



Perspectives on Maternal Vaccination from Obstetrical Clinicians: A Qualitative Multi-site Study

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Abstract

Objectives Despite the seriousness of influenza and pertussis, availability of safe and effective vaccines against them, and long-standing maternal vaccination recommendations, US maternal influenza and Tdap vaccination rates have been low. To increase vaccination rates in obstetric offices, it is important to understand clinician perspectives and office processes. We conducted in-depth interviews with nurses and providers on these topics.

Methods Interviewees worked in obstetric offices in one-of-four participating health systems in NY and CA. We audio-recorded and transcribed 20–30-min interviews. We used predetermined categories to code interviews with Dedoose, then iteratively refined codes and identified themes.

Results We conducted 20 interviews between 4/2020 and 9/2020: 13 providers (physician or nurse midwife) (5 NY, 8 CA); 7 office nurses (6 NY, 1 CA). In almost all offices, patient refusal of influenza vaccine was considered the major vaccination barrier; Tdap was often deferred by patients until post-delivery. Nurse-only visits for either vaccine were rare. Vaccination outside the office was uncommon; few offices systematically documented vaccines given elsewhere in a retrievable manner. Participants emphasized patient education as key to prenatal care, but the number of topics left little time for immunizations. Few interviewees could identify an office “immunization champion,” knew their office vaccination rates, or had participated in vaccination quality improvement. Several interviewees indicated that they or another provider were good at persuading hesitant patients, but their method had not been shared with other clinicians.

Conclusions for Practice Multiple practical barriers and maternal vaccine hesitancy limit maternal vaccination. Quality improvement strategies are needed.

Keywords Maternal immunization · Prenatal care · Immunization · Influenza

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Significance

What is already known on this subject To prevent influenza and pertussis, we have safe, effective vaccines and long-standing maternal vaccination recommendations. Nonetheless, maternal vaccination rates have been relatively low. To address this, it's important to understand clinician perspectives and office processes.

What this study adds During in-depth interviews with OB nurses, obstetricians, and midwives, respondents supported maternal vaccination but were not aware of their rates. Hesitancy was the biggest perceived barrier. Documented refusal was sometimes used to remember to avoid offering vaccines again. Efforts are needed to improve maternal vaccination communication and work processes during busy OB visits.

Introduction

Vaccination against influenza and pertussis are routinely recommended during pregnancy because of severe health outcomes among pregnant individuals and their infants, in the case of influenza, and among infants infected with pertussis (CDC, 2013; Grohskopf et al., 2020). Influenza carries a greater risk of hospitalization for pregnant than for non-pregnant patients (Mertz et al., 2016). For each flu season from 2010–11 to 2017–18, pregnant individuals accounted for 24–34% of influenza-associated hospitalizations among females ages 15–44 years, although only ~9% of US females in this age category were pregnant each year (Lindley et al., 2019). Infants < 6 months of age, who are ineligible for influenza vaccination, are more than four times as likely to die from influenza than those children > 2 years of age (Shang et al., 2018). Fortunately, maternal influenza vaccination has been associated with a 48% reduced risk of laboratory-confirmed influenza infection among infants < 6 months of age (Nunes & Madhi, 2018).

Pertussis, while not as common as influenza, is not rare; 18,617 US cases occurred in 2019. Pertussis hospitalizations have been most common among infants < 6 months of age (CDC, 2021). Administration of tetanus, diphtheria, pertussis vaccine (Tdap) during pregnancy is 91% effective against pertussis disease in offspring during the first 2 months of life (Baxter et al., 2017).

For these reasons, maternal influenza and Tdap vaccination are recommended during every pregnancy. Individuals who are or will be pregnant during the influenza season should receive injectable influenza vaccine. Tdap should be administered each pregnancy, optimally between

27- and 36-weeks gestation (preferably during the earlier part of this period) (CDC, 2013; Grohskopf et al., 2020). Despite the disease seriousness, availability of safe and effective vaccines, and long-standing recommendations from the American College of Obstetrics and Gynecology (ACOG) and Advisory Committee on Immunization Practice (ACIP), maternal influenza and Tdap vaccination coverage in 2019 (pre-COVID-19 pandemic) were only 53.7% and 54.9%, respectively (Lindley et al., 2019).

Experts have delineated categories of factors that affect vaccine receipt: elements involving patients, providers/practices, and systems (Szilagyi et al., 2008). Many studies have examined the impact of provider- and system-focused immunization interventions within pediatric, family medicine, and internal medicine practices (e.g., patient reminders, provider prompts, performance feedback, multi-component quality improvement) (Community Preventive Services Task Force, 2022). However, relatively few assessed these interventions in obstetric practices (Bisset & Paterson, 2018; Ellingson et al., 2019; Frew et al., 2018; Goodman et al., 2015; Mohammed et al., 2019; Moniz et al., 2013; Stockwell et al., 2014; Ogburn et al., 2007).

Similarly, the literature on hesitancy for childhood vaccines has grown (Chung et al., 2017; Hofstetter et al., 2018; McClure et al., 2017; Mohanty et al., 2018) but vaccine hesitancy during pregnancy remains understudied. In one survey of pregnant individuals, the most common reason for not receiving influenza vaccination was believing the vaccine was ineffective (17.6%). For Tdap the most common reason was not knowing vaccination was needed during each pregnancy (37.9%). For both vaccines, the second most common reason was concern about fetal safety (influenza 15.9%; Tdap 17.1%) (Lindley et al., 2019).

To generate and implement strategies to increase vaccination rates in obstetric offices, a better understanding of nurse and provider perspectives and current office processes is critical. To this end, we conducted key informant interviews with nurses, midwives and obstetricians affiliated with participating health systems in New York and California. Interviews were designed to highlight perspectives of front-line obstetrical workers on current vaccination policies and procedures in their workplaces.

Methods

Ethics

This qualitative study was given exempt status by research subjects review boards of University of Rochester Medical Center (URMC); Rochester Regional Health (RRH); and University of California, Los Angeles (UCLA). The study was performed in accordance with the ethical standards

laid down in the 1964 Declaration of Helsinki and its later amendments.

Settings and Participants

Interviewees were providers (midwives, obstetricians) and nurses employed at participating obstetric practices affiliated with one-of-four healthcare systems: two in the Rochester, NY region and two in Los Angeles, CA. As a prerequisite for study inclusion, offices had to stock both influenza and Tdap vaccines. In the Rochester region (population 750,000), the two involved systems (URMC, RRH) provide most of the obstetric care. In Los Angeles (population 10.5 million), UCLA (primarily commercially insured patients) and Los Angeles County Department of Health Services (primarily publicly insured patients) are two of the largest healthcare systems. These settings provided variability in geography, healthcare system type, payor mix, and patient populations. For example, the descent of most Hispanic patients in Rochester is Caribbean, while in Los Angeles is it Mexican or Central American.

We identified all obstetrical practices in these four healthcare systems. We asked each practice's manager to identify one provider and one nurse who could best answer questions regarding vaccine delivery procedures and workflow. The choice was based on a subjective judgement by the practice manager because, although we collected information on each suggested person's role, years in practice, and years working at that office, attention to immunization issues was not captured. Once identified by the practice manager, a member of the study team reached out to the potential subject via email.

The 20–30-min interviews were conducted from April to September 2020 (during COVID-19 pandemic) using audio-conferencing. Interviews were recorded and transcribed after obtaining the participants' verbal informed consent. To promote interview uniformity, one investigator (CR) conducted all NY interviews, and another (PS) conducted all CA interviews; each was a physician and experienced qualitative researcher. The interviewers did not have a prior relationship with the participants. During the consent process, participants were told the role of the interviewer and the study's goal: understanding the participants' perceptions of maternal immunization practices. Each introduced himself or herself at the outset of the interview and noted the study's goal: understanding the participants' perceptions of maternal immunization practices. Two additional team members were on the line to assist with informed consent and note taking. Neither field notes nor transcriptions of recordings included participant identifiers, and neither was shared with participants for review. Participants were compensated \$50.

Measures

We used a semi-structured interview tool consisting of open-ended questions with targeted follow-up prompts. Interview topics were specific to maternal influenza and Tdap vaccination including office policies and procedures, provider and nurse efforts to increase rates, previous quality improvement (QI) initiatives, perceived barriers and facilitators. Interview topics and discussion guides were based on our related studies (Rand et al., 2020) and other maternal vaccination studies (Ault et al., 2012; Mouzoon et al., 2010; Zakrzewski et al., 2014). The interview guide was piloted, and suggested prompts continued to be refined after piloting.

Data Analysis

We used directed content analysis (Hsieh & Shannon, 2005) to evaluate interviews based on prior research that led us to development of the initial coding scheme. We used pre-determined categories to code transcribed interviews using Dedoose software. Coding categories were refined and expanded iteratively, until all interviews had been coded using the final Master Code List. As we reviewed transcripts, fewer novel responses emerged; the perceptions expressed in the last few interviews coded did not lead to new codes. The coding tree (a list of parent codes, child codes, and descriptions of each child code) was maintained on the shared coding platform.

Four researchers (SH, RB, AB, DC) comprised the coding team. Dyads independently coded interview text, revising codes as needed. Another team member compared the applied codes for discrepancies. We met to resolve discrepancies, further edit and unify code lists. Using the revised Master Code List, we re-coded previously coded interview texts, and then double-coded and compared interview texts. Coding of approximately two-thirds of the interviews continued in this manner until discrepancies between coders were rare. After the coding consistency goal was met, the interviews were single coded and checked independently. Questions that arose while coding continued to be addressed by the coding team.

After reviewing data obtained from the analytic platform and memos created during coding, clear themes emerged.

Results

Respondents

We conducted 20 interviews: 13 with providers (5 NY, 8 CA) and 7 with nurses (6 NY, 1 CA).

Current Policies and Procedures

Almost all participants stated that in their office influenza vaccination began when vaccine arrived and stopped when influenza season was over. Tdap vaccine usually was recommended at 27–36 weeks, often at the earlier end of this period, but patients often deferred Tdap until post-delivery.

Although telemedicine visits were common during the COVID-19 pandemic, patients were seen frequently enough that they were not referred elsewhere for vaccination. Occasionally vaccinations were given during in-office nurse-only visits, e.g., after telemedicine visits during influenza season.

Interviewees believed that patients infrequently received antenatal Tdap or influenza vaccination outside their practice.

“Sometimes our patients will go with their partners to a [retail pharmacy] so that they can go together to get the vaccination. But most of the time, they’re in the office... Some of our patients are nurses or medical providers themselves, and they will have [flu vaccine] at their own work.”

Few offices had a process for systematically documenting vaccinations given elsewhere in a retrievable manner, so vaccinations given at the workplace or a pharmacy, for example, might be missed in vaccination rate audits. Offices rarely documented their vaccinations in the state’s immunization information system (IIS). Some nurses reported using the IIS, but providers were consistently unaware of it.

Respondents uniformly reported that their office personnel did not routinely contact patients to bring them in specifically for vaccines or nurse-only visits because obstetric patients have frequent visits. A few were aware that their electronic health record (EHR) sent automated patient reminders about upcoming visits. If patients had not received a recommended vaccine, the assumption was that they had refused it or would get caught up at the next visit.

Provider Reminders

Many methods were used to ensure vaccinations were not inadvertently overlooked. Traditional vaccination *standing orders* (protocols that authorize designated team members to vaccinate without obtaining a patient-specific provider order) were used in some offices. In many offices, staff could “pend” an order. Then they would give the vaccine before the provider saw the patient and have the provider sign subsequently or remind the provider to sign the pending order so the vaccine could be given after the provider visit.

Electronic “sticky notes” were part of the EHR in many offices in NY. These electronic prompts were used to communicate among healthcare personnel that a test or vaccine was due [“...it’s harder to miss because we go into that at

every visit”]. Sticky notes were used pre-visit as prompts or post-visit as a reminder to vaccinate next visit. [“*Sometimes they decline in their first trimester... so then we note that in the little sticky note saying, ‘Needs flu vaccine at next visit.’ Until they get it, we usually just keep it up there.*”] Occasionally, the sticky note was used to remember a previous vaccine refusal “*so we’re not asking them at every visit.*”

We found variability in *checklist* use to prompt providers to order vaccines. In some offices they were shared by all personnel; in another, only one physician used the checklist. One interviewee noted that the checklist only had value if you have “*everybody on board to use it,*” whereas another indicated that in her office none of the nurses “*feel empowered to touch it.*” Some interviewees felt their checklist was a time saver, abolishing the need to “*click in a lot of places,*” but others felt theirs was only useful to nurses and trainees, was too redundant and “*ginormous,*” or was available but not used. As with the sticky notes, checklists were often used to remember to avoid offering a vaccine repeatedly.

A few offices used an EHR *provider prompt* to remind providers to order vaccines. Although some offices did pre-visit planning, few utilized a systematic method for having staff prompt providers to order vaccines. One interviewee felt that a provider prompt would be particularly helpful for influenza vaccination because of its seasonality.

“Just when I feel like I’ve got it as part of my spiel and my regular thing, all of the sudden it’s gone. And then I sort of have to re-remind myself at the next season... So, I think... a prompt would be really helpful because it would just be one less thing that we have to... think about on a calendar schedule.”

Some providers used other routine lab work (e.g., glucose tolerance test) as a cue to order Tdap vaccine.

Patient Education

Most participants emphasized patient education as essential to prenatal care and the first prenatal visit as a time for intensive education, although Tdap, given late in pregnancy, might not be discussed. Sources for handouts included the Centers for Disease Control and Prevention (CDC),¹ ACOG, or the office’s university affiliate. A few offices used a screening checklist to rule out vaccination contraindications.² Interviewees sometimes reflected that immunization

¹ The Vaccine Information Statement (VIS) is a document, produced by CDC, that informs vaccine recipients or their legal representatives about the benefits and risks of a vaccine they are receiving. All vaccine providers are required by the National Vaccine Childhood Injury Act to give the appropriate VIS prior to every dose of specific vaccines, including influenza and Tdap.

² See <https://www.immunize.org/catg.d/p4065.pdf>.

could get short shrift due to the large number of essential topics.

“I don’t know that patients read it... It would be helpful if we were able to get some kind of either electronic or some kind of information in which the expectations are... set up, so that the patients can get some prior information without it being just the counseling that we provide because we’re not perfect and there’s definitely times... we forget to offer it.”

“There is a Tdap and pregnancy handout that specifically addresses the whooping cough and the benefits of having the whooping cough protection for the fetus and when they’re born how they have the protection for the first few weeks. There is a handout specifically about that but nothing else for the flu.”

“... most of them are on different apps regarding pregnancy...if they can also add something on those apps regarding vaccination during pregnancy, that would be good because when [patients] come they kind of know, “Oh, today’s for my sugar test... I know because I saw it on my app. “So, if we make sure that they do have [vaccination information], that would make it much easier.”

Barriers to Vaccination

We asked respondents about their perceptions of major barriers to vaccination in their practices.

Patients Refuse/Delay

Table 1 shows quotes describing patient vaccine hesitancy. In almost all offices, influenza vaccine refusal was considered the major vaccination barrier, with an estimate of 25–35% of pregnant patients refusing. The most common influenza vaccine concerns were similar to previously documented parental concerns (Kempe et al., 2020): fear the vaccine would make them sick or give them flu, cause harmful side effects, fail to work, or was unnecessary. Many interviewees noted that Tdap induced less maternal concern, estimating refusals at 5–20%. However, patients often opted for Tdap post-delivery, thinking that the vaccine’s sole purpose was “cocooning,” i.e., preventing disease spread from contacts.

Other Barriers

Table 1 also includes quotations reflecting a few other notable barriers. Differences between patient attitudes toward influenza vaccine and Tdap may be based in healthcare personnel’s differing approaches. Some providers described differences in Tdap versus influenza vaccine workflow, often

favoring higher Tdap rates. While most interviewees denied that time pressure was an important cause for missing vaccinations, some noted that hectic office sessions could lead to missed opportunities. Confusion about the EHR was a barrier to consistent vaccination in some offices: “*We’ve only been live on it for about 18 months so we’re still kind of digging around finding things.*” Additionally, in an office where the nurse is expected to offer vaccines during rooming, the lack of a nurse prompt was “*something that we have struggled with.*”

Increasing Vaccination Rates

Lack of Immunization “Champion,” Feedback

Almost no interviewees were aware of their office vaccination rates and none could identify a team member who led vaccination efforts. “*I think it’s just so well integrated in how we provide prenatal care that I would say that it’s very much a collaborative effort... We have a breastfeeding champion, but we don’t have something like that for vaccinations.*”

Staff Support for Vaccination

Respondents stated that providers strongly supported vaccination during pregnancy but may not prioritize immunization discussions. In most offices staff strongly supported immunization, but in others, immunizations were considered just a checklist item.

Performance Improvement

While some of the offices had experience with QI activities (e.g., increasing breastfeeding rates), few had done vaccination-related QI. At most offices, “*It’s pretty much everybody just trying to do their best.*”

Communication

(Table 2) Several interviewees indicated that they or someone in the office was notably good at persuading vaccine hesitant patients. Techniques described included having the patient address their concern to the physician if not persuaded by nursing personnel, answering patients’ questions, offering the vaccine at each visit, or emphasizing that vaccination was primarily to protect the infant. Most respondents felt limited time was not an important barrier to these discussions, but some asserted that additional discussion with vaccine refusers was useless. Some lamented that nurses were not more involved in immunization communication, new hires might not be fully versed in immunization importance, and other providers in the practice were not as active in their vaccine recommendation.

Table 1 Perceived barriers to vaccination

Category	Supporting quotes
Causes of patient vaccine hesitancy as described by providers/nurses	
Fear of feeling sick/getting flu after vaccination	<ul style="list-style-type: none"> • The flu is more of a problem because people think they can get sick from the vaccine. So, it's the same thing for the general population, right? Like, "Oh, I don't want to get sick. I'm pregnant, it's going to be worse and I don't want to do that, but I will do your Tdap but not the flu" • ...that's probably one of the biggest things why people don't want to get the flu vaccine is because they think it's gonna give them the flu
Vaccine effectiveness concern	... "it doesn't work" so they're not gonna get it. They [the scientists] always get it wrong. The strain is [wrong]—you know—they get the flu vaccine and then they still get the flu
Vaccine safety concern	Some people have a weird thing about the tetanus part of it so you have to explain to them that it's fine and "We wouldn't give it to you if it wasn't gonna be okay for you" ... some people are like "Oh, I'm only supposed to have that once every 10 years I've already had it, I don't want it again"
Injection pain avoidance	It's a matter of patients being fearful for many reasons, vaccines hurt, it's going to hurt their arm. They don't feel like having that... Many women have needle phobias and pain phobias, ironically, because they're going to give birth to a baby, but the idea of their arm being sore, they just will put it off week after week after week...
Belief that flu/pertussis is not a problem	... and I think a lack of understanding of how dangerous the flu can be. So, they think the flu vaccine is gonna cause a problem. They don't think the flu is really going to cause an issue and so it just doesn't seem important to them
Desire to minimize any intervention during pregnancy	<ul style="list-style-type: none"> • There are a small percentage that choose to delay until after delivery. I guess with the notion that it is unsafe in pregnancy... • With flu vaccine, I think there's a lot of vaccine hesitation... They're hesitant to get anything new administered that they haven't had before during their pregnancy
Patient is generally "anti-vax"	<ul style="list-style-type: none"> • But I will say that in our practice [referring to midwifery practice] I think we have a little bit of a self-selected bias in that a lot of patients who do come to us come to us because we tend to have more of a holistic and ... patient-centered model of care... we tend to have patients who come to us because they don't necessarily want to just be told what to do... I would say that overall my suspicion is that we probably have a higher rate of, for lack of a better term, anti-vaxxers in our group • I mean we do have people here who don't believe in vaccinations. That also can be a big deterrent and there is nothing that you're gonna do or say that are gonna get them to vaccinate themselves or their children. And so that's another barrier
Misinformation from Internet/social media	<ul style="list-style-type: none"> • I think, actually, a lot of it is that patients are getting false information from blogs and from mommy groups. These patients want, quote unquote, all natural, not realizing that severe illness from influenza is also natural. Their desire is to kind of avoid as much as possible... A lot of them. I would say it's very frequent to get that question. "Oh, well I read on this," or "I heard on this," and then they go into whatever questions they have • Then recently, we had it before, but it got worse is for the flu vaccine is the conspiracy theory now about microchipping with the vaccine, yeah. So that's what I'm starting to hear more and more about regarding the flu vaccine... So basically, I don't know if you have heard but there is something going on in the social media, especially since the COVID that they're going to come and vaccinate you and try to microchip so they will know where you are, they can get all your information through those microchips

Table 1 (continued)

Category	Supporting quotes
Other barriers to vaccination in obstetric offices	
Provider/nurse feels they will be unable to change patient's mind	<ul style="list-style-type: none"> • ... most people come in with like already a plan. They're either absolutely gonna take the vaccine the moment you have it available or they just are not willing to listen to you about it unfortunately • ..some of my colleagues [have] said ... "<i>I don't put up a fight with the patient if they say, 'No, I don't want it.'</i>" "There's too many people in my experience, over many, many years who don't want the flu shot and it's just been so many times they've said the same thing over and over again. I feel like it doesn't necessarily change that patient who doesn't want it already. I don't feel like I changed their mind that often
Healthcare personnel approach flu vaccine differently	"Everyone in the office definitely recommends annual flu vaccine and Tdap during pregnancy. I think we're a little bit more relaxed when it comes to the flu vaccine, meaning if I ask a patient at her first prenatal visit, 'Hey, do you want your flu shot?...' and if the patient says 'no,' I really don't bring it up again. But Tdap, I would say is a different story. I feel like a lot of the providers, if their patient declines Tdap, we do further counsel them, we put it in the note to discuss again at next visit"
Workflow favors higher Tdap rates	"...because there's a lot to do at the first prenatal visit. ... sometimes I forget to bring (the flu vaccine) up with them or ask them, whereas at the 28 week visit for Tdap, there's not that much other stuff to do. ... Because the nurses don't automatically give the flu shot like they do the Tdap—which actually now that I'm saying that they should just do the same thing. And so it really requires the OB provider to bring it up with them. If I forget, then I just do it the next time I see them.... It's just not as streamlined, getting the flu vaccine"

Discussion

To better understand vaccination barriers and facilitators during pregnancy, we conducted in-depth interviews with obstetric nurses and providers in four healthcare systems in two states. In almost all offices, the major perceived barriers were hesitancy for influenza vaccine and patient deferral until post-delivery for Tdap. Differences in the Tdap and influenza vaccine workflow were common. Vaccination outside the office was rare, but when it happened few offices could easily retrieve the records. Various methods were used to prevent vaccination missed opportunities, but few offices had a system to remind nurses to vaccinate. Most participants emphasized patient education as key to prenatal care, but the plethora of items requiring attention left little time for immunization discussions. Few interviewees could identify an office "immunization champion," knew their office vaccination rates, or had done vaccination-related QI. Several interviewees acknowledged that they or another provider was good at persuading hesitant patients, but their method had not been shared with others.

An April 2020 CDC Internet survey showed that vaccination coverage was highest among pregnant individuals who reported receiving a provider offer or referral for vaccination (Razzaghi et al., 2020). In a similar Spring 2019 survey, the most common reasons for non-vaccination were believing the influenza vaccine was ineffective and not knowing that

Tdap was needed during each pregnancy. These concerns were followed by fetal safety concerns for both vaccines (Lindley et al., 2019). Findings from our qualitative study were consistent with these results and explain some components of hesitancy. Respondents believed that providers in their office consistently recommended vaccination but 25–35% of their pregnant patients refused influenza vaccine and, while Tdap induced less concern, many patients deferred until after delivery, diminishing Tdap's benefit. More patient education on the importance of maternal antibody transfer is needed to emphasize the newborn's protection.

Ault et al. (2012) published programmatic priorities for improving antenatal influenza immunization, four of which highlight themes found in our study. Similarly, the National Vaccine Advisory Committee (NVAC) identified opportunities to increase maternal vaccination, including, among others: (1) Enhancing communication to address the safety and effectiveness of immunizations during pregnancy; (2) Maximizing obstetrical care providers' recommendation and administration of recommended maternal immunizations; and (3) Supporting efforts to increase the use of EHRs and state IISs among obstetrical care providers (National Vaccine Advisory Committee, 2015). A systematic review of evidence on the effectiveness of interventions to improve influenza vaccination coverage in pregnant individuals found a lack of effective interventions. The authors recommended

Table 2 Communication techniques as described by providers/nurses

Category	Supporting quotes
Sharing evidence-based information	
Emphasis on increased risk during pregnancy	<ul style="list-style-type: none"> • ...my usual explanation in terms of the flu vaccine is explaining to the patient that pregnant patients do tend to get sicker with the flu. That it is a safe vaccine for both her and for her fetus and that it is highly recommended to reduce any complications during pregnancy • ...I tell them that the H1N1 was really lethal and the year that we had the H1N1 flu present that one in three pregnant women who contracted the virus actually died...and I tell them that the H1N1 strain is always in the flu vaccine • [I tell them]...of people who get very ill from the flu and are critically ill, a higher percentage of them are pregnant women... You [pregnant] are immunocompromised, your body functions differently...even though 'normal you' doesn't get the flu vaccine, perhaps 'pregnant you', there's a good reason to get it
Emphasis on vaccine's inability to cause flu	<ul style="list-style-type: none"> • So when they tell me that [the flu vaccine will give them the flu], I usually tell them it's not a live vaccine... • ...we definitely are all well versed in talking to them about the reasoning behind...the flu vaccine and that the flu vaccine doesn't give you the flu... • I explain...In layman terms that their body is being presented this protein and that their body makes antibodies...so that they can fight off the flu...But if it doesn't prevent the flu it should mitigate their response to that flu. I explain that the ickiness that they feel after the flu vaccine is because their body is mounting an immune response...but I assure them that it's not the vaccine that's giving them the flu
Emphasis on protection of baby (Tdap)	<ul style="list-style-type: none"> • ...try to just educate them that the baby can't receive the Tdap vaccine until I think it's like one month of age or two months so they are getting the vaccine to pass it on to baby in utero for their protection • [regarding Tdap] So when you tell them that it's really to help protect the baby, it's not necessarily for you to be boosted, most people I would say end up accepting it • ...for the Tdap vaccine, my explanation is that we're giving the Tdap mostly for the pertussis portion of it so that she can create antibodies to pass on to her child and so that her child will also have this extra amount of protection in the first couple of months before they're old enough for their own vaccine
Emphasis on protection of baby (flu)	<p>... there is a study that came out a couple of years ago that just noted that women who had a flu vaccine were less likely to have stillbirths. And for some patients I will sometimes talk about that as a way to try to emphasize the importance of it</p>
Sharing personal experiences	<ul style="list-style-type: none"> • ...when I explain why it [getting the flu] specifically in pregnancy it can be such a problem, sometimes that is helpful. And I do tell them I have personally taken care of pregnant women who are intubated in the ICU with the flu it can make you very sick...I do want them to know it's a serious thing • ...usually, and I tell them that whooping cough is very prevalent in the area and we did have a patient who refused it once and her baby did end up getting the whooping cough and was in the NICU for quite a bit of time • [a provider/nurse may say] I just had my flu shot last week and I had no problems with it. I find myself saying that a lot you know I was fine, didn't even hurt, I didn't get sick so some of that is all kind of myth

Table 2 (continued)

Category	Supporting quotes
Providing a unified and clear multi-disciplinary message to patients	<ul style="list-style-type: none"> • Nurses are very good about providing the patients the information and kind of letting them know that's one thing the provider will talk to them about, say a Tdap at the 27 week visit...the nurses are kind of laying the groundwork • ...everyone in the office we get the flu vaccine. So we have badges that in addition to our name badge it says that we're flu fighters so it shows we are protecting ourselves to help protect you... • ...upon orienting all the new hires...we educate them that the flu shot is safe. The flu vaccine is recommended even in your first trimester. The risks of getting the influenza are X, Y, and Z. So we try to be very uniform about that • [initially discussing inconsistent messaging at the practice and what may help]...making sure that all the providers are on the same page with the same type of education ...If they really took the time to at least say a few sentences about why it's important, what the benefits are and just to educate them that it isn't a live vaccine and they're not gonna get sick from the vaccine • When a patient declines...usually the next step, especially if it's already a face to face visit for the patient with the physician, they usually will say, "I offered her the flu. She doesn't want it. Maybe you should counsel her as well." I think there's probably some room for improved counseling from nursing, so it doesn't fall on the provider
Communication in response to vaccine hesitation/declination	<ul style="list-style-type: none"> • [in response to patient declination] I think you really [have to explain that what] we're doing is to ensure that you and your baby has the best outcome and are the safest and I think that that reasoning really resonates with a lot of patients in pregnancy, that make them open to getting their vaccines • ...if they're declining it or seem on the fence ... I ask them about what their hesitations are. Because I think that often times is part of the key to figuring out what the concerns are and then how you can potentially address them • The patients who are on the fence about it [Tdap], it's because they don't really know what the reason is for it. So when you tell them that it's really to help protect the baby, it's not necessarily for you to be boosted, most people I would say end up accepting it • [in response to hesitation] ...when you then have more of a dialogue about, "Well, tell me more about that," and understanding what the reason is that they would like to defer it or not get it, often you might uncover a fear of pain or fear of an intervention or a story that they heard. And then you could have some dialogue, they might think about it and then they may end up getting it

simply, "that clinicians provide influenza pamphlets to pregnant people with a verbalized statement about the benefits of influenza vaccine to newborns (Wong et al., 2015)." Our respondents, while supportive of maternal vaccination, were unaware of their immunization rates, and lacked experience with immunization QI efforts.

Strengths and Limitations

We performed interviews with obstetric clinicians in two diverse geographic areas that served both commercially insured and low-income patients covered by Medicaid. Interviewing both providers and nurses gave us a broader understanding of immunization processes and helped us gather novel suggestions that go beyond the published literature.

Limitations include the small number of practices and individual interviewed (particularly California nurses), the lack of generalizability to other states and more rural areas, and that information on barriers and patient refusal reasons were based on clinician self-report, not verified by chart review or patient interviews.

Conclusions

In this qualitative study, obstetric clinicians expressed widespread support for maternal influenza and Tdap vaccination. Respondents believed that the biggest barrier to maternal vaccination was vaccine hesitancy for influenza and deferral until after delivery for Tdap. Clinicians were not aware

of their actual immunization rates nor involved in immunization-related quality-improvement efforts. Developing and sharing methods to both emphasize immunization's importance and address maternal concerns during busy obstetric visits may improve antenatal vaccination rates.

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Declarations

Conflict of interest All authors, except Dr. Humiston, have no conflicts of interest to report. Dr. Humiston is a consultant to Sanofi Pasteur. In the last 12 months, Dr. Humiston's employer received grant money for her work on "The Vaccine Education from Training to Practice" program, from GSK. "The Vaccine Education from Training to Practice" program was also sponsored by the Pediatric Infectious Diseases Society Foundation through unrestricted educational grants from Sanofi Pasteur US, Merck & Co., Inc., Pfizer, Inc., Seqirus USA, Inc., and Valneva USA, Inc.

Ethical Approval This qualitative study was given exempt status by research subjects review boards of University of Rochester Medical Center (URMC); Rochester Regional Health (RRH); and University of California, Los Angeles (UCLA).

Consent to Participate Only verbal consent to be interviewed was obtained from the healthcare professionals who were our respondents. No paper or electronic documentation of consent (with identifiers) was obtained. The verbal consent was obtained with two people from the research team on the audio line; it was obtained before the audio-recording equipment was turned on.

Consent for Publication Not applicable.

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