COVID Vaccine Information Sources Utilized by Female Healthcare Workers

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Rachel Paul, MPH; Nandini Raghuraman, MD, MSCI; Ebony B. Carter, MD, MPH;
Anthony O. Odibo, MD, MSCE; Jeannie C. Kelly, MD, MS; Megan E. Foeller, MD; Marta J. Perez, MD

BACKGROUND: Clinical trials of the messenger RNA COVID-19 vaccines excluded individuals with active reproductive needs (attempting to conceive, currently pregnant, and/or lactating). Women comprise three-quarters of healthcare workers in the United States—an occupational field among the first to receive the vaccine. Professional medical and government organizations have encouraged shared decision-making and access to vaccination among those with active reproductive needs.

OBJECTIVE: This study aimed to characterize the information sources used by pregnancy-capable healthcare workers for information about the COVID-19 vaccines and to compare the self-reported "most important" source by the respondents' active reproductive needs, if any.

STUDY DESIGN: This was a web-based national survey of female, US-based healthcare workers in January 2021. Recruitment was done using social media and subsequent sharing via word of mouth. We classified the respondents into 6 groups on the basis of self-reported reproductive needs as follows: (1) preventing pregnancy, (2) attempting pregnancy, (3) currently pregnant, (4) lactating, (5) attempting pregnancy and lactating, and (6) currently pregnant and lactating. We provided respondents with a list of information sources (friends, family, obstetrician-gynecologists, pediatrician, news, social media, government organizations, their employer, and "other") and asked respondents which source(s) they used when looking for information about the vaccine and their most important source. We used descriptive statistics to characterize the information sources and compared the endorsement of government organizations and obstetrician-gynecologists, which were the most important information source between reproductive groups, using the chi-square test. The effect size was calculated using Cramér V.

RESULTS: Our survey had 11,405 unique respondents: 5846 (51.3%) were preventing pregnancy, 955 (8.4%) were attempting pregnancy, 2196 (19.3%) were currently pregnant, 2250 (19.7%) were lactating, 67 (0.6%) were attempting pregnancy and lactating, and 91 (0.8%) were currently pregnant and lactating. The most endorsed information sources were government organizations (88.7%), employers (48.5%), obstetrician-gynecologists (44.9%), and social media (39.6%). Considering the most important information source, the distribution of respondents endorsing government organizations was different between reproductive groups (*P*<.001); it was most common among respondents preventing pregnancy (62.6%) and least common among those currently pregnant (31.5%). We observed an inverse pattern among the respondents endorsing an obstetrician-gynecologist as the most important source; the source was most common among currently pregnant respondents (51.4%) and least common among those preventing pregnancy (5.8%), *P*<.001. The differences in the endorsement of social media as an information source between groups were significant but had a small effect size.

CONCLUSION: Healthcare workers use government and professional medical organizations for information. Respondents attempting pregnancy and those pregnant and/or lactating are more likely to use social media and an obstetrician-gynecologist as information sources for vaccine decision-making. These data can inform public health messaging and counseling for clinicians.

Key words: coronavirus, COVID-19, immunization, immunization in pregnancy, information sources, SARS-CoV-2, social media, vaccine campaign, vaccine information

Introduction

The COVID-19 pandemic placed unprecedented strain on the physical and mental health of healthcare workers, who faced the physical dangers of the virus and the stress of personal protective equipment shortages and exposure to a novel virus.[1,2] The pandemic has also increased the burden of unpaid care work for women,[3] who comprise three-quarters of full-time healthcare workers in the United States.[4] Furthermore, pregnant individuals faced the additional risk of higher rates of severe disease and death owing to COVID-19.[5−7] In December 2020, the US Food and Drug Administration (FDA) issued the first emergency use authorization (EUA) for a COVID-19 vaccine with robust effectiveness and safety in clinical trials.[8] However, the trials excluded individuals attempting to conceive and those who were pregnant or lactating, so these individuals did not have the safety and effectiveness data applicable to their physiological and reproductive state.[9] Studies have demonstrated increased vaccine hesitancy during the COVID-19 pandemic among female sex individuals[10] including those who were pregnant,[11] and among healthcare workers[12−15], who were among the first to have access to vaccination.[16]

We conducted a cross-sectional, web-based survey of US-based, pregnancy-capable healthcare workers in January 2021. Previously, we reported that individuals with active reproductive needs (attempting to conceive, pregnant, and/or lactating) were less likely to strongly desire the COVID-19 vaccine and less likely to perceive the vaccine as very safe than respondents preventing pregnancy.[17] As individuals with active reproductive needs did not see their physiology represented in vaccine trial data, we characterized the information sources that our respondents used to find information about the vaccine.

AJOG MFM at a Glance

Why was this study conducted?
This study aimed to understand the information sources for the COVID-19 vaccine used by pregnancy-capable healthcare workers

Key findings
The most frequently reported source of COVID-19 vaccine information was government organizations. The information source endorsed as most important differed by the reproductive need; respondents attempting conception, those pregnant, and/or those lactating were more likely to report an obstetrician-gynecologist (OB-GYN) as their most important source. Respondents with active reproductive needs were more likely to use social media as an information source for COVID-19 vaccine information.

What does this add to what is known?
Pregnancy-capable healthcare workers look to government organizations for COVID-19 vaccine information. Individuals with active reproductive needs consider an OB-GYN as the most important source for COVID-19 vaccine information. These results suggest opportunities to prioritize education on clear and informative messaging to healthcare workers in vaccination campaign strategies.

Materials and Methods
Respondents
We administered a cross-sectional, web-based survey. Individuals were eligible to complete the survey if they were 18 to 50 years of age, pregnancy-capable, were healthcare workers in the United States, and had interacted with patients since March 2020. We defined a healthcare worker as an employee in the healthcare field that had any type of patient contact. Pregnancy-capable was defined as an individual of biological female sex who had not undergone sterilization procedure or hysterectomy.

Recruitment and enrollment
We recruited respondents using social media channels (Instagram, Twitter, and Facebook) to obtain a sample that was diverse in age, practice setting, healthcare roles, and geography. Social media is used by >80% of adults aged 18 to 49 years and by 78% of women in the United States.[18] Our department social media accounts made the original recruitment posts with a link to the survey; the respondents were encouraged to share the link with their colleagues and repost the original recruitment post (ie, snowball sampling). Individuals reviewed a consent information sheet before beginning the survey. Our

institutional review board deemed this study as exempt before any recruitment activities owing to the anonymous nature of the survey.

Procedures
After completing the screening questions, the respondents answered questions about their demographic and reproductive characteristics, their role in healthcare, and their attitudes about the COVID-19 vaccine. We asked respondents, "When looking for information about the vaccine, what information source(s) did you use?" and provided them with a list of options, prompting them to check all that apply: friends, family, obstetrician/gynecologist (OB-GYN), pediatrician, news (online, TV, radio), social media, government organizations (Centers for Disease Control and Prevention [CDC], FDA), my employer, and "other." If the respondents selected other, they were required to describe the information source. The respondents could also select "I didn't look for information." Following that question, we asked the respondents to identify the information source that was most important to them when looking for information about the vaccine; they were provided with the same list and asked to choose 1 option.

At the end of the survey, they were asked to enter a unique, anonymous ID so that duplicate responses could be removed before analysis.

Data analysis
Data collection and management were conducted using Research Electronic Data Capture (REDCap).[19,20] We used descriptive statistics to characterize the information sources endorsed by the respondents. We categorized them into 6 groups on the basis of self-reported active reproductive needs as follows: (1) preventing pregnancy, (2) attempting pregnancy, (3) currently pregnant, (4) lactating, (5) attempting pregnancy and lactating, and (6) currently pregnant and lactating. Given that our recruitment strategy was social media-based, we examined the endorsement of social media as a source across groups. Two authors reviewed the description of "other" information sources and recoded it into an existing category where appropriate (eg, they included maternal-fetal medicine doctors with OB-GYN) and defined 5 additional information sources on the basis of the free text responses. We compared the endorsement of government organizations and OB-GYN as the most important information source between reproductive groups using the chi-square test and calculated the effect size using Cramér V. With 5° of freedom in our comparisons, we considered an effect size >0.22 as large. Data analysis was conducted using SPSS version 27 (IBM Corp, Armonk, NY).

Results
The survey was active from January 8, 2021 to January 31, 2021; the full enrollment flow and characteristics of the respondents have been previously described.[17] Briefly, the respondents had a median age of 37 years; 89.1% were White and 6.9% were Hispanic. The respondents were from across the United States; the 3 most common regions were Midwest (31.4%), Southeast (21.8%), and Northeast (18.3%). A total of 11,405 unique respondents as follows were included in our analysis: 5846 (51.3%) were preventing

TABLE
Sources of information for the COVID-19 vaccine endorsed by pregnancy-capable healthcare workers

Information source	Information source (check all that apply)	Most important information source
Government organization	88.7	51.4
Employer	48.5	5.2
Obstetrician-gynecologist	44.9	19.8
Social media	39.6	4.7
News	36.3	2.2
Friends	33.0	1.3
Family	19.4	0.8
Pediatrician	14.4	2.8
Peer-reviewed journal, other research[a]	8.4	6.0
Professional medical organization[a]	3.3	2.2
Other physician[a]	2.7	1.6
Other[b]	1.1	0.7
Colleagues[a]	0.7	0.2
Vaccine manufacturer[a]	0.5	0.2
Did not seek information	0.8	0.7

Data are presented as percentages; numbers may not add up to 100 owing to rounding.

[a] Category created post hoc from free text descriptions of "other" information sources; [b] Only includes responses that were not recoded into other categories.

Paul. COVID-19 vaccine information sources. Am J Obstet Gynecol MFM 2022.

pregnancy, 955 (8.4%) were attempting pregnancy, 2196 (19.3%) were currently pregnant, 2250 (19.7%) were lactating, 67 (0.6%) were attempting pregnancy and lactating, and 91 (0.8%) were currently pregnant and lactating. The respondents endorsed a wide variety of information sources for vaccine information (Table). Government organizations were endorsed by 88.7% of the respondents, followed by the respondents' employers (48.5%), OB-GYNs (44.9%), and social media (39.6%). On the basis of the free text answers from the respondents that endorsed an "other" information source, peer-reviewed journals/other research, professional medical organizations, other physicians, colleagues, and the vaccine manufacturer were created as categories post hoc. When asked which information source was the most important, 51.4% endorsed government organizations, 19.8% endorsed OB-GYNs, and 6.0% endorsed peer-reviewed journals or other research (Table).

When we examined the endorsement of government organizations as the most important information source on the basis of reproductive group, there was a significant difference between groups with a large effect size ($P<.001$; df=5; Cramér's V=0.25) (Figure, A). Respondents preventing pregnancy were most likely to endorse government organizations (62.6%), followed by those attempting pregnancy (46.7%). Respondents who were currently pregnant had the smallest proportion endorsing government organizations as their most important source of information (31.5%).

Conversely, half the respondents who were currently pregnant endorsed an OB-GYN as the most important source of information about the COVID-19 vaccine (51.4%), as did 38.5% of the respondents who were currently pregnant and lactating. Approximately one-fourth of respondents attempting pregnancy, lactating, or attempting pregnancy and lactating endorsed an OB-GYN as the most important source (range: 21.2%−28.1%), and very few respondents preventing pregnancy endorsed an OB-GYN as the most important source of information (Figure, B). This distribution was also significantly different between groups ($P<.001$; df=5; Cramér's V=0.44). The endorsement of social media as an information source was significantly different across groups; respondents in each active reproductive needs group were more likely to endorse social media than those preventing pregnancy. However, the proportion of each group endorsing social media had a narrow range and the effect size was small (range 36.6%−43.3%; $P<.001$; Cramér's V=0.07).

Comment
Principal findings
In a large sample of pregnancy-capable, US-based healthcare workers, we found that government organizations, respondents' employers, OB-GYNs, social media, and the news were the most used sources for COVID-19 vaccine information. Respondents with active reproductive needs are more likely to use an OB-GYN and social media as information sources for COVID-19 vaccine decision-making that those preventing pregnancy.

Results
Over half of our sample comprised pregnancy-capable healthcare workers who endorsed government organizations as the most important source of vaccine information. Respondents preventing pregnancy were significantly more likely to report government organizations as their most important source of COVID-19 vaccine information at 62.6%, whereas 31.5% of pregnant patients reported the same. At the time of our survey, the FDA had granted EUA to 2 COVID-19 messenger RNA vaccines.[21] Manufacturers of both excluded participants attempting pregnancy and those who were pregnant and lactating from trial participation,[9,20] and in the EUA, the

FIGURE

Proportion of female healthcare workers in each reproductive group that endorsed (A) government organizations and (B) obstetrician-gynecologists as their most important information sources regarding the COVID-19 vaccine.
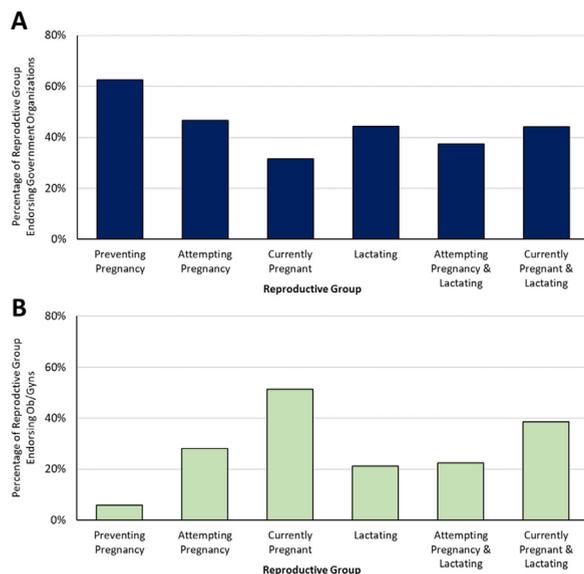
Paul. COVID-19 vaccine information sources. Am J Obstet Gynecol MFM 2022.

FDA included pregnant and lactating individuals in the "unknown risks/data gap" group along with people <16 years of age and immunocompromised individuals. The CDC Advisory Committee on Immunization Practices stated "If a woman is part of a group (eg, healthcare personnel) who is recommended to receive a COVID-19 vaccine and is pregnant, she may choose to be vaccinated. A discussion with her healthcare provider can help her make an informed decision."[22] Therefore, there was a paucity of guidance available from government organizations for healthcare workers with active reproductive needs. This may explain why pregnant respondents in our sample were less likely to identify government organizations as their most important source of information.

The first time a government organization explicitly recommended COVID-19 vaccination for pregnant individuals was on April 23, 2021, when CDC director Dr Rochelle Walensky announced the recommendation owing to emerging data on safety of vaccination in the pregnant population.[23] In our sample, 88% of respondents reported using government organizations as a source, and given the well-established vaccine hesitancy in female and pregnant populations,[10,11,14,17] government organizations should spotlight fertility, pregnancy, and lactation in vaccine messaging and campaigns.

We found that pregnant and/or lactating respondents were more likely to consider an OB-GYN as their most important information source for COVID-19 vaccine decision- making. Pregnant patients have more frequent interactions with their OB-GYN than other reproductive groups, which may contribute to this finding. OB-GYNs are key stakeholders in immunization strategies, participating in preconception, antenatal, and postpartum vaccination and provide general, preventative medical care to nonpregnant individuals.[24] Therefore, it is imperative that OB-GYNs are highly knowledgeable on the risk of existing and emerging infectious diseases and the safety and efficacy of immunizations so they can counsel patients appropriately.

Social media was a common information source reported in our sample, and endorsement was significantly higher in individuals with active reproductive needs. Although social media can be a place of medical misinformation creating a "parallel pandemic,"[25] it can also be used by government organizations and individual medical professionals to share vital public health information.

Clinical implications

As previously reported in this sample and elsewhere, female sex, pregnancy, hoping to conceive, and lactating individuals have been associated with vaccine hesitancy.[10–12,14,26] Soon after the vaccine became available, misinformation about COVID-19 vaccines causing infertility spread in online communities.[27] This underscores the value of clear messaging targeted toward reproductive-aged females and pregnancy- and lactation-specific messaging. This messaging can be difficult when vaccination trial exclusion results in an absence of evidence. Professional medical societies have called for changing the FDA guidelines for the inclusion of pregnant women in therapeutic trials.[28,29] If these data had been available from trials, consistent messaging could have been employed from the start.

However, it begs another important question as follows: in a novel pandemic without vaccine clinical trial data in pregnancy where pregnant individuals are looking to an OB-GYN for counseling, what information sources are being used by obstetrical physicians to perform this counseling? These data can emphasize the importance of government and professional medical organizations, empowering not only patients but also OB-GYNs specifically with the best available information and counseling tools to utilize in patient care. Continued communication from these organizations is critical as new vaccines are made available in the United

States[30] and more information becomes available about COVID-19 vaccination in pregnancy.[31]

Research implications

Future work should examine the effectiveness of targeted vaccine messaging to combat COVID-19 and limit other diseases in pregnancy and should inform future public health strategies. Of particular importance is further research elucidating how pregnant individuals utilize information for vaccine decision-making. It is well-documented that recommended maternal immunizations can protect maternal health and that passive immunity obtained by antenatal vaccination can protect the fetus; in infants, it can be shared by placental and breastmilk transfer, especially before infant and childhood immunization is available. In the influenza season following the H1N1 pandemic, there was record influenza immunization uptake by pregnant individuals. The top reason given for immunization by those who accepted it was "to protect their infant" (33.2%) followed by "to protect themselves" (20%). Conversely, the top reason for declining vaccination was "concern about safety risk to infant."[32] Effective vaccine messaging can also help protect future child health, as work with decision-making for other vaccines has shown; parents are already thinking about childhood vaccines during the prenatal period.[33]

Strengths and limitations

Our study's strengths include a large sample size and respondents with a wide range of reproductive statuses, including those trying to conceive and lactating, in addition to a large comparison group who were preventing pregnancy. We also captured these data at a time-sensitive period of a novel vaccination campaign, when the least amount of data for vaccine decision-making was available and the vaccine was only available to healthcare workers and select high-risk individuals.

There are also several limitations to our study. Despite a completion rate among eligible respondents of over 90%, we are unable to calculate a response rate owing to the web-based structure and snowball recruitment strategy. To participate, respondents must have internet access, and social media-based recruitment may limit exposure of the survey to particular online communities, limiting the generalizability of results and introducing possible selection bias, particularly regarding the use of social media as an information source. As published previously, 73.6% of respondents had received a dosage of the vaccine at the time of the survey, and most participants strongly desired vaccination. It is possible that pregnancy-capable healthcare workers who had less vaccine confidence used different information sources. Our survey was created during a novel pandemic and vaccination rollout and therefore is not a validated survey instrument.

Conclusions

This study shows that pregnancy-capable healthcare workers highly value COVID-19 vaccine information from government organizations, their employers, OB-GYN physicians, and social media, but that, their most valued information source is different according to their reproductive needs; that those preventing pregnancy, identify government organizations as their most important source; and those pregnant and/or lactating, report an OB-GYN physician as their most important source and a greater use of social media. These data can help inform vaccine campaign messaging and physician empowerment, facilitating targeted education to patients. ◼

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Author and article information

From the Divisions of Maternal-Fetal Medicine & Clinical Research, Department of Obstetrics and Gynecology, Washington University School of Medicine, St. Louis, MO (R. Paul and Drs Raghuraman, Carter, Odibo, Kelly, and Perez); Maternal-Fetal Medicine, Saint Alphonsus Medical Center, Boise, ID (Dr Foeller).

Corresponding author: Marta J. Perez, MD. martajperez@gmail.com