pandemic in the form of heightened transmission, mortality, and now, disproportionately low levels of vaccination among Blacks.[3,15] Recent research has demonstrated the impact of trusted ambassadors such as Black physicians, faith leaders, and other community members in facilitating conversations regarding hesitancy and has shown high levels of success driving vaccine uptake when these methods are employed.[15-17]

Despite reluctance to receive a COVID-19 vaccine, 50% of hesitant respondents agreed that vaccines are efficacious, adding to existing evidence that suggests hesitancy is COVID-19 vaccine specific and not necessarily the product of more generally held beliefs surrounding vaccines. Responses to Likert statements regarding the scientific foundation of available COVID-19 vaccines suggest a lack of understanding for vaccine science and may reflect the effects of misinformation disseminated by trusted sources. This adds probable merit to additional educational initiatives, which may have more definite impact in point-of-care situations such as the ED. Specifically for Black patients, provider intervention has been suggested as an effective measure for reducing COVID-19 vaccine hesitancy.[18]

Successful communication with hesitant audiences will require the strategic use of trusted channels. Lack of trust in government and traditional media sources was elevated for the vaccine-hesitant, while friends and family ranked the highest in terms of trustworthiness (51%) among the presented sources. While this presents the natural challenges associated with word-of-mouth communications and inherent biases in information communicated by loved ones, the findings also suggest that concentrated microtargeting strategies may be more successful than large-scale appeals from government agencies, officials, or other sources. The findings of this study also suggest that social media is likely not an effective agent of change, with both vaccine-hesitant and willing groups reporting very low levels of trust in the medium. Social media platforms have also been found to be associated with the distribution of misinformation and responsible for driving vaccine hesitancy.[19]

TABLE 3 Attitudes and opinions affecting vaccine hesitancy

	Vaccine hesitant	Willing to receive vaccine	Difference (95% CIs)	*p*-value
Confidence in vaccine science				
Vaccines are founded on false science. *(Disagree)*	147 (44.1)	602 (82.6)	38.4 (32.4, 44.4)	<0.001
Vaccines can cause detrimental health issues. *(Disagree)*	37 (11.1)	341 (46.7)	35.6 (30.7, 40.6)	<0.001
The best way to beat COVID is by having most people getting the infection rather than getting vaccinated. *(Disagree)*	187 (56.3)	568 (77.8)	21.5 (15.4, 27.6)	<0.001
Some batches of vaccines from the same manufacturer are safer than others. *(Disagree)*	74 (22.1)	235 (32.2)	10.0 (4.4, 15.6)	<0.001
Vaccines are effective in preventing disease spread/infection. *(Agree)*	176 (52.5)	652 (89.2)	36.6 (30.8, 42.4)	<0.001
Face masks work to slow the spread of COVID. *(Agree)*	241 (72.4)	671 (91.9)	19.6 (14.4, 24.7)	<0.001
The COVID-19 vaccine from one manufacturer might be safer or better than a COVID-19 vaccine from another manufacturer. *(Agree)*	136 (40.6)	366 (50.1)	9.4 (3.0, 15.8)	0.004
Trusted health/vaccine information sources				
Government communications (CDC, NIH)	131 (39.6)	574 (78.9)	39.3 (33.2, 45.3)	<0.001
Traditional news (FOX, CNN, NYT)	106 (32.0)	374 (51.4)	19.4 (13.2, 25.6)	<0.001
Friends/family	169 (51.1)	444 (61.0)	9.9 (3.5, 16.4)	0.003
Online blogs/forums (Healthline, WebMD, Personal/WordPress, Wikipedia)	73 (22.1)	218 (30.0)	7.9 (2.3, 13.5)	0.013
Social media (YouTube, Twitter, Facebook, Instagram, Reddit, etc.)	35 (10.6)	90 (12.4)	1.8 (−2.3, 5.9)	0.39
Scenarios that would impact health decision				
Your primary care physician or family doctor urges you to get vaccinated	107 (32.3)	612 (84.1)	51.5 (45.8, 57.3)	<0.001
Your children, spouse, or other immediate family encourage vaccination	114 (34.7)	571 (78.4)	43.8 (37.8, 49.7)	<0.001
A large study comes out showing no side effects in a large cohort of people you relate with	126 (38.3)	554 (76.1)	37.8 (31.7, 43.9)	<0.001
There is new scientific data that shows no long-term side effects (6 months or more)	130 (39.5)	551 (75.8)	36.3 (30.2, 42.4)	<0.001
A number of your friends are vaccinated and do not experience any side effects	123 (37.4)	536 (73.6)	36.2 (30.1, 42.4)	<0.001
A celebrity you look up to is vaccinated without side effects	40 (12.2)	225 (30.9)	18.8 (13.9, 23.6)	<0.001

Note: Data are reported as *n* (%).

The study also documents expressed concerns from the hesitant group regarding the potential for detrimental health effects caused by COVID-19 vaccines. This finding aligns with existing research on the influence of perceived side effects on hesitancy in ED populations[6] and is likely associated with the hesitant group's increased agreement that immunity is better achieved via infection than via vaccination. Increased levels of hesitancy were also detected in younger females, irrespective of race. This may evidence ongoing concerns held by some regarding the vaccines' effects on fertility, despite a lack of evidence to suggest any such association or heightened risk.[20]

The fraction of health care workers in the hesitant group (19.7%) presents additional concerns in terms of hospital operations and challenges to mitigate hesitancy attributed to a lack of vaccine information. Health care workers are likely to have among the greatest access to current vaccine science, yet their level of hesitancy suggests that existing channels of communication may not be resonating with them. Hesitancy among health care workers also poses the threats of workforce disruption and further disease spread. An outbreak among unvaccinated health care workers, regardless of their unique roles, has the potential to seriously disrupt hospital operations, impede patient care, and/or risk transmission of the virus to patients during asymptomatic or incubation phases. This in turn threatens patients, guests, other staff and the credibility of the associated institution.

Among those willing to accept vaccination, 90% said they would be willing to receive the vaccine in the ED. This suggests the powerful role the emergency department can play in improving vaccination rates, especially among those who may not otherwise have access to health care.[21] Furthermore, by better

understanding the reasons for vaccine hesitancy and vaccine misinformation, as explored in this study, EDs will be better equipped to help address vaccine hesitancy, among both patients and health care personnel.[22]

Vaccine hesitancy also risks aggravating barriers to health care access for vaccinated persons seeking care for non–COVID-19–related illness, with more drastic effects on traditionally underserved populations. Hospitals fielding a high volume of COVID-19 patients have been forced to suspend elective procedures, preventative care, and other care for non–COVID-19 illness. With unvaccinated Americans driving hospitalizations, hospitals may be forced to suspend these services once again. This evidences the increased need and motivation for hospitals and health systems to understand and attempt to mitigate reasons for vaccine hesitancy in their localities, with successful interventions having the possible adjunct effect of improving non–COVID-19 disease outcomes.

LIMITATIONS

This project is subject to limitations associated with survey-based research. The findings are drawn from a discrete geographic region and may not be generalizable. We did not ascertain the geographic distribution of participants regarding urban versus rural residence; however, the great majority of all patients presenting to our EDs are from the greater Philadelphia metropolitan area (i.e., nonrural origin). Because this represented a longitudinal survey over time, secular trends of media influence and vaccine availability may have influenced patients over the course of the study; in addition, the rapid spread of the delta variant occurred largely after our study was completed. As with any survey study, self-reporting may be subject to a variety of biases, including social desirability and recall bias. We did not perform follow-up with any subjects to determine if they received vaccination at some later point.

CONCLUSIONS

This study identified a high degree of COVID-19 vaccine hesitancy among ED patients, with self-reported barriers related to worries about vaccine safety among other concerns. Hesitant patients were less likely to trust government sources of health information than friends/family. Further work will be required to test ED-based interventions to mitigate vaccine hesitancy in select populations.

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CONFLICT OF INTEREST

BSA discloses equity in VOC Health, a company developing novel COVID-19 testing methods, and honoraria from Becton Dickinson related to cardiac arrest care. The other authors have no potential conflicts to disclose.

AUTHOR CONTRIBUTIONS

Felix E. Fernández-Penny: codesigned survey instrument, contributed to data collection and quality assurance, led manuscript drafting and revisions. Eliana L. Jolkovsky: codesigned survey instrument; contributed to data collection and quality assurance. Frances S. Shofer: led quantitative/statistical analysis, contributed to manuscript (results and methods). Keith C. Hemmert: contributed to design, contributed to manuscript draft (discussion) and critical revision. Hisham Valiuddin: contributed to design, contributed to manuscript draft (discussion) and critical revision. Julie E. Uspal: contributed to design, contributed to manuscript draft (discussion) and critical revision. Nathaniel A. Sands: contributed to design, contributed to data analysis. Benjamin S. Abella: oversaw study development, research team management; contributed to analysis, manuscript drafting and critical revision.

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