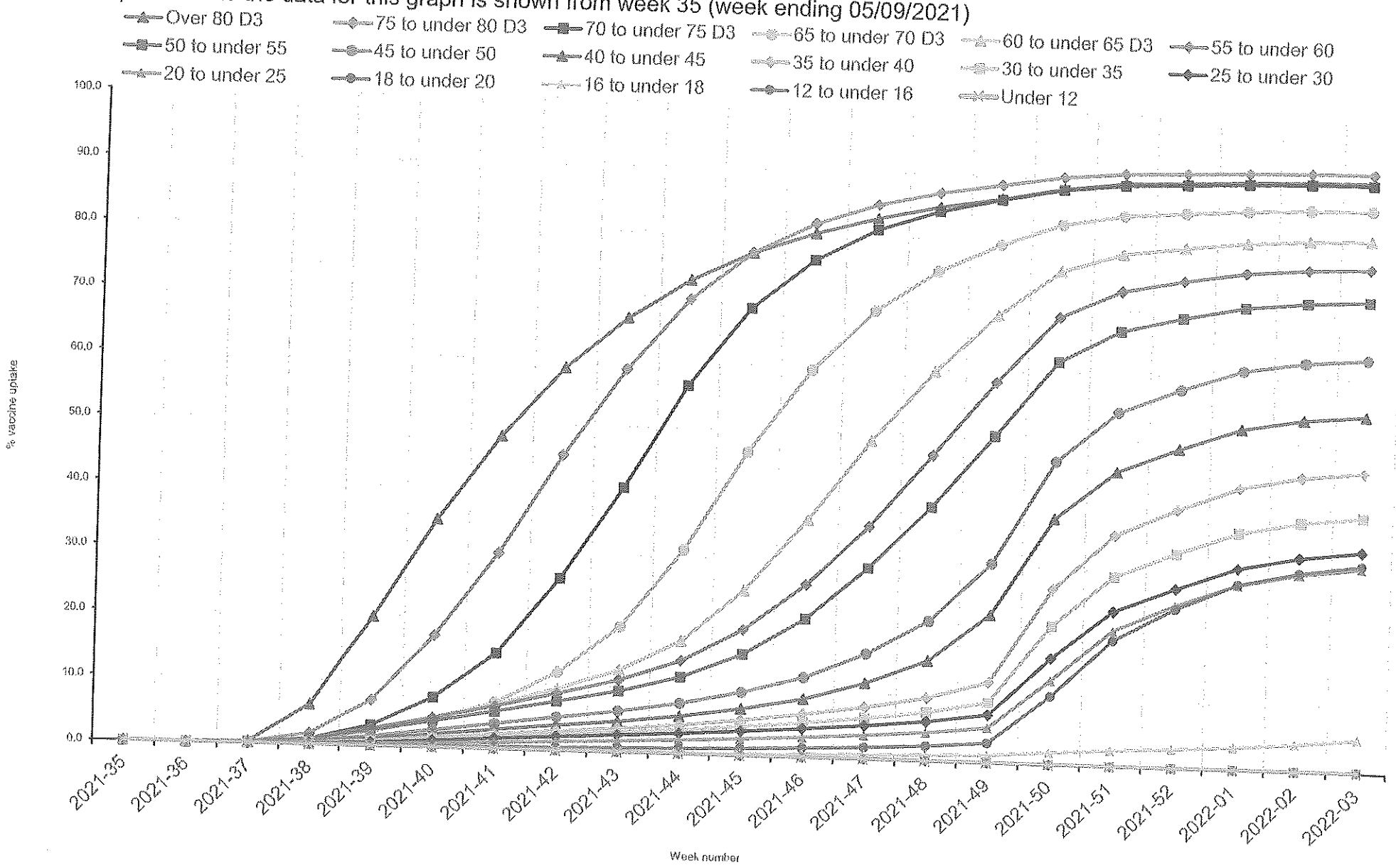
c) Dose 3 - please note the data for this graph is shown from week 35 (week ending 05/09/2021)



Vaccination in immunosuppressed individuals

Provisional vaccine uptake data in living and resident people identified as immunosuppressed in England to the end of week 3 can be found in Table 5. This shows that vaccine uptake in the 533,374 identified as immunosuppressed was 95.5% for at least dose 1, 94.0% for at least 2 doses and 86.5% for at least 3 doses. Data on vaccine uptake in people with at least 3 doses by age in England can be found in the National flu and COVID-19 surveillance reports.

Table 5. Vaccine uptake in people identified as immunosuppressed in England

Immuno-suppression	People in NIMs Cohort	Numbers vaccinated with at least 1 dose	Percentage vaccine uptake with at least 1 dose	Numbers vaccinated with at least 2 doses	Percentage vaccine uptake with at least 2 doses	Numbers vaccinated with at least 3 doses	Percentage vaccine uptake with at least 3 doses
England	533,374	509,583	95.5	501,540	94.0	461,498	86.5

Detailed information on the characterisation of the immunosuppressed group by NHS Digital is available.

Vaccination in pregnancy

Vaccination of pregnant women alongside their peers is recommended in the UK and other countries as an important way to protect pregnant women and their unborn children against COVID-19 disease. Vaccination of pregnant women is strongly recommended by the Royal College of Obstetricians and Gynaecologists and the Royal College of Midwives.

Increased severity of COVID-19 disease in pregnant and recently pregnant women has been reported after the first SARS-CoV-2 wave in England (20,21) and in Scotland (22,23). Pregnant women who develop severe disease have increased rates of admission to ICU, need for invasive ventilation and pre-term delivery. Data from the US Centers for Disease Control and Prevention (CDC) found that pregnant women were around 3 times more likely to be admitted to ICU and nearly 3 times more likely to require invasive ventilation compared to non-pregnant women with COVID-19 disease and 25% more likely to die (24).

From 16 April 2021, the Joint Committee on Vaccination and Immunisation (JCVI) advised that pregnant women be offered COVID-19 vaccines at the same time as people of the same age or risk group (25). Therefore, any pregnant women not in a high-risk group would likely have received their first dose from mid-April 2021 as part of the general adult population programme in those aged under 50 years. This was offered by decreasing age group (25). As part of the ongoing review of the programme, the JCVI met on 2 December 2021 and considered further data on severity of SARS-CoV-2 infection in pregnant women and their pregnancies together with data on vaccine safety; as a result pregnant women were added to the UK's priority COVID-19 vaccine list (26).

Prior to 16 April 2021, COVID-19 vaccine was delivered to priority groups, based on clinical risk and risk of exposure, and delivered in order of priority. On 22 December 2020, JCVI advised that vaccine could be offered to pregnant and breast-feeding women who were in these risk categories The Pfizer vaccine was rolled out from early December 2020, AstraZeneca vaccine was used from 4 January 2021 and the Moderna vaccine became available from April 2021.

There is evidence of high levels of protection against SARS-CoV-2 infection in pregnant women after COVID-19 vaccination (27, 28, 29) and evidence that vaccination induces higher antibody levels than after disease (29). Between February and September 2021, 0.4% of 1,714 pregnant women with COVID-19 symptoms who required hospital treatment in the UK had received 2 doses of COVID-19 vaccine and, of 235 pregnant women who were admitted to intensive care with COVID-19 disease in that period, none had received 2 doses of vaccine (30). Similar findings have been reported from Scotland (23,31) with the most recent study reporting that 90.9% (748 out of 823; 95% CI 88.7–92.7) of SARS-CoV-2 associated with hospital admission, 98% (102 out of 104; 95% CI 92.5–99.7) of SARS-CoV-2 associated with critical care admission and all baby deaths, occurred in pregnant women who were unvaccinated at the time of their COVID-19 diagnosis (22). The researchers also found high extended perinatal mortality rate for

women who gave birth within 28 days of a COVID-19 diagnosis compared to rates across the pandemic period and in women vaccinated and going on to give birth within 28 days.

COVID-19 vaccines used in the UK programme do not contain live SARS-CoV-2 virus and therefore cannot infect a pregnant woman or her unborn child with the virus. Whilst, as is commonly the case in trials of medicinal products, pregnant women were excluded from the original COVID-19 vaccine trials, there is accumulating experience and evidence of the safe and effective use of mRNA vaccines (such as the Pfizer-BioNTech or Moderna) in pregnant women. In Scotland COVID-19 vaccine had been administered in more than 18,000 pregnancies to the end of October 2021 (22) and nearly 4,000 women in Wales had received their first dose of vaccine before they gave birth (between 01/01/2021 and 30/11/2021) (32). In the USA more than 180,000 women have indicated they were pregnant at the time they received COVID-19 vaccination to 22 November 2021 (33).

No safety concerns relating to COVID-19 vaccination of pregnant women have been found in published studies to date (34, 35, 36, 37). The rate of vaccine side-effects appears to be similar in pregnant and non-pregnant populations (34).

This report presents data on vaccine coverage and outcomes for women delivering up to the end of October 2021 and updates the early data on COVID-19 vaccination in pregnant women published in the COVID-19 vaccine surveillance report – week 47 COVID-19 vaccine weekly surveillance reports (weeks 39 to 3, 2021 to 2022). Findings continue to be considered preliminary.

Vaccine coverage

COVID-19 vaccine coverage in women before they give birth has increased as more women have become eligible for vaccination. In August 2021, 22.5% of women giving birth had received at least one dose of vaccine. This increased to 32.1% of women who gave birth in September, and 41.3% in October 2021. 29.4% of women who gave birth in October 2021 had received 2 doses of the vaccine (Table 6).

In the overall period between January and October 2021 a total of 442,481 women gave birth of whom 58,165 had received at least one dose of COVID-19 vaccine prior to delivery (39,782 of these women had received at least 2 doses). There were 1,228 women who had received their first dose prior to pregnancy, 3,819 in the first trimester, 16,324 in the second and 19,530 in the third trimester. A further 17,264 women were known to have received dose one before giving birth but without enough information to establish which trimester. Of these women, 15,274 were known to have received this dose in pregnancy, and 1,990 were around the start of pregnancy.

Of all vaccinated women giving birth, 37,627 had received one or more doses of only Pfizer vaccine; 2725 one or more doses of only Moderna; 1,350 one or more doses of only AstraZeneca and the remaining 16,463 of vaccinated women received a mixture of doses:

12,494 received a combination of Pfizer and Moderna and 3,969 received AstraZeneca with Pfizer or Moderna.

Table 6. Overall vaccine coverage in women giving birth, by month of delivery[1]

Month	Women giving birth	One or more doses by time of delivery	Two or more doses by time of delivery	Unvaccinated at delivery	Unvaccinated who went on to receive dose(s) after pregnancy to 19/01/2022
Jan-21	41,949	18 (0%)	1 (0%)	41,765 (99.6%)	31,621 (75.7%)
Feb-21	40,093	82 (0.2%)	(0%)	39,872 (99.4%)	30,212 (75.8%)
Mar-21	44,589	293 (0.7%)	25 (0.1%)	44,164 (99%)	33,156 (75.1%)
Apr-21	42,874	489 (1.1%)	94 (0.2%)	42,214 (98.5%)	31,234 (74%)
May-21	44,177	1,249 (2.8%)	306 (0.7%)	42,744 (96.8%)	30,700 (71.8%)
Jun-21	43,813	4,344 (9.9%)	639 (1.5%)	39,312 (89.7%)	26,674 (67.9%)
Jul-21	47,226	7,632 (16.2%)	2,152 (4.6%)	39,403 (83.4%)	25,000 (63.4%)
Aug-21	45,789	10,319 (22.5%)	5,921 (12.9%)	35,275 (77%)	20,610 (58.4%)
Sep-21	46,219	14,828 (32.1%)	9,999 (21.6%)	31,205 (67.5%)	16,155 (51.8%)
Oct-21	45,752	18,911 (41.3%)	13,473 (29.4%)	26,637 (58.2%)	11,795 (44.3%)

[1]1,725 women could not be matched with a NIMS record; their vaccine status is therefore unknown, they are excluded from these figures.

Table 7. Vaccine coverage by ethnicity, for women giving birth August to October 2021 (latest 3 months)[1]

	Women giving birth in August to October 2021	One or more doses by time of delivery	Two or more doses by time of delivery	Unvaccinated at delivery	Unvaccinated who went on to receive dose(s) after pregnancy to 19/01/2022
Asian	16,563	4,459 (26.9%)	2,768 (16.7%)	12,104 (73.1%)	7,100 (58.7%)
Black	6,265	834 (13.3%)	429 (6.8%)	5,431 (86.7%)	1,765 (32.5%)
Other	5,320	1,476 (27.7%)	1,032 (19.4%)	3,844 (72.3%)	1,712 (44.5%)
Mixed	3,272	845 (25.8%)	559 (17.1%)	2,427 (74.2%)	955 (39.3%)
White	99,234	34,401 (34.7%)	23,252 (23.4%)	64,833 (65.3%)	34,799 (53.7%)
Unknown	7,106	2,043 (28.8%)	1,353 (19%)	4,478 (63%)	2,229 (49.8%)

[1]585 women could not be matched with a NIMS record; their vaccine status is therefore unknown, they are excluded from these figures.

Table 8. Vaccine coverage by quintile of deprivation of the small area in which the woman lived, for women giving birth August to October 2021 (latest 3 months)[1]

	Women giving birth in August to October 2021	One or more doses by time of delivery	Two or more doses by time of delivery	Unvaccinated at delivery	Unvaccinated who went on to receive dose(s) after pregnancy
1 - most deprived	33,012	6,035 (18.3%)	3,381 (10.2%)	26,977 (81.7%)	10,636 (39.4%)
2	29,593	7,973 (26.9%)	5,077 (17.2%)	21,620 (73.1%)	10,417 (48.2%)
3	26,653	9,237 (34.7%)	6,145 (23.1%)	17,416 (65.3%)	9,730 (55.9%)
4	24,753	9,940 (40.2%)	6,875 (27.8%)	14,813 (59.8%)	9,367 (63.2%)
5 - least deprived	22,394	10,677 (47.7%)	7,784 (34.8%)	11,717 (52.3%)	8,186 (69.9%)
Unknown	1,355	196 (14.5%)	131 (9.7%)	574 (42.4%)	224 (39%)

[1]585 women could not be matched with a NIMS record; their vaccine status is therefore unknown, they are excluded from these figures.

Table 9. Vaccine coverage by age of mother, for women giving birth August to October 2021 (latest 3 months)[1]

Age	Women giving birth in August to October 2021	One or more doses by time of delivery	Two or more doses by time of delivery	Unvaccinated at delivery	Unvaccinated who went on to receive dose(s) after pregnancy
Under 20	2,562	226 (8.8%)	77 (3%)	2,336 (91.2%)	602 (25.8%)
20 to 24	15,407	2,156 (14%)	904 (5.9%)	13,251 (86%)	4,967 (37.5%)
25 to 29	35,024	7,781 (22.2%)	4,281 (12.2%)	27,243 (77.8%)	13,703 (50.3%)
30 to 34	48,607	18,075 (37.2%)	12,419 (25.5%)	30,532 (62.8%)	17,780 (58.2%)
35 to 39	28,571	12,731 (44.6%)	9,475 (33.2%)	15,840 (55.4%)	9,349 (59%)
40 and above	6,962	3,089 (44.4%)	2,237 (32.1%)	3,873 (55.6%)	2,159 (55.7%)
Unknown	627	(0%)	(0%)	42 (6.7%)	(0%)

[1]585 women could not be matched with a NIMS record; their vaccine status is therefore unknown, they are excluded from these figures.

Using the most recent 3-month period, there were 137,760 women who gave birth of whom 44,058 (32.0%) were vaccinated. These women accounted for 76% of all vaccinated women giving birth since January. There were differences in vaccine coverage by both ethnicity (Table 7) and by quintile of deprivation (Table 8). Women of black ethnicity and women living in the most deprived areas in England were least likely to have been vaccinated with one or 2 doses of COVID-19 vaccine before they gave birth. Coverage increased as levels of deprivation decreased (Table 8). Vaccine coverage increased with increasing age group to those aged 35 to 39 years in whom uptake was 43.9% for one dose and 33.2% for 2 doses (Table 9), with similar coverage in women who were aged 40 years or over when they gave birth.

Methods

Data on COVID-19 vaccination status together with details of each vaccine administered is recorded in a central dataset called the National Immunisation Management Service (NIMS)[1]. In addition, NHS Digital manages the Hospital Episode Statistics (HES) datasets, containing information about hospital activity in England.

Records of women giving birth ('delivery records') in the months since 1 January 2021 were identified in HES. De-duplication of delivery records resulted in a dataset of women who had given birth with 1 record per woman, identified by her NHS Number, and the latest 'delivery episode' associated with her. An 'earliest' and 'latest' likely pregnancy start date were assigned to each woman's record, using the known delivery date and further information from her record, where available:

1. Where a valid gestational age was recorded (GESTAT_1 between 24 and 42), the woman's earliest pregnancy start date was calculated by taking the number of weeks away from the delivery date, and then calculating an additional earlier week, to account for GESTAT_1 recording completed weeks of pregnancy. In a similar way, latest pregnancy start date was calculated by taking the number of weeks of GESTAT_1 away from the delivery date.

2. Where no valid GESTAT_1 was available, the first 12 diagnoses codes were examined to identify any with a code suggesting delivery at term (O60.2). In this case the gestational age at delivery was assumed to be between 37 and 42 completed weeks of pregnancy, and a similar method was used to establish earliest and latest pregnancy start dates.

[1] NIMS Data controllers are NHSEI and NHSD. The NIMS IT software is commissioned by NHSEI via South Central West CSU and is provided by the System C & Graphnet Care Alliance

3. Where no valid GESTAT_1 was available and there were no codes suggesting term delivery, the first 12 diagnoses codes were examined to identify any suggesting pre-term delivery (O60.1 or O60.3). In this case the gestational age at delivery was assumed to be between 24 and 36 completed weeks of pregnancy, and these values were used to establish earliest and latest pregnancy start dates.
4. In the absence of any additional information in the woman's record (or in conflicting cases where diagnoses codes suggesting both term and pre-term delivery appeared in the same record), the gestational age at delivery was assumed to be between 24 and 42 completed weeks of pregnancy, and these values were used to establish earliest and latest pregnancy start dates.

Earliest and latest dates for the start of each trimester were established in a similar way, using the windows of trimester 1: day 0 to day 97 (where day 0 is the earliest or latest pregnancy start date, as established using the method above), trimester 2: day 98 to day 195 and trimester 3: day 196 to delivery. Each woman's delivery record was linked to her record(s) in the NIMS using the NHS Number, establishing her vaccine status as either having had one or more doses before delivery (including any prior to becoming pregnant) or not having had any doses of the vaccine prior to delivery, using the NIMS vaccine records.

For each vaccine dose (this analysis considered doses one to 4) the woman was known to have received, the following information was ascertained:

Dose administered pre-pregnancy	Dose administered before the earliest pregnancy start date
Dose administered in pregnancy	Dose administered after the latest pregnancy start date and before the delivery date
Dose administered post-pregnancy	Dose administered on or after the delivery date based on NIMS records extracted on 19 January 2022
Dose in pregnancy: unknown	Dose administered around the start or pregnancy: after the earliest pregnancy start date and before the latest pregnancy start date
Unvaccinated	No vaccine records exist for the woman, based on NHS number

And the following information about trimester

Dose administered pre-pregnancy	Dose administered before the earliest pregnancy start date
Dose administered in trimester 1	Dose administered after the latest pregnancy start date and before the earliest pregnancy start date +97 days
Dose administered in trimester 2	Dose administered after the latest pregnancy start date +98 days and before the earliest pregnancy start date +195 days
Dose administered in trimester 3	Dose administered after the latest pregnancy start date +196 days and before the delivery date
Dose administered post-pregnancy	Dose administered on or after the delivery date based on NIMS records extracted on 19/01/2022
Dose in trimester unknown	Dose administered in the 'gap' between trimesters, because of inaccuracy in establishing pregnancy start date
Unvaccinated	No vaccine records exist for the woman, based on NHS number

The ethnicity, residence and age information used to generate Tables 7 to 9 was taken from the NIMS record. The analysis within this section was carried out on 19 January 2022. The latest HES data available were for October 2021, and HES data since April 2021 are considered provisional.

Pregnancy outcomes

The following figures present rates of women in England who:

1. Gave birth to one or more live-born babies at term without low birthweight; that is, they experienced none of the following adverse outcomes considered (outcomes 2 to 4), according to their delivery record.
2. Gave birth to a stillborn baby (based on recorded diagnoses)
3. Gave birth to a baby with low birthweight (<2,500g) or a very low birthweight (<1,500g). The babies with a very low birthweight are therefore a subset of the low birthweight babies.
4. Gave birth prematurely (<37 weeks gestation), very prematurely (<32 weeks gestation) and extremely prematurely (<28 weeks gestation). The very premature and extremely premature are therefore a subset of women who gave birth prematurely.

These analyses assess whether rates were different in women giving birth between January and October 2021, who received one or more COVID-19 vaccination doses during their pregnancy compared with those who did not (either because they were unvaccinated or had only received vaccine doses prior to pregnancy). The analyses do not take other factors that might affect these outcomes into account, such as age (except for outcome 1 above) and whether the woman was categorised as clinically at risk. However, women who gave birth after 17 April 2021 without the reported complications (outcome 1 above), were also reviewed with vaccinations given from 16 April onwards. This is a more homogenous group of pregnant women who were eligible for vaccination based solely on age and not because they were considered at high risk of exposure or severe disease. Therefore, data are also presented for women giving birth between April and October 2021 for comparison.

Figure 4: Women giving birth January to October 2021 to live-born babies at term without low birthweight

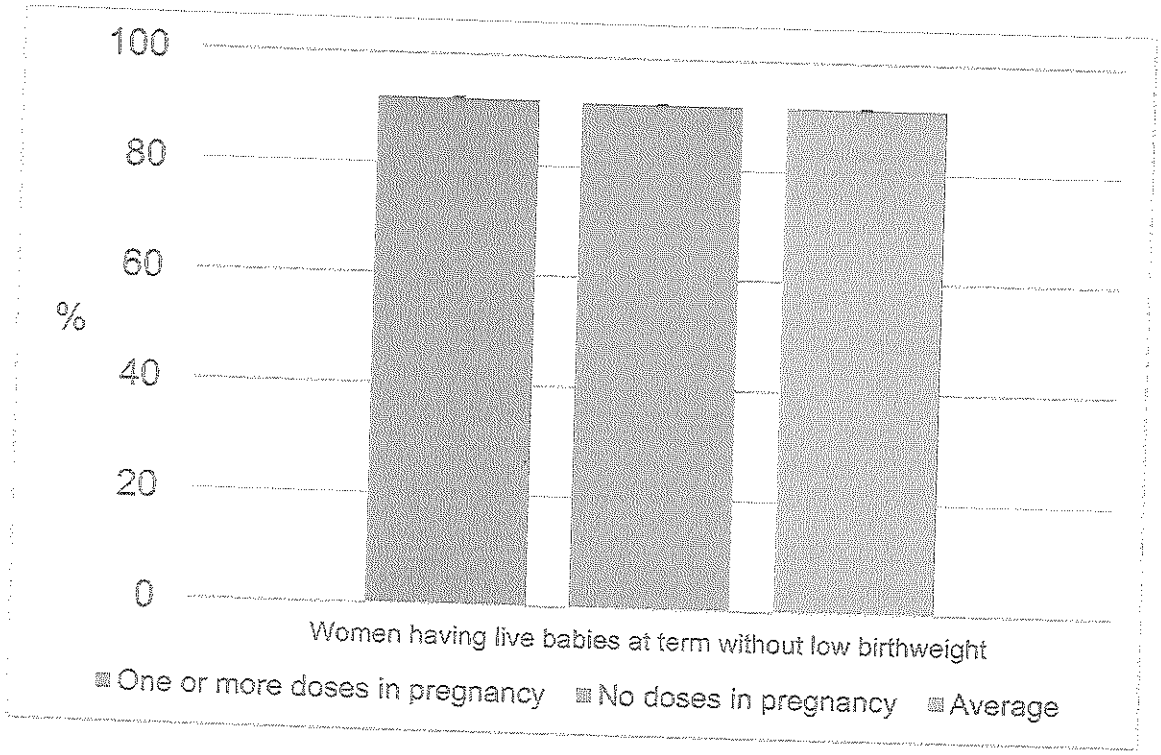


Figure 5: Women giving birth January to October 2021 to live-born babies at term without low birthweight, by age

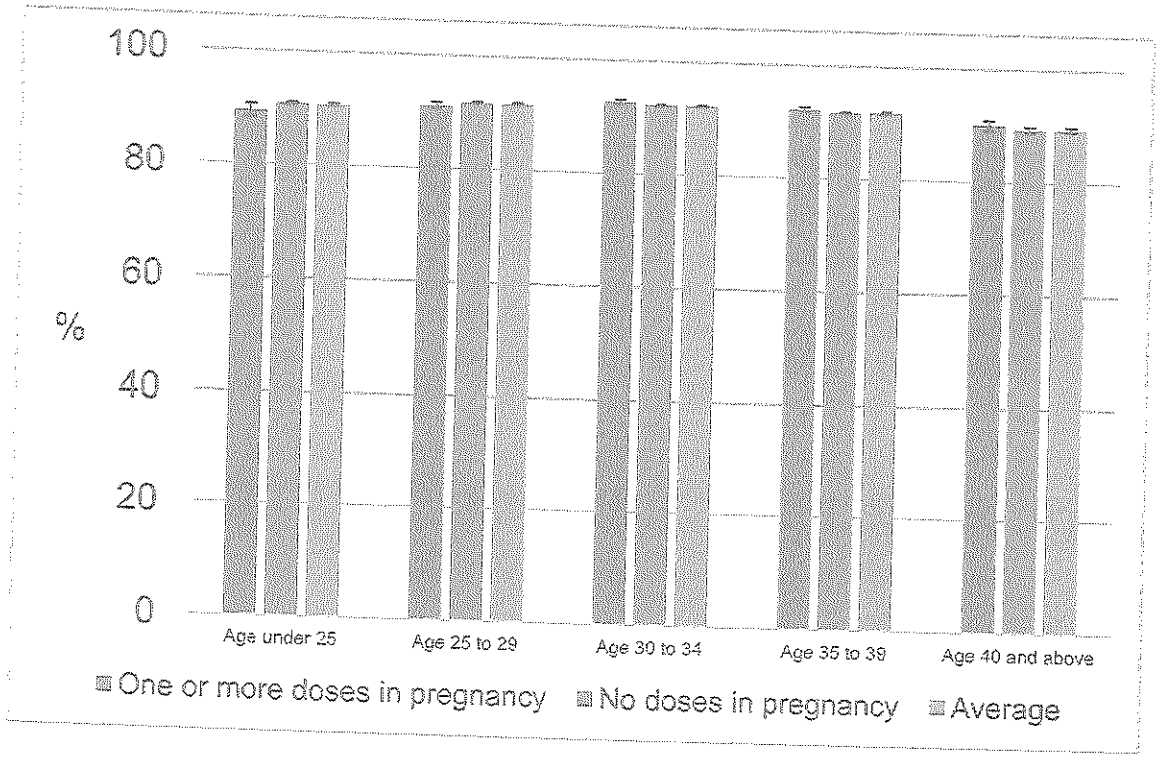


Figure 6: Women giving birth April to October 2021 to live-born babies at term without low birthweight

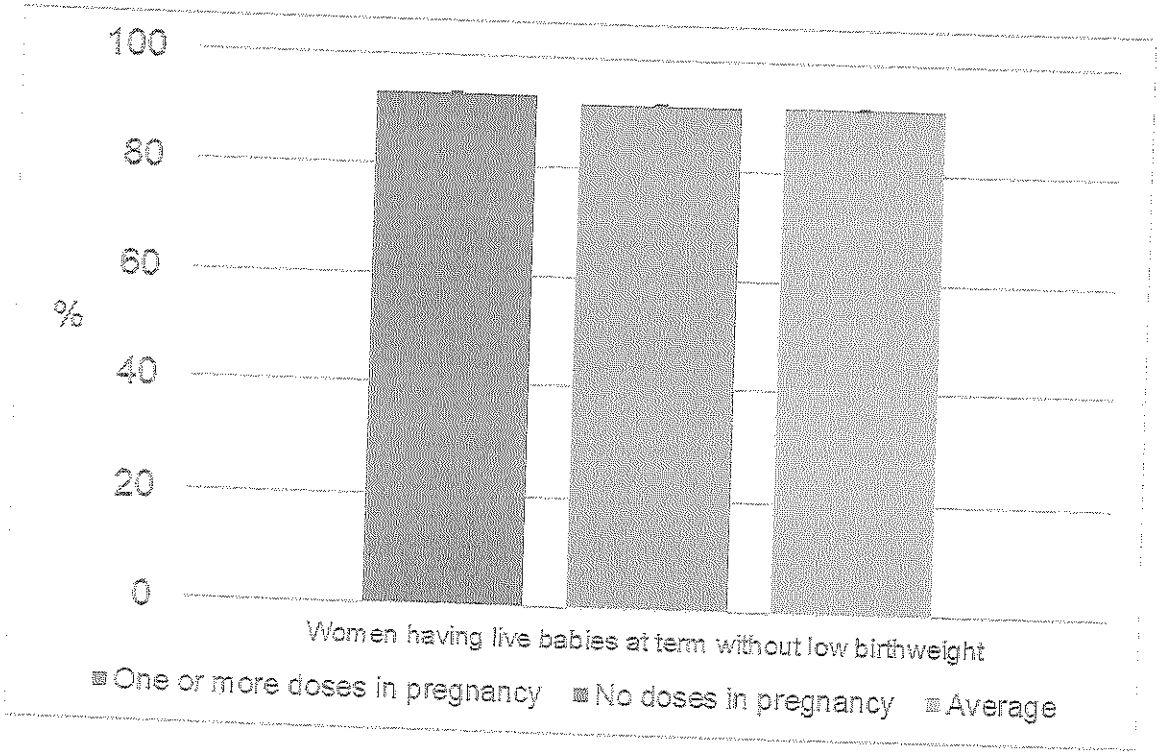


Figure 7: Women giving birth April to October 2021 to live-born babies at term without low birthweight, by age

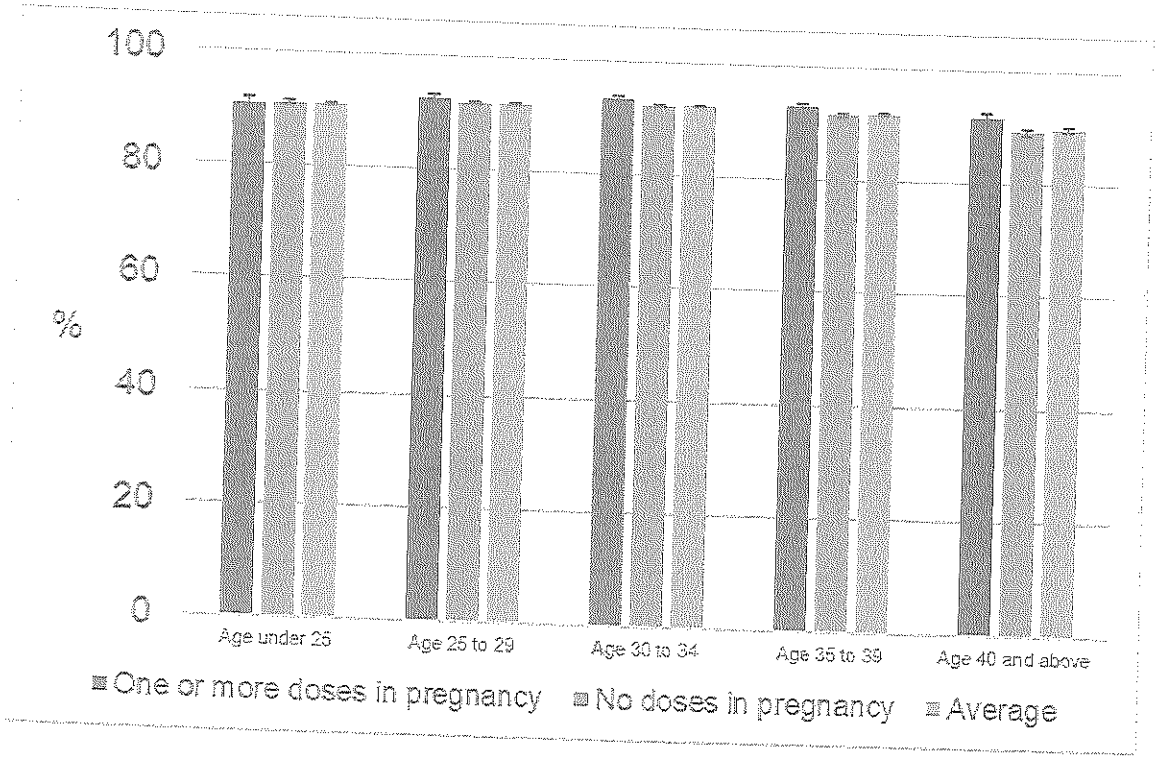


Figure 8: Stillbirths experienced by women giving birth January to October 2021

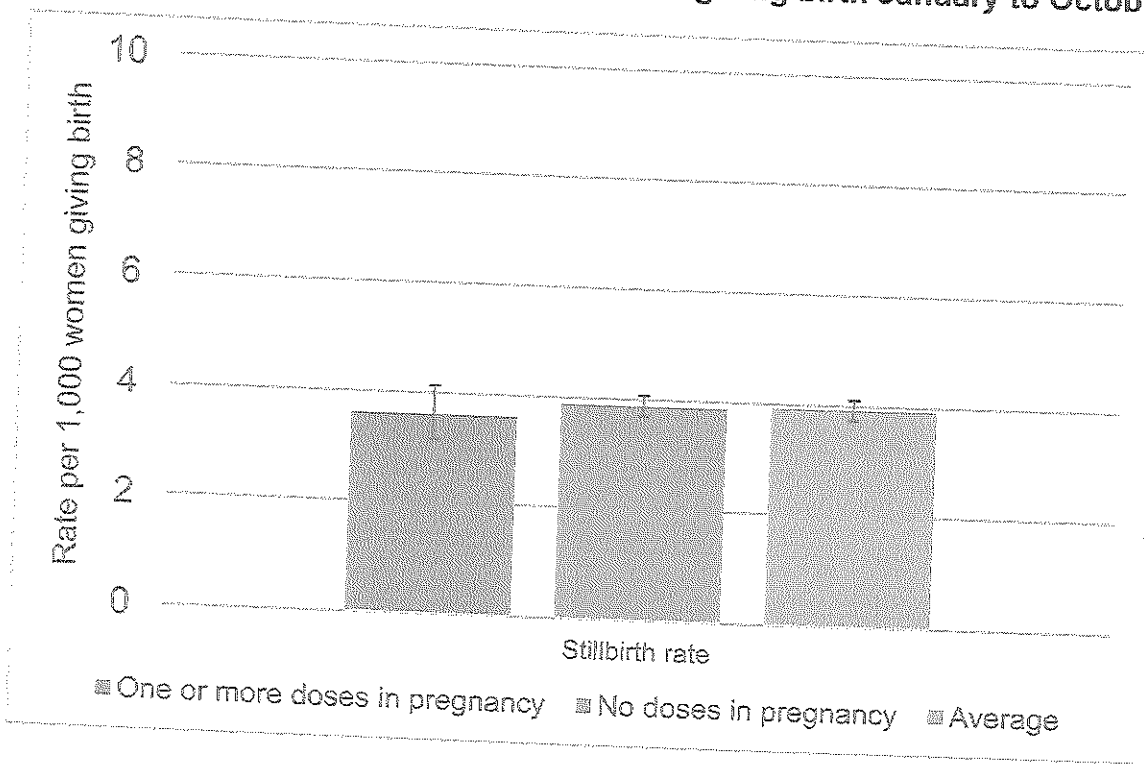


Figure 9: Low birthweight babies to women giving birth January to October 2021