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Explainer on COVID vaccination, fertility, pregnancy and breastfeeding

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Last updated 5 November 2022

This document is long! Where should I go?

- [Want to know about COVID vaccination and female fertility? Go to q1](#)
- [Want to know about COVID vaccination and periods? Go to q3](#)
- [Want to know about COVID vaccination and male fertility? Go to q4](#)
- [Want to know about COVID vaccination during pregnancy? Go to q5-10](#)
- [Want to know about COVID vaccination while breastfeeding? Go to q11](#)

1. I heard that the COVID vaccine might reduce female fertility. Is this true?

No. In fact, multiple strands of evidence tell us that COVID vaccines do not reduce fertility.

Pregnant people were not included in the first round of trials, and participants were asked to avoid becoming pregnant, but nonetheless a number of people became pregnant by accident. The accidental pregnancies occurred equally across the vaccinated and the unvaccinated groups, which tells us that vaccines did not prevent pregnancy. The rate of adverse events have been similar in the control and vaccinated groups. You can find the accidental pregnancy data [here \(AZ\)](#), [here \(Moderna\)](#), [here \(Pfizer\)](#) and [here \(Janssen\)](#).

Vaccine	Control group			Vaccinated group		
	Participants	Pregnancies	Miscarriages (rate)	Participants	Pregnancies	Miscarriages (rate)
Pfizer	22,021	47	7 (15%)	22,026	42	3 (7%)
Moderna	15,170	7	1 (14%)	15,181	6	0 (0%)
AstraZeneca*	4,830	43	14 (32%)	4,925	50	18 (36%)
Janssen (J&J)	21,895	4	1 (25%)	21,888	4	1 (25%)

* Note that these pregnancy losses potentially include terminations reported as miscarriages, because the participant lives in a country in which termination of pregnancy is illegal. If the data from these countries is excluded, the pregnancy loss rate is 21% with the control and 14% with the vaccine.

Following the general rollout, we have been able to collect further data about the effect of the vaccines on human fertility. In a cohort of [2,126 couples trying to conceive](#) in the USA and Canada between December 2020 and September 2021, vaccination status in the female partner did not

change the per cycle rate of conception. In IVF patients, COVID vaccination does not affect ovarian function, egg quality, fertilisation or clinical pregnancy rate. You can read these studies [here \(Aharon\)](#), [here \(Bentov\)](#), [here \(Safrai\)](#), [here \(Morris\)](#), [here \(Orvieto\)](#), [here \(Odeh-Natour\)](#), [here \(Avraham\)](#) (for mostly mRNA vaccines). You can read studies done on inactivated vaccines (Sinovac and Sinopharm) in IVF settings [here \(Cao\)](#) and [here \(Shi\)](#). A study looking at ovarian reserve in fertile volunteers before and after mRNA COVID vaccination found no change. You can read more [here](#).

In the wider population, [27,370 people](#) in the USA had reported post-vaccination pregnancies to the CDC by 14 June 2021 and by 31 July 2021 [10,178 people](#) in the USA who had had at least one dose of the COVID vaccine had reported a pregnancy to one of the nine largest healthcare providers. In Ontario, by the end of June 2021, [712 people](#) had reported becoming pregnant after having received two doses of COVID vaccine. In the UK, by January 2022, [20,691 people](#) had received at least one dose of the COVID vaccine prior to pregnancy, become pregnant and given birth.

The vaccine works by instructing our bodies to make antibodies that bind to a viral protein called Spike. This stops the virus from infecting our cells. The claim that the vaccine might reduce fertility came from the idea that there are proteins in the placenta that have some similarities with Spike, so the antibodies that block Spike might also attach to the placenta. But the viral and placental proteins are not similar enough that we would expect this to happen and laboratory studies have now confirmed that this is the case. You can read more about this [here](#), [here](#) and [here](#). If antibodies against Spike did cause problems for the placenta, we would expect to see miscarriages in pregnant people who become infected with COVID, and we don't see this. You can find studies [here](#) and [here](#).

2. I am not pregnant, but I would like to have children later. Should I get the vaccine?

There is no evidence that the vaccine will reduce your chances of getting pregnant later and in the UK, the Royal College of Obstetricians and Gynaecologists says that ["women trying to become pregnant do not need to avoid pregnancy after vaccination"](#). In the USA, the CDC recommends that [people who are trying to become pregnant or who may become pregnant in the future](#) receive the COVID vaccine. For people in your position, there is no reason not to get the vaccine if you are offered it.

3. I heard that getting the COVID vaccine might cause changes to my period. Is this true?

Yes, but the changes are small and cycles quickly return to normal. Four studies ([Edelman](#), [Gibson](#), [Alvergne](#), [Edelman again](#)) which recruited participants in advance of vaccination and asked them to record their cycles in real time found that vaccination was associated with a delay to the next period that was small compared to normal variation (0 - 3.9d, with the largest delay seen in those who received both doses in a single cycle) but that cycle timings returned to normal within one or two months. A [Norwegian study](#), which asked a cohort of 5,688 people who had already been recruited to a study of vaccine side effects to recall their period immediately before and after vaccination. This study found an 8% increase in reports of heavier than usual flow immediately after vaccination.

4. I heard that the COVID vaccine might reduce male fertility. Is this true?

No. In a cohort of [2,126 couples trying to conceive](#) in the USA and Canada between December 2020 and September 2021, vaccination status in the male partner did not change the per cycle rate of conception. And seven studies looking at sperm quality before and after vaccination found no concerning changes to sperm count or quality. You can read studies done on people undergoing IVF

[here \(Orvieto\)](#), [here \(Safrai\)](#) and [here \(Xia\)](#), two done on volunteers [here \(Gonzalez\)](#) and [here \(Lifshitz\)](#), and two done on sperm donors [here \(Barda\)](#) and [here \(Gat\)](#).

For people who are concerned about male fertility, it is also worth considering that [COVID infection temporarily reduces male fertility](#). This is in line with [a number of studies](#) that have found that COVID infection reduces sperm count and quality.

5. I am pregnant. What are the risks of catching COVID during pregnancy?

There is some evidence that COVID infection increases the risk of miscarriage ([Balachandren](#) and [Sacinti](#)), although not all studies have not been able to find this ([Cosma](#), [Freiesleben](#), [Calvert](#)). Preterm birth and stillbirth are more common than normal in pregnant COVID19 patients, and their babies are more likely to be admitted to the neonatal unit (summarised [here](#)). Pregnant COVID patients are also more likely to need intensive care than COVID patients who are not pregnant (summarised [here](#)).

6. Does the vaccine prevent people from catching COVID during pregnancy?

Four studies from Israel have looked at how effective COVID vaccines are at preventing COVID infection specifically in pregnancy. Two of these, published in 2021, found that the effectiveness of COVID vaccines in pregnancy are similar to their effectiveness in the wider population. You can read these studies [here \(Goldshtein\)](#) and [here \(Dagan\)](#). More recent studies have looked at the effectiveness of boosters. [Schrag](#) found boosters to be 97% protective against hospitalisation and 81% protective against infection in the delta period, and 86% protective against hospitalisation and 79% protective against infection in the omicron period. [Guedalia](#) found them to be 97% effective against hospitalisation and 99% against severe disease in the delta period, and 94% effective against severe disease in the omicron period. [Data from the USA](#) showed similar findings.

Three studies have looked at the severity of disease during breakthrough infections in pregnancy, showing that vaccination is 80-90% protective against moderate or severe disease. You can read them [here \(Morgan\)](#), [here \(Ilter\)](#) and [here \(UK ONS\)](#). A [recent preprint \(Hui\)](#) also found that vaccination reduces the rate of preterm birth in people who get breakthrough infections.

7. Can the COVID vaccine cross the placenta?

One study of 19 people who received the COVID vaccine during pregnancy could not detect any vaccine mRNA or spike protein in placenta or cord blood. You can read this study [here](#). Babies of vaccinated mothers do not have any anti-spike IgM, indicating that the vaccines themselves do not cross the placenta. You can see the data on this [here](#), [here](#) and [here](#), with an explanation on the interpretation of the studies [here](#).

[A study of 48 placentas](#) collected shortly after vaccination was unable to detect any Spike protein or mRNA. Vaccination is also not associated with any placental pathology ([Shanes](#) and [Boelig](#)).

8. Is it safe to have the COVID vaccine during pregnancy?

Yes. The safety of COVID vaccination in pregnancy is being monitored in a number of ways.

Passive monitoring schemes, such as Yellow Card in the UK and VAERS in the USA, collect information that doctors, patients and their families report. Neither of these schemes has detected adverse events

occurring more often following COVID vaccination than they normally do in pregnancy. In the UK, on the 16th August 2021, at which point 55,000 pregnant people had been vaccinated, the MHRA released a statement saying “there is no pattern from the reports to suggest that any of the COVID-19 vaccines used in the UK, or any reactions to these vaccines, increase the risk of miscarriage or stillbirth. There is no pattern from the reports to suggest that any of the COVID-19 vaccines used in the UK increase the risk of congenital anomalies or birth complications.” You can read the statement [here](#). The Yellow Card reports are regularly updated and you can find them [here](#). You can transcripts from White House Briefings on VAERS reports following vaccination in pregnancy [here](#) and [here](#).

29 studies that actively track the outcomes after pregnancy have also been done, across eight countries and 334,210 people vaccinated during pregnancy. None of these studies have found any increased risk of miscarriage, preterm birth, stillbirth or babies being born smaller than expected, or with congenital abnormalities, following COVID vaccination. You can find a summary of all these studies in table form [here](#). Two meta-analyses ([Prasad](#) and [Watanabe](#)) taking in many of these studies have found that COVID vaccination actually reduces the risk of stillbirth and babies needing intensive care, presumably because these can occur as a result of COVID infection.

Registry studies recruit people at vaccination, track the outcomes of their pregnancies and compare the outcomes to those we normally see in pregnancy. In the USA, the V-safe pregnancy registry has examined the outcomes for 22,836 people vaccinated in pregnancy and their babies. The first report from V-safe found that, among 713 people vaccinated in pregnancy who had given birth by 30th March 2021, [the rates of adverse events were the same as we normally see](#). A follow up study looking at outcomes of people vaccinated before 20 weeks of pregnancy found [no increased risk of miscarriage following vaccination](#). Two further follow ups ([to September 2021](#) and [August 2022](#)) found that the rate of adverse events at birth continued to remain normal.

The BORN Ontario registry comprises 64,234 people vaccinated during pregnancy in Ontario, Canada. Among the 43,099 who have already given birth, there was no increased risk of stillbirth, preterm birth or babies being smaller than expected for their gestational age. You can read more [here](#), [here](#), [here](#) and [here](#)). A study looking at 18,399 people vaccinated against COVID during pregnancy [in Scotland](#) found no increased risk of stillbirth, babies dying shortly after birth, or preterm birth following vaccination. The Swiss [COVI-PREG registry](#) followed 1012 people vaccinated during pregnancy and found no increased risk of miscarriage, preterm birth, stillbirth, or babies needing intensive care or dying. Two small registry studies, of [390 people vaccinated during pregnancy in Israel](#) and [242 people vaccinated during pregnancy in the USA](#) found no increased risk of miscarriage, preterm birth, babies being born smaller than expected or with congenital abnormalities, or needing intensive care.

Case-control studies identify people who experienced a certain adverse event and determine whether these people are more likely to have been vaccinated than those who did not experience the event. Two such studies have been done using 105,446 pregnancies (of which 31,080 had been vaccinated) in the USA’s Vaccine Safety Datalink system. [One of these](#) found no concerning patterns linking COVID vaccination to stillbirth; [the other](#) found no association between miscarriage and having recently received a dose of COVID vaccine. A [follow up looking specifically at boosters](#) also found no association between miscarriage and having recently received a booster. [A study looking at 18,950 pregnancies in](#)

[Norway](#) also found that people who experienced a miscarriage were no more likely to have received a dose of COVID vaccine in the previous three or five weeks, than those who did not miscarry.

Seventeen cohort studies compared the outcomes for people who were vaccinated, compared to those who were unvaccinated. All of these found no increased risk of adverse outcomes associated with vaccination and three ([UKHSA](#), [Hui](#) and [Piekos](#)) found evidence that vaccination reduces the risk of stillbirth and preterm birth. Two studies looking at miscarriage rates found no increased risk of miscarriage associated with vaccination ([Goldshtein](#) and [Sadarangani](#)). [One study](#) that looked specifically at congenital abnormalities following vaccination in the first trimester found that these were no more likely to occur than in unvaccinated people, or those who received the vaccine after the first trimester. You can read these studies [here \(Goldshtein\)](#), [here \(Blakeway\)](#), [here \(UKHSA\)](#), [here \(Theiler\)](#), [here \(Wainstock\)](#), [here \(Lipkind\)](#), [here \(Goldshtein again\)](#) and [here \(Ruderman\)](#), [here \(Dick\)](#), [here \(Magnus\)](#), [here \(Boelig\)](#), [here \(Hui\)](#), [here \(Piekos\)](#), [here \(Sadarangani\)](#) and [here \(Calvert\)](#). [One of these](#) also followed babies for up to six months after birth and found no difference in the rates of serious illness or death between babies in the vaccinated and unvaccinated groups.

9. Will being vaccinated while I am pregnant give my baby any protection against COVID once they are born?

We have many reports showing that the protective antibodies your body makes after you are vaccinated (IgG) cross the placenta. You can read some of them [here \(first report\)](#), [here \(Gray\)](#), [here \(Mithal\)](#), [here \(Prabhu\)](#), [here \(Collier\)](#), [here \(Beharier\)](#), [here \(Zdanowski\)](#), [here \(Rottenstreich\)](#), [here \(Atyeo\)](#), [here \(Prahl\)](#), [here \(Shook\)](#), [here \(Sajadi\)](#), [here \(Yang\)](#), [here \(Matsui\)](#) and [here \(Otero\)](#).

Early reports suggest that vaccination in pregnancy is [about 61% effective](#) at protecting babies under six months old from hospitalisation with COVID. More recent studies ([Carlsen](#), [Halasa](#), [Dutra](#)) that distinguished between protection in the delta and omicron waves, found vaccination in pregnancy was 80% and 38% protective against hospitalisation with the delta and omicron variants, respectively, and 71% and 33% effective at protecting against any infection.

10. Is the COVID vaccine recommended during pregnancy?

In the UK, the Royal College of Obstetricians and Gynaecologists and the Royal College of Midwives [recommend getting vaccinated against COVID](#) if you are pregnant. From the 16th December 2021, pregnant people are in [a priority group](#) for COVID vaccination, because of their increased risk.

In the USA, [the CDC recommends that all pregnant people get the COVID vaccine](#).

11. I am breastfeeding. Should I get the vaccine if I am offered it?

There is no known risk associated with giving non-live vaccines whilst breastfeeding and no safety signals have appeared in breastfeeding people or their babies. In the UK, the Royal College of Obstetricians and Gynaecologists [recommends the vaccine to people who are breastfeeding](#) and in the USA, the CDC also [recommends that all breastfeeding people receive the COVID vaccine](#).

On the 2nd September, the MHRA released a statement based on UK vaccine safety surveillance saying “There is no current evidence that COVID-19 vaccination while breastfeeding causes any harm to

breastfed children or affects the ability to breastfeed.” You can read the statement [here](#). A study that asked 50 breastfeeding people to document any side effects in themselves or their babies found no severe adverse events. You can read this study [here](#).

Two studies looking for vaccine mRNA in breast milk have been unable to detect it. You can read them [here \(Golan\)](#) and [here \(Mattar\)](#). Three studies that first concentrated the mRNA from milk, were able to detect it in some donors at very low levels. [Low](#) found mRNA at 2 parts per billion in 3 out of 10 milk donors. You can read an explanation of what 2 parts per billion means [here](#). [Yeo](#) found mRNA in 4 out of 31 milk donors at a maximum of 0.17 parts per billion and [Hanna](#) found mRNA in 3 out of 11 milk donors at a maximum of 0.011 parts per billion.

A study that looked for the chemical PEG, which is used to stabilise mRNA vaccines, in the breast milk of 13 people did not find that its levels increased after vaccination (note that PEG is commonly found in many cosmetics, so was found in some milk samples from unvaccinated donors). You can read this study [here \(Golan\)](#).

A number of studies have shown that the protective antibodies your body makes get into breast milk at high concentrations. You can find them summarised in [this systematic review](#). [One of these studies](#) found that antibodies could persist in breast milk for as long as six months after vaccination. There is also some evidence that T cells that respond to COVID19 get into breast milk. You can read about this [here](#) and [here](#). These antibodies and T cells are expected to give your baby some protection against COVID19, although more research is being done to find this out.

Revision history

Updated 24 January 2021 to include a trial-by-trial breakdown of the outcomes for participants who became pregnant during the trials.

Updated on 26 January 2021. Q3. "Following the publication of the data showing that the vaccine is safe in pregnant animals..." changed to "Following the publication of the interim data showing that the vaccine is safe in pregnant animals..." Q5 updated to more closely mirror the language of the JCVI report.

Updated on 3 February 2021 to incorporate developmental and reproductive toxicity studies using the Oxford/AZ vaccine in mice. I have also changed the link on the risks of COVID-19 infection during pregnancy to point to a living systematic review in the BMJ, which acts as a more comprehensive and up-to-date resource than the individual studies.

Updated on 10 February 2021 to add the safety data that has so far been collected in the USA and UK.

Updated on 19 February 2021 to add further safety data collected in the USA and UK.

Updated on 24 February 2021 to add an easy-reference table summarising the accidental pregnancy data.

Updated on 3 March 2021 to add the safety data that has been collected through V-safe in the USA, and to update the data that has been collected through the VAERS and Yellow Card schemes.

Updated on 4 March 2021 to add data about transfer of antibodies across the placenta and through breast milk following vaccination, and to add a link to my article at Nature Reviews Immunology.

Updated on 11 March 2021 to add data about accidental pregnancies in the Janssen vaccine trial, reformat to move the details of the accidental pregnancies to question 2, and new data about the effects of vaccination on antibodies crossing the placenta and into breast milk. I have also updated the VAERS data, to include data collected to 26 February.

Updated on 19 March 2021 to update VAERS data, collected to 11 March.

Updated on 23 March 2021 to add a new study on transfer of antibodies across the placenta, and to update the first preprint that came out on this to its final, published form.

Updated on 29 March 2021 to add a new study about the transfer of antibodies into breast milk and to update VAERS data, collected to 19 March.

Updated on 1 April 2021 to add another study looking at transfer of antibodies across the placenta following vaccination.

Updated on 5 April 2021 to reformat the answer to Question 6 and to add information about the UK's new active surveillance system.

Updated on 8 April 2021 to add another study showing that antibodies are transferred across the placenta following vaccination.

Updated on 9 April 2021 to update VAERS data, collected to 4 April.

Updated on 13 April 2021 to add another study showing that antibodies are found in breast milk following vaccination

Updated on 18 April 2021 to reflect the new advice in the UK that all pregnant people should be offered the vaccine, and to update VAERS data, collected to 8 April.

Updated on 22 April 2021 to incorporate the updated V-safe data.

Updated on 26 April 2021 to update VAERS data, collected to 16 April

Updated on 5 May 2021 to update VAERS data, collected to 3 May, and to add a new study on the immune properties of breast milk following vaccination.

Updated on 14 May 2021 to add a new study on antibodies crossing the placenta and entering breast milk following vaccination

Updated on 25 May 2021 to add a new study on antibodies crossing the placenta following vaccination

Updated on 28 May 2021 to add data to show that vaccines do not cross the placenta, and further data to show they don't cross into breast milk. Also added, data to show that they don't raise antibodies to the placental protein syncytin, and another study into the outcomes for babies whose mothers are vaccinated during the third trimester of pregnancy.

Updated on 2 June 2021 to add a study showing no placental pathology is associated with COVID vaccination.

Updated on 3 June 2021 to add two studies showing no impact of vaccination on fertility in IVF patients.

Updated on 4 June 2021 to add another study showing no impact of vaccination on pregnancy rate in IVF patients.

Updated on 7 June 2021 to update VAERS data, collected to 28 May.

Updated on 30 June 2021 to add a new study looking at antibodies and vaccine mRNA in breastmilk following vaccination

Updated on 13 July 2021 to add a new study on safety and efficacy of the Pfizer vaccine specifically in pregnant people

Updated on 15 July 2021 to add new information on the safety of COVID vaccination in pregnancy, collected in Ontario, Canada.

Updated on 22 July 2021 to add a pregnancy registry study from Israel, and another study showing that antibodies cross the placenta following vaccination

Updated on 26 July 2021 to add UKOSS data on COVID19 hospitalisations during pregnancy, and to reorder and reformat the document as some parts of it were getting out of hand!

Updated on 27 July 2021 to add another study showing no impact of vaccination on fertility in IVF patients, and to add studies about the effect of COVID19 vaccination on sperm quality

Updated on 10 August 2021 to add a new study on the safety of COVID vaccinations in pregnancy from the UK.

Updated on 12 August 2021 to add data from the V-safe datalink, showing that 1073 people who had completed their vaccinations had gone on to report pregnancies to their healthcare providers.

Updated on 13 August 2021 to add the follow-up study done in the V-safe pregnancy registry cohort, plus two new studies on antibodies in breast milk following vaccination

Updated on 18 August 2021 to add a statement from the MHRA on Yellow Card reports of vaccination during pregnancy, to the 16th August

Updated on 26 August 2021 to add another study showing transfer of antibodies into breast milk following vaccination

Updated on 3 September 2021 to add a statement from the MHRA on Yellow Card reports of vaccination in people who are breastfeeding, to the 25th August

Updated on 8 September 2021 to add a second study from Israel on the effectiveness of COVID vaccination specifically in pregnancy

Updated on 9 September 2021 to add a case-control study using Vaccine Safety Datalink data to show no association between miscarriage and COVID vaccination in the previous 28 days.

Updated on 13 September 2021 to reflect a post-publication change to [this study](#). Originally, they estimated miscarriage rates. In the update, they state the absolute numbers without an estimate of rate. Rates are now calculated in [a study on the same dataset](#), with longer follow-up

Updated on 15 September 2021 to cite a review of studies about COVID and male fertility, rather than just one.

Updated on 27 September 2021 to add another study showing transfer of antibodies into breast milk following vaccination - although note that [this study](#) found that mRNA vaccines are rather better at doing this than the Janssen vaccine.

Updated on 29 September 2021 to add data from V-safe and Vaccine Safety Datalink presented at the ACIP meeting on September 23rd.

Updated on 14 October 2021 to add a new study showing that antibodies raised by vaccination do not bind the placental protein syncytin-1.

Updated on 22 October 2021 to add a case-control study from Norway showing no association between miscarriage and COVID vaccination in the previous three or five weeks.

Updated on 25 October 2021 to add updated fertility and pregnancy loss data published from the AstraZeneca trials

Updated on 19 November 2021 to add two new studies looking at the transfer of antibodies across the placenta following vaccination in pregnancy

Updated on 25 November 2021 to add new data released by UKHSA on birth outcomes of vaccinated vs unvaccinated people in the UK from January to August 2021

Updated on 30 November 2021 to add an Israeli study looking at outcomes at birth for those vaccinated in pregnancy, compared to those who were not vaccinated

Updated on 6 December 2021 to add a new preprint showing spike-specific T cells in breastmilk, and to update a preprint on the same topic to the paper, now published following peer review.

Updated on 10 December 2021 to add a new preprint showing that vaccination does not lead to the production of anti-Syncytin1 antibodies

Updated on 16 December 2021 to add a new preprint looking at the ability of mRNA COVID vaccines to cross the placenta

Updated on 17 December 2021 to add a new preprint looking at how long maternal anti-COVID IgG lasts in babies after birth

Updated on 22 December 2021 to add an update from the BORN Ontario registry showing [no difference in the rate of stillbirths](#) between vaccinated and unvaccinated people in Ontario, January - October 2021

Updated on 28 December 2021 to add a new [preprint](#) looking at antibodies in babies following vaccination before pregnancy or while breastfeeding and [this study](#) on the safety of mRNA vaccination in those who are breastfeeding.

Updated on 5 January 2022 to add [recent data from UKOSS and MBRRACE](#) to the section on vaccine effectiveness in pregnancy and to tidy up and reformat the section on vaccine safety in pregnancy (but with no new data).

Updated on 6 January 2022 to add a [new cohort study](#) using data from the Vaccine Safety Datalink

Updated on 6 January 2022 to add a new section on COVID vaccination and menstrual changes with links to new studies from the [USA](#) and [Norway](#).

Updated on 10 January 2022 to add a study looking at [ovarian reserve before and after vaccination](#) in fertile volunteers

Updated on 14 January 2022 to add new data on the safety and effectiveness of COVID vaccines in pregnancy [from Scotland](#)

Updated on 21 January 2022 to add a new study looking at [conception rates following COVID infection and vaccination](#)

Updated on 24 January 2022 to update from preprints to peer reviewed versions of articles, where these have become available, to update the systematic review on the risks of COVID in

pregnancy to [this newer one](#), and to make the links to the studies on transplacental antibody transfer and transfer of antibodies to breast milk easier to navigate

Updated on 28 January 2022 to add a new study on [how COVID vaccination affects the success of IVF](#) and to change the link to the [UK HSA data](#) to the latest release

Updated on 11 February 2022 to add a new [cohort study](#) on vaccination in pregnancy, including six months of post-birth follow-up data

Updated on 15 February 2022 to update from the preprint to the peer-reviewed version of [Shook et al](#)

Updated on 16 February 2022 to add [the first study](#) looking at how effective vaccination in pregnancy is at protecting newborns from COVID

Updated on 8 March 2022 to fix a broken link

Updated on 10 March 2022 to add [V-safe data about post-vaccination pregnancies](#) to June 2021

Updated on 18 March 2022 to add a link to [my Nature Reviews Immunology article](#) which is basically a peer-reviewed version of this explainer (shh! don't tell the journal!)

Updated on 23 March 2022 to add a [new preprint](#) looking at transfer of antibody across the placenta.

Updated on 25 March 2022 to add a [new study](#) done using the BORN Ontario registry.

Updated on 1 April 2022 to add [this study](#), which looked for Spike mRNA and protein in placentas after vaccination

Updated on 4 April 2022 to add [this study](#), which looked at rates of congenital abnormalities specifically following vaccination in the first trimester

Updated on 23 April 2022 to add the updated [UKHSA data](#) on pregnancy outcomes for vaccinated compared to unvaccinated people in the UK

Updated on 25 April 2022 to update the section on breastfeeding and vaccination. Two preprints looking for vaccine mRNA in milk have been updated to link to their peer-reviewed versions: [Golan](#) and [Low](#), and a [third study \(Yeo\)](#) on the same topic has been added. The list of studies on antibodies in breast milk is getting too long to be manageable, so has been replaced with a [systematic review](#). The list of studies replaced by the systematic review is: [Gray](#), [Perl](#), [Friedman](#), [Baird](#), [Collier](#), [Charepe](#), [Low](#), [Kelly](#), [Jakuszk](#), [Romero Ramirez](#), [Fox](#), [Sajadi](#), [Golan](#) and [Juncker](#).

Updated on 13 May 2022 to add [new data on vaccine coverage from UKHSA](#), a [systematic review and meta-analysis](#) showing that COVID vaccination reduces the rate of stillbirth, and three vaccine safety in pregnancy studies that have come out over the last few months, but I only just spotted ([Trostle](#), [Dick](#), [Magnus](#)).

Updated on 16 May 2022 to add two studies that look at effectiveness of COVID vaccination at preventing disease severity in pregnancy: [Iltis](#) and [Morgan](#).

Updated on 22 May 2022 for easier navigability

Updated on 31 May 2022 to add a [new cohort study from Boelig and colleagues](#).

Updated on 1 June 2022 to add new data from the [Swiss COVI-PREG registry](#).

Updated on 6 June 2022 to update a preprint on the lack of anti-syncytin antibodies following COVID-19 vaccination to its [peer-reviewed version](#) and to add a [new study](#) looking at protection of babies under 4 months old following vaccination in pregnancy

Updated on 9 June 2022 to replace the [original December 2020 FDA briefing document](#) for the Pfizer vaccine with the [updated data](#) submitted for full approval in August 2021 - more

pregnancies and longer follow ups are now shown in the table in q1. You can find the original figures shown in that table [here](#)

Updated on 24 June 2022 to include a [new study](#) looking at protection of newborns against COVID hospitalisation, following vaccination in pregnancy, and to update the section on sperm count and quality before and after vaccination by adding three more studies ([Barda](#), [Lifshitz](#) and [Gat](#)).

Updated on 7 July 2022 to add a [new preprint on vaccine safety in pregnancy from Australia](#) and to update a preprint on antibody transfer across the placenta following vaccination to [the version published following peer review](#).

Updated on 12 July 2022 to add [data from the UK office for national statistics](#) on vaccine effectiveness against hospitalisation in pregnancy, among those who already have a positive COVID test

Updated on 26 July 2022 to add [a new preprint from Israel](#) looking at the effectiveness of boosters in pregnancy

Updated on 4 August 2022 to add two new studies on the effects of vaccination on the menstrual cycle ([Alvergne](#) and [Gibson](#)).

Updated on 23 August 2022 to add studies on the risk of miscarriage following SARS-CoV2 infection ([Balachandren](#), [Sacinti](#), [Cosma](#) and [Freiesleben](#)) and on COVID vaccine safety in pregnancy ([Fell](#), [Piekos](#), [Sadarangani](#)).

Updated on 25 August 2022 to add studies on IVF outcomes following COVID vaccination ([Odeh-Natour](#), [Avraham](#), [Xia](#)).

Updated on 29 August 2022 to point to the latest version of the [UKHSA](#) data

Updated on 27 September to add a [new study](#) on the levels of vaccine mRNA in breast milk

Updated on 27 September to add a [new study](#) on the effectiveness of boosters during pregnancy

Updated on 2 October to add a [new study](#) on the effect of COVID vaccination on periods

Updated on 4 October to add a [new meta-analysis](#) looking at maternal and neonatal outcomes following COVID vaccination in pregnancy

Updated on 10 October to add a [new study](#) looking at the effect of inactivated COVID vaccines on outcomes following frozen embryo transfer.

Updated on 20 October to add the data on safety and effectiveness of COVID vaccines in pregnancy presented at the [ACIP meeting](#). I have also removed some links to population-level data that is now more than a year old (UK intensive care data [between February and July 2021](#) and [between May and October 2021](#)).

Updated on 3 November to add a [new study](#) looking at the risk of miscarriage or ectopic pregnancy following COVID vaccination in early pregnancy

Updated on 5 November to change a preprint to the [version published after peer review](#)