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A mother breastfeeds her newborn at a hospital in Belgium.

BREASTFEEDING AND COVID VACCINES: WHAT THE DATA SAY

Early studies suggest that vaccines are safe and that antibodies transfer in milk. But do they protect the baby? **By Shannon Hall**

Molly Siegel had long awaited a COVID-19 vaccine. As an obstetrician at Massachusetts General Hospital in Boston, she regularly saw pregnant people with COVID-19, and knew that the vaccine was the best way to protect herself, her family and others in her workplace. But with a seven-month-old baby at home who was still breastfeeding, she felt hesitant.

Understandably so. Following established norms for clinical trials, pregnant and breastfeeding people were not included in any of the trials for COVID-19 vaccines. So, as health systems around the world began to vaccinate eligible adults, scores of lactating people were left to make their decision in the dark.

“I certainly was frustrated that there weren’t studies on the vaccine in pregnant and lactating women – that as a group, they were excluded from the research,” Siegel says. “It made it really hard to know, as both the patient and the provider, how to think about the vaccine.”

Still, Siegel could not see any plausible risk to her breast milk (she knew that COVID-19 vaccines contain no live virus, for instance), and focused on the benefit of protecting herself

and everyone around her. So she got the shot. Then, she donated samples of her breast milk to researchers who would analyse its contents in one of the first such studies.

Now, thanks to Siegel and other participants, scientists are beginning to understand the effects of COVID-19 vaccines on breast milk, and their preliminary results should come as welcome news to the more than 100 million lactating people across the world.

Scientists have so far looked only at the vaccines made by Pfizer–BioNTech and Moderna, and have not detected the vaccines in breast milk. What they have found are antibodies, produced by mothers in response to inoculations, to the coronavirus SARS-CoV-2.

“We’re really happy to have something good to hang our hat on,” says Stephanie Gaw, a perinatologist at the University of California, San Francisco. “The studies are small, they’re still early, but very positive.” Now, researchers want to know whether those antibodies can provide babies with at least partial protection against COVID-19.

Vaccine questions

Throughout the pandemic, pregnant people and new mothers have been faced with a slew of concerns and questions about the coronavirus.

One trend that became clear early on is that pregnant people diagnosed with COVID-19 are more likely to be hospitalized than are those of the same age who are not pregnant. That could be because the body is already working hard – the growing uterus pushes upwards, reducing lung capacity, and the immune system is suppressed so as not to harm the baby. Those factors don’t disappear the day a baby is born. As such, some obstetricians suspect that lactating individuals are also susceptible to severe COVID-19.

That conclusion might encourage breastfeeding mothers to get vaccinated, but scientists weren’t sure how they would respond to the vaccines, because little is known about the period of lactation.

So Kathryn Gray, a maternal–fetal medicine specialist at Brigham and Women’s Hospital in Boston, Massachusetts, and her colleagues decided to test how well the Pfizer–BioNTech and Moderna vaccines work in this group. They recruited 131 participants who were about to receive either vaccine and who were lactating, pregnant or neither, and found that the lactating individuals (which included Siegel and 30 others) generated the same robust antibody response as did those who were not lactating¹. In other words: the vaccine is just as beneficial for breastfeeding mums.

A second study by Gaw and her team, posted on the preprint server medRxiv, agrees². The team drew blood from 23 lactating participants and found that antibodies to SARS-CoV-2 increased after their second dose.

But for many parents, the looming

question – as Siegel asked herself – was whether a COVID-19 vaccine would harm a nursing infant. After all, some medications are not recommended during lactation because they pass through breast milk to infants. Nursing mothers are advised against taking high doses of aspirin, for example; even after low doses, mothers are warned to monitor the infant for signs of bruising and bleeding. Some vaccines are off limits, too. The US Centers for Disease Control and Prevention (CDC) advises nursing mothers against receiving the yellow-fever vaccine, which involves a live, weakened form of the virus, on the off-chance that an infection passes to the infant.

Because of such cases, some pharmacists and vaccine administrators have been urging nursing mothers to discard their breast milk after they are vaccinated.

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“I think that clearly shows ignorance and a lack of understanding,” says Kirsi Jarvinen-Seppo, an immunologist at the University of Rochester Medical Center in Rochester, New York. “There seems to be an awful amount of misinformation out there on all levels.”

Unlike the yellow-fever vaccine, COVID-19 vaccines do not carry a risk of igniting an active infection. In addition, COVID-19 vaccines are extremely unlikely to cross into breast milk. The fragile messenger RNA used in the Pfizer–BioNTech and Moderna vaccines, for example, is designed to break down so quickly that it should never leave the cells where it was injected – let alone get into the bloodstream and then the breast. In fact, researchers don’t expect that any of the current vaccines will be excreted into breast milk.

To that end, the World Health Organization recommends that mothers continue to breast-feed after vaccination. In addition, the CDC and the UK Joint Committee on Vaccination and Immunisation issued statements shortly after the first vaccines were authorized in both countries. These noted that no safety concerns had been identified from the available data, so lactating people could choose to be vaccinated.

“It’s sort of a backwards way of recommending it,” argues Christina Chambers, a paediatrician at the University of California, San Diego, and the Rady Children’s Hospital. “The foundation is that there’s no reason to avoid it, which is a dilemma.”

So Gaw and her colleagues ran a safety check. In a small study³, her team looked at breast milk samples from six participants up to two days after they received the Pfizer–BioNTech or

Moderna vaccine, and found no trace of the mRNA in either case. (The group is now scouring a larger number of milk samples for different components of the vaccine, and expanding their study to include all the available COVID-19 vaccines in the United States.)

Liquid gold

There is one type of particle that scientists are eager to see in breast milk following a vaccine: COVID-19 antibodies.

Researchers have long known that newborn babies don’t effectively produce antibodies against harmful bacteria and viruses; and it can take three to six months for this kind of protection to kick in. To help in those early days, a mother’s breast milk overflows with antibodies capable of staving off potential threats.

“It’s specifically designed by the mother, and by Mother Nature, to provide the child with the child’s first vaccine,” says Hedvig Nordeng at the University of Oslo, who specializes in medication use and safety in pregnancy and lactation. “Breast milk by itself is more than nutrition, breast milk is medicine.”

In the mother, immune cells called B lymphocytes (or B cells) constantly produce antibodies. Then, once lactation begins, the mammary glands send out a chemical signal that draws these B cells to the breast – where they park in the glands and produce thousands of antibodies per second, ready to move into the breast milk in huge quantities. But unlike molecules from medications, coffee and alcoholic drinks, which are so small they can pass into the breast milk on their own (although at diluted levels), antibodies are too large to do so. Instead, receptors on the surface of the milk ducts grab the antibodies and package them in protective, fluid-filled bubbles that allow them to pass safely through the milk-duct cells and into the milk on the other side⁴.

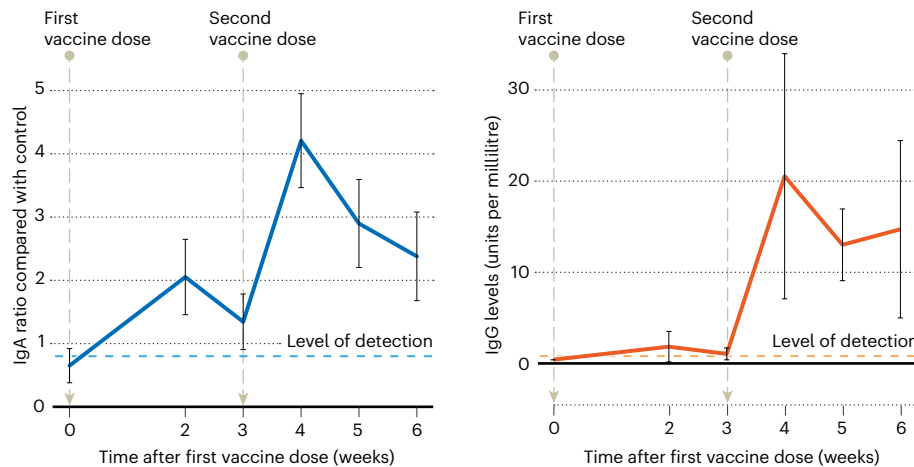
“This process is so magical,” says Galit Alter, an immunologist and virologist at Harvard Medical School in Boston, who worked on Gray’s study.

What happens once antibodies reach the baby, however, is more mysterious. Antibodies in the breast milk do not make it into a baby’s bloodstream, but coat the mouth, throat and gut before they’re ultimately digested⁴. Nonetheless, these antibodies seem to provide protection. It could be that they work at the body’s entrances to fend off infection before it takes root.

Not all babies are raised on breast milk, but studies have shown that babies who exclusively breastfeed for their first six months have far fewer middle-ear infections than those who are breastfed for a shorter time, or not at all⁵. They also have a lower risk of respiratory-tract infections⁶. And lactating mothers who receive the influenza vaccine (and therefore transmit those protective antibodies to their infant through breast milk) provide

BREAST-MILK BENEFITS

A study of 84 lactating health-care workers found that their breast milk contains substantial levels of antibodies to the coronavirus SARS-CoV-2 for several weeks after they were vaccinated. The study looked at two antibodies, immunoglobulin A (IgA, also found in the linings of the gut and respiratory tract) and immunoglobulin G (IgG, also found in the blood).



some protection to babies who are too young to receive the shot⁷.

The same could be true for COVID-19 antibodies. Early this year, researchers found that breast milk from people who recover from the virus similarly oozes with antibodies⁸. And a smattering of small studies, many not yet peer reviewed, have found antibodies in breast milk from people who received the vaccine^{1,2,9–12} (see ‘Breast-milk benefits’).

When Gray and her colleagues, for example, checked the blood and the breast milk of lactating mothers who had received a COVID-19 vaccine, they found high levels of COVID-19 antibodies in every sample¹.

“It’s very nice after this past year to have a tiny bit of good news,” says paediatric immunologist Bridget Young at the University of Rochester Medical Center.

And it’s a particularly exciting finding given that babies are not currently eligible to receive any of the available vaccines (although both Pfizer–BioNTech and Moderna have started trials of their COVID-19 vaccines in children as young as six months).

Whereas COVID-19 is often mild in younger populations, babies less than two years of age who contract the disease are more likely to be hospitalized than older children are⁸. That’s thought to be because the bronchioles, the passageways that deliver air to the lungs, are much smaller in babies. In addition, babies and children can develop a severe illness known as MIS-C (multisystem inflammatory syndrome in children), in which different parts of the body become inflamed after the child contracts COVID-19.

Milk mysteries

One of the big unknowns now is how much protection babies receive from breast milk.

To begin, scientists aren’t sure whether

these antibodies are actually functional – meaning that they would kill the virus that causes COVID-19 if they came into contact with it. But early research is promising. Last year, a team in the Netherlands collected antibodies from the breast milk of people with a previous SARS-CoV-2 infection and found that the samples could neutralize the virus in the laboratory¹³. A month later, Young, Jarvinen-Seppo and their colleagues posted similar findings, which were subsequently published¹⁴.

Both teams are currently conducting the same experiment with vaccine-induced antibodies, following a study by scientists in Israel¹⁰ suggesting that antibodies created

“It’s very nice after this past year to have a tiny bit of good news.”

after vaccination could stop the virus infecting cells. The authors of that study predict that these antibodies should protect the baby, says Yariv Wine, an immunologist at Tel Aviv University and a co-author of the paper.

But this can happen only if the antibodies persist. Scientists don’t yet know how long vaccinated people will continue to make COVID-19 antibodies, but evidence indicates they do so for a considerable time; one study of 33 people¹⁵ suggests that antibody production in adults given the Moderna vaccine continues for at least 6 months. That could mean that babies will continue to receive some protection from their mothers, as long as they continue nursing – although antibody concentrations in breast milk do drop over time⁴.

And that constant replenishment is key. Scientists suspect that antibodies are digested in

the baby’s gut after hours to days. That means their partial immunity will probably disappear once breastfeeding has ceased. It also suggests that giving breast milk to older children (as many vaccinated mothers have discussed in online forums) probably won’t give them partial immunity – at least not for long.

But even for babies who are exclusively breastfed, clinicians urge mothers to continue to follow public-health strategies when they have visitors. “Anyone who’s handling the baby in close contact really should be vaccinated and should be masked,” says Andrea Edlow, a maternal–fetal medicine specialist at Harvard Medical School and Massachusetts General Hospital, who worked on the study with Gray.

Luckily, more data are on the way. Gray and her team will be tracking their participants, including Siegel and others, for a full year (although the details are still being discussed). Gaw’s team at the University of California, San Francisco, is planning to assess the overall health and rate of infections of babies while they’re being breastfed – the million-dollar question at the moment. The two studies pitting vaccine-induced antibodies against the virus in a Petri dish should offer another answer to this question.

Scientists are also working to analyse the antibodies in further detail. Chambers and her colleagues at the University of California, San Diego, for example, currently receive milk samples from roughly 40 participants per day; they also plan to follow the babies’ growth and development.

Nonetheless, the results so far are promising enough that most experts would urge nursing mothers to get their shots. “If I had an itty-bitty baby right now, I would not take the risk – I would not wait,” Alter says. “If you can empower your kid with immunity, I wouldn’t even question it.”

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