2024 Annual SHOT Report – Supplementary information

Chapter 28: Anti-D Immunisation in Pregnancy

No previous pregnancy (NPP) n=13

There were 13 new cases in 2024, cumulative to 152 cases analysed by SHOT since 2012.

Summary of 2024 NPP data

The data from 2024 relating to women or birthing people with NPP demonstrates that in most of the cases (11/13) alloimmune anti-D was identified at or after 28 weeks; in 2 cases alloimmune anti-D was detected at birth and in 1 case alloimmunisation was confirmed 8 months post-birth. The alloimmune anti-D was suspected to be present at 2 weeks post-birth however alloimmunisation could not be confirmed due to present of anti-D immunoglobulin (Ig) administered postnatally to cover a fetomaternal haemorrhage (FMH) of 101.5mL. There was one case where alloimmune anti-D was identified at 12 weeks gestation and 1 case at 27 weeks gestation.

Table 28.1: Time of first detection of alloimmune anti-D

Gestation when alloimmune anti-D was first detected	Number of new cases 2024	Number of cases cumulative to 2024
Before 28 weeks	2	25
At or after 28 weeks, before birth	8	55
At birth	2	64
Other	1	3*
No information	0	5
Total	**13**	**152**

**Alloimmune anti-D was detected 2 weeks postpartum after a large FMH of 101.5mL at birth, managed correctly. This antibody was still detected after 8 months, confirming the alloimmunisation. Alloimmune anti-D was detected 6 months postpartum after large FMH of 12.7mL at birth, managed correctly. Alloimmune anti-D was detected 3 months postpartum prior to a surgical procedure, twin pregnancy managed correctly.*

Weight and body mass index (BMI) at booking

High BMI and weight are considered potential risk factors for D alloimmunisation as in these cases the efficacy of the prophylactic injection can be reduced (Ngan, et al., 2024). For this reason, SHOT has been collecting both details to assess and understand their impact as risk factors associated to D alloimmunisation. Since 2023, further efforts have been made by SHOT to collect BMI with or without weight as this represents a more accurate indicator of obesity. Despite these efforts in 2024 there were 5 cases where BMI

was not reported, or information was not available. SHOT will continue to pursue efforts in obtaining this information to inform on the risk present when women or birthing people have a high BMI i.e., BMI >30 during pregnancy.

Table 28.2: Weight and BMI at booking

	Number of new cases 2024	Number of cases cumulative to 2024
Booking weight		
<68 Kg	4	55
68-80 Kg	0	17
>80 Kg (obese)	0	20
No information	9	60
Total	**13**	**152**
Booking BMI		
18.5 – 24.9	5	6
25 – 29.9	2	3
≥30 (obese)	1	5
No information	5	6
Total	**13**	**20**

Routine antenatal anti-D prophylaxis (RAADP)

Of the NPP cases eligible to receive RAADP (10/13), 9 patients received the correct dose within the correct time frame. There was one case where RAADP was not administered in a timely manner as the woman concealed pregnancy up to 37 weeks gestation. In one case the alloimmune anti-D was identified at 27 weeks gestation (not eligible) but RAADP was given at 28 weeks unnecessarily.

Table 28.3: Details of RAADP in eligible cases i.e., alloimmune anti-D detected ≥28 weeks gestation

RAADP regimen	Number of new cases 2024	Number of cases cumulative to 2024
Single dose 1500IU at 28-30 weeks	9	97
Single dose 1500IU >30 weeks	1	4
Two dose regiment 1500IU	0	1
Not given	1*	22
Unknown	0	2
Total eligible cases	**10**	**126**

**Patient concealed pregnancy up to 37 weeks gestation.*

It is a positive sign that most of the women received RAADP correctly and the only case where it was not given in the correct time frame was not a result of an error or oversight of

the service. RAADP has been shown to reduce antenatal alloimmunisation from 1% to 0.35% in D-negative pregnancies. The National Institute for Health and Excellence (NICE) guidelines (TA156) cover RAADP for women who are D-negative (NICE, 2008; Qureshi, et al., 2014).

Cell-free fetal DNA (cffDNA)

The uptake of the cffDNA screening test seems to be improving. In 2024 in almost 50% (6/13) of the reports submitted to SHOT, cffDNA was performed in the index pregnancy, compared to 2/7 (29%) in 2023. There were 6 cases where cffDNA was not performed. In one case it was stated that the test was not offered as the patient had not been alloimmunised at this stage of pregnancy. This can indicate confusion of the different tests available i.e., screening assay for non-immunised pregnant women and birthing people versus the diagnostic assay for fetal D-typing, provided by the International Blood Group Reference Laboratory (IBGRL), for immunised pregnant women and birthing people.

Table 28.4: cffDNA testing

cffDNA test	Number of cases 2024	Details
Not performed	6	3 No guideline or pathway in place for antenatal fetal D screening test 1 Patient concealed pregnancy until 37 weeks gestation 2 No reason provided
Performed	6	6 Predicted D-positive fetus
No information	1	
Total	**13**	

Details of potential sensitising events (PSE)

There were 3 cases of PSE reported during pregnancy; two cases of antepartum haemorrhage/per vaginal bleeding (APH/PVB) where the management was correct and one case of a fall/abdominal trauma where the anti-D Ig was given outside the 72-hour window.

Table 28.5: Details of PSE

Number of PSE	Details	Management
2 cases of APH/PVB	At 26^{+4} and at 39^{+4} weeks	<2mL/no fetal cells seen, 500IU anti-D Ig given <24 hours post-PSE
1 case of fall/abdominal trauma	At 17^{+5} weeks	1500IU given >72 hours post-PSE

9 cases 1 case	No PSE reported No information provided	

Pregnancy outcome in NPP cases

Pregnancy outcomes were reported in all NPP cases, all 13 live births. With regards to neonatal intervention for haemolytic disease of the fetus and newborn (HDNF), 8 required treatment as shown on table below (Table 28.6).

Table 28.6: Outcome of pregnancies reported in 2024

Number of cases	Outcome	Treatment for signs/symptoms of HDFN
13	Live births	6 no treatment required 3 Phototherapy 2 Phototherapy and IVIg* 1 Phototherapy, fluid rehydration, IVIg*, folic acid and top-up transfusion 1 Top-up transfusion

**IVIg – Intravenous immunoglobulin*

Previous pregnancies (PP) n=55

The index pregnancy in these cases refers to the current pregnancy – the pregnancy in which alloimmune anti-D was first detected.

There were 55 new cases in 2024, cumulative to date 443 cases.

Summary of 2024 PP data

In 2024, there were 19 cases where alloimmune anti-D was identified in the first trimester (≤12 weeks gestation). This represents cumulatively 168/443 (37.9%) of NP cases where alloimmune anti-D is identified in the first trimester since 2012. In these cases, the data set with higher relevance is from previous pregnancy, where it is more likely to identify the reason for alloimmunisation, assuming that no other relevant transfusion/transplantation history has changed between pregnancies. In cases where alloimmune anti-D was detected later in the pregnancy (>12 weeks gestation), which in 2024 was 36 cases, the details of the index pregnancy including PSE and management of pregnancy are more relevant to identify the contributory factors for alloimmunisation. In these cases, the relative contribution of events in the previous pregnancy is less certain.

Table 28.7: Time of first detection of alloimmune anti-D

Gestation when was alloimmune anti-D was first detected	Number of new cases 2024	Number of cases cumulative to 2024
Before or at 12 weeks	17	166
After 12 weeks to 28 weeks (incl. late booking)	11	62
At or after 28 weeks	18	138
At birth	8	63
Other	1	14*
Total	**55**	**443**

**1 case alloimmune anti-D identified >1 year post-birth when woman attended for a gynaecology procedure, 3 preoperative assessment following pregnancy, 3 at planned follow up of large FMH at birth where correct dose of anti-D Ig had been given, 7 unknown.*

In 2024, there was one case where immune anti-D was identified one-year post-birth. The potential risk factors for alloimmunisation associated to this case was high BMI (33) and birth of previous pregnancy beyond 40 weeks gestation (40^{+6}).

Details of birth in the pregnancy immediately preceding index (current) pregnancy

Outcome of preceding pregnancy

Table 28.8: Outcome of the preceding pregnancy

Outcome of preceding pregnancy	Number of cases	Details
Live births	36	25 D-positive neonates 2 D-negative neonates 9 unknown D-status
Other	19	7 miscarriages (at 4, 5, 6, 10, 11, 14 weeks gestation and 1 unknown) 2 miscarriages abroad 1 at 8 weeks gestation and 1 unknown gestation) 1 possible miscarriage (unknown gestation) 2 terminations of pregnancy (1 at 8 weeks gestation, 1 unknown gestation) 2 ectopic pregnancies 5 information not given

Method of birth of preceding pregnancy (for women and birthing people who carried to a live birth, in 2024 n=36)

Table 28.9: Birth details of preceding pregnancy

Type	Number of new cases 2024	Number of cases cumulative to 2024
Vaginal	20	174
Instrumental	0	17
Elective caesarean section	6	47
Emergency caesarean section	8	49
No information	2	70
Total	**36**	**357**

Gestation at birth of preceding pregnancy (for women and birthing people who carried to a live birth, in 2024 n=36)

Cumulatively (data collected from 2015 onwards), 63 out of 336 (18.8%) previous pregnancies lasted beyond the 40 weeks gestation. National Health Service (NHS) maternity statistics 2023-2024 indicate 12.0% of pregnancies are extended beyond 40 weeks: https://digital.nhs.uk/data-and-information/publications/statistical/nhs-maternity-statistics/2023-24. Births beyond 40 weeks can be a potential risk of alloimmunisation if the prophylactic anti-D is no longer detected (Davies, et al., 2011).

Table 28.10: Gestation at birth of preceding pregnancy

Gestation at birth (weeks)	Number of new cases 2024
40 weeks or less	22
More than 40 weeks	8
No information	6
Total	**36**

Postpartum management in preceding pregnancy (for women and birth people who carried to a live birth, in 2024 n=36)

Table 28.11a: Test for postpartum FMH

FMH test performed postpartum	Number of cases 2024	Details
Performed	21	16 Kleihauer (KLH) only 1 Flow cytometry (FC) only (no FMH volume reported) 4 KLH and FC (postpartum FMH volumes of 13, 33, 52, >2mL and <4mL (FMH not specified)

Not performed	4	2 D-negative baby 1 Mother regarded as D-positive (D-variant patient) 1 Immune anti-D detected*
No information	11	
Total	**36**	

Alloimmune anti-D identified in previous pregnancy in 2019, but report had not been submitted at the time.

Table 28.11b: Postpartum anti-D Ig prophylaxis

Correct administration including dose and timing?	Number of new cases 2024	Number of cases cumulative to 2024
FMH test and appropriate anti-D Ig dose	16	195
No prophylaxis	2*	20δ
Incorrect dose/timing of anti-D	2**	10δ
D-negative baby	2	27
No information	14***	106▽
Total	**36**	**358**

Woman did not give consent (n=1), immune anti-D already present (n=1)
** 2 cases of large FMH volumes (33mL and 52mL) where the patient received more anti-D Ig than required (1 woman received 1500IU more than required, 1 woman received 3000IU more than required)*
***No information about FMH testing, dose administered or time frame (n=3). Anti-D Ig was given at the correct time frame however FMH bleed not reported to confirm if correct dose administered (n=1).*
δReasons included immune anti-D detected at time of birth, typed in error as D-positive, refused, from abroad, learning difficulties, needle phobic, declined, missed anti-D Ig in error, dose 250IU, dose given late, transcription error of maternal D group into the electronic health record*
▽No consent for FMH test given 500IU (n=1); not able to determine if correct dose in absence of FMH testing, no FMH test detail so not able to determine if correct dose in absence of FMH testing (n=4); FMH testing done, correct dose administered but no information about timeframe (n=1).*

Management of pregnancy immediately preceding index (current) pregnancy for women and birthing people who carried to a live birth (n=36)

Weight and BMI at booking of preceding pregnancy

Table 28.12: Booking weight and BMI of preceding pregnancy

	Number of NPP cases 2024	Number of cases cumulative to 2024
Booking weight		
<68	11	102
68-80	2	30
>80 (obese)	2	41
No information	21	184
Total	**36**	**357**

Booking BMI		
18.5 – 24.9	8	10
25 – 29.9	4	5
≥30 (obese)	3	5
No information	21	37
Total	**36**	**57**

Cumulatively, of the 331 cases where the booking weight in the preceding pregnancy was provided, 41 (12.4%) had a weight higher than 80Kg. Data from maternity services indicate that 26% of pregnant women at 15 weeks were obese or severely obese: https://digital.nhs.uk/data-and-information/publications/statistical/maternity-services-monthly-statistics/november-2023-experimental-statistics. High BMI and weight are considered potential risk factors for D alloimmunisation as in these cases the efficacy of the prophylactic injection can be reduced (Ngan, et al., 2024).

RAADP in preceding pregnancy

Table 28.13: RAADP in preceding pregnancy

RAADP regimen	Number of NPP cases 2024	Number of cases cumulative to 2024
Single dose	19	220
Two doses	2	17
Given (no details on dose)	1	5
Not given	5*	42**
No information	9	73
Total	**36**	**257**

**1 woman regarded as D positive (when D-variant), 2 RAADP not part of local policy, 2 cases appropriate reason not given.*
***Reasons include; needle phobic, D-variant treated as D-positive, learning difficulties, concealed pregnancy, prior to RAADP introduction, delivered abroad, declined, typed incorrectly including typed incorrectly as D-positive, midwife error, one transcription error maternal D group to electronic health record, notes stated not required.*

In the 2024 data set, RAADP in the preceding pregnancy was administered on the deltoid muscle in 13 cases and in 10 the information was not provided. There were no cases of RAADP administered in the gluteal muscle.

cffDNA testing in preceding pregnancy

Table 28.14: cffDNA testing

cffDNA test	Number of cases 2024	Details
Not performed	20	18 No guideline or pathway in place for antenatal fetal testing 1 No consent from woman 1 D-variant woman treated as D-positive

Performed No information	8 8	Predicted D-positive fetus
Total	**36**	

Details of potential sensitising events in preceding pregnancy reported in 2024

Table 28.15: Details of PSE

Number of PSE	Details
16 PSE reported	**Appropriate management** • Miscarriage at 10 weeks gestation, medical management. Anti-D Ig not administered as per guidelines • Miscarriage at 14 weeks gestation. 500IU anti-D Ig administered. No FMH testing required as <20 weeks gestation **Inappropriate management** • Transfusion of D positive red cells postnatally. No FMH testing performed, and no anti-D Ig administered. D variant patient treated as D positive **Inconclusive management** • APH/PVB at 23+2 weeks gestation. 1500IU anti-D Ig given <72 hours post PSE. Unknown details regarding FMH testing • Ectopic pregnancy. No further details reported • Ectopic pregnancy. No further details reported • Miscarriage at 8 weeks gestation (abroad). No anti-D Ig administered (verbal information provided from woman) • Miscarriage at 6 weeks gestation. No further details reported • Miscarriage at 5^{+5} weeks gestation. No further details reported • Miscarriage not confirmed. Information provided by patient in retrospect (in the index pregnancy) • Miscarriage at 4 weeks gestation. No further details reported • Miscarriage at 11^{+2} weeks gestation. No further details reported • Miscarriage abroad. No further details reported • Miscarriage. No further details reported

	• Termination of pregnancy. No further details reported. • Termination of pregnancy at 8 weeks gestation. No further details reported.

Since reporting began in 2013, a total of 115 PSE have been reported in the preceding pregnancies of which 58 (50.4%) were managed correctly. The percentage of cases managed correctly is likely to be higher but without the full details of the PSE management including how the PSE was managed e.g., medically or surgically, FMH testing and anti-D Ig administration it is not possible to complete the assessment.

Details of cases where anti-D detected at first trimester booking of index pregnancy (≤12 weeks gestation) (n=19)

The details of the preceding pregnancy may provide information on the cause of D alloimmunisation in these cases.

Table 28.16: Details of management in previous pregnancy ('-' = no information/unknown or not applicable)

Case	Obesity (BMI)	RAADP	PSE	Birth (weeks)	Birth route	PPP	Risk factors/ comment
1	No	No	Miscarriage (10 weeks)	-	-	-	Multiple pregnancies (2 previous miscarriages and 1 live birth)
2	-	No	No	39	Emergency C/S	-	Previous pregnancy abroad. RAADP not given as not part of policy. No information about management post birth
3	-	-	-	-	Emergency C/S	D-positive baby, anti-D Ig given but no further details	Multiple pregnancies (4), all abroad. Anti-D Ig given postnatally but not known the dose administered
4	-	No	-	37^{+1}	Vaginal	Transfusion of D-positive red blood cells (RBCs) postnatal	D variant patient treated as D positive (2 previous pregnancies). D-positive RBCs were transfused post birth.
5	-	-	-	-	-	-	Previous pregnancy abroad. No information available
6	-	Yes (single dose)	-	36^{+5}	-	D-positive baby, KLH <2mL, 1500IU anti-D Ig	Complex pregnancy, IVH pregnancy and previous PPH. Multiple pregnancies, 1 live

						given <24 hours post birth	birth, 1 termination of pregnancy and 1 miscarriage
7	-	-	Possible miscarriage	-	-	-	Possible miscarriage reported retrospectively (in the index pregnancy)
8	-	Yes (single dose)	No	39^{+1}	Elective C/S	D-positive baby, KLH <2mL, 1500IU anti-D Ig given <24hours post birth	None
9	No	Yes (single dose)	No	39^{+2}	Emergency C/S	D-positive baby, KLH =13mLs, 2000IU anti-D Ig given <72 hours post birth	Large FMH volume (>12mLs) identified at birth, but managed correctly
10	-	Yes (single dose)	No	40	Vaginal	D-positive baby, KLH <2mLs, 500IU anti-D Ig given <24 hours post birth	Multiple pregnancies (2 live births and 1 miscarriage)
11	-	-	-	39	Vaginal	-	2 previous pregnancies abroad. No information available
12	-	Yes	No	-	-	D-positive baby, anti-D Ig administered but no further details	2 previous pregnancies abroad. No information available
13	No	No	No	33	Emergency C/S	D-positive baby, FMH testing not performed and anti-D Ig not given	Incorrect postnatal management

14	-	-	-	40^{+1}	Vaginal	-	No information reported about management of pregnancy pre- and postnatally
15	No	No	No	36^{+2}	Vaginal	D-positive baby, FMH testing (KLH and FC) =52mL, 9500IU anti-D Ig given <72 hours. Follow-up FMH testing detected 2mL, no further anti-D Ig given	RAADP not given and no anti-D Ig given with a follow-up result of 2mL, following a large FMH volume at birth
16	-	Yes (single dose)	No	40^{+1}	Vaginal	D-positive baby, no fetal cells detected (KLH), 500IU anti-D Ig given <24 hours post birth	Multiple pregnancies (3)
17	-	-	Miscarriage	-	-	-	Miscarriage abroad. Multiple pregnancies (3). No further information available
18	No	No	Miscarriage	-	-	-	No information about the management of miscarriage. Multiple pregnancies (3)
19	-	-	-	-	-	-	Previous pregnancy in different hospital. No information available

Details of index pregnancy for cases where alloimmune anti-D detected after first trimester (>12 weeks) in index (current) pregnancy (n= 36)

Further information is requested on the index pregnancy when alloimmune anti-D is detected after the first trimester, as it may be that the D alloimmunisation occurred in the index pregnancy rather than in the preceding pregnancy.

Booking weight and BMI of index pregnancy

Table 28. 17: Booking weight and BMI

	Number of NPP cases 2024	Number of cases cumulative to 2024
Booking weight		
<68	13	95
68-80	9	57
>80 (obese)	7	45
No information	7	69
Total	**36**	**266**
Booking BMI		
<18.5	3	3
18.5 – 24.9	7	10
25 – 29.9	8	14
≥30 (obese)	12	19
No information	6	10
Total	**36**	**56**

Cumulatively, 45 out of 197 (22.8%) women where booking weight was provided and who developed alloimmune anti-D in the index pregnancy, were clinically obese at booking. Data from maternity services indicate that 26% of pregnant women at 15 weeks gestations were obese (BMI >30) or severely obese (BMI >40): https://digital.nhs.uk/data-and-information/publications/statistical/maternity-services-monthly-statistics/november-2023-experimental-statistics.

To determine the accuracy of the obesity as an indicator for D alloimmunisation, since 2023 further efforts have been made to collect the BMI as well as the weight. As shown on Table 28.17 the number of obese pregnant women (BMI >30 or weight >80Kg) when assessing BMI (12/26) differs from when assessing this indicator with weight (7/36). Data from 2023 and 2024 when assessing the BMI provided shows that 19 out of 46 (41.3%) women were obese at booking in the index pregnancy. However, robust data is required to determine a conclusion regarding obesity as an indicator for D alloimmunisation and as such SHOT will continue to collect these details in 2025.

RAADP in the index pregnancy

Table 28.18: Details of RAADP

RAADP regimen	Number of cases 2024
Single dose 1500IU at 28-30 weeks	20
Single dose 1500IU >30 weeks	1
Two dose regiment 1500IU	0
Not given	13*
Unknown	2
Total eligible cases	**36**

**8 cases where alloimmune anti-D was identified prior to the RAADP appointment. 1 D variant woman treated as D-positive. 1 RAADP was missed in error. 1 woman did not consent administration. 1 woman failed to attend appointment. 1 no appropriate reason provided.*

cffDNA testing in the index pregnancy

Table 28.19: cffDNA testing

cffDNA test	Number of cases 2024	Details
Not performed	20	9 No guidelines or pathway in place for antenatal fetal D screening test 1 Not consented by woman 1 Missed by the obstetric team, test not offered 1 Partner D homozygous 1 Patient with immune anti-D 1 Late booking 6 No suitable reason/ no reason provided
Performed	12	11 predicted D-positive fetus 1 Inconclusive result
No information	4	
Total	**36**	

Details of potential sensitising events in the index pregnancy

Table 28.20: Details of PSE reported in the index pregnancy prior to D sensitisation

Number of PSE	
5 PSE reported	1 APH/PVB at 17 weeks gestation. No anti-D Ig given as woman did not report the PSE at the time 1 APH/PVB at 29 weeks gestation. No fetal cells present in the KLH sample. 1500IU given >72 hours post PSE (168 hours) 1 APH/PVB at 27 weeks gestation. FMH testing not performed. 500IU anti-D Ig given <72 hours post PSE 1 APH/PVB with abdominal pain at 29 weeks gestation. No fetal cells detected in flow cytometry. 1500IU anti-D Ig given <72 hours post PSE 1 Threatened miscarriage at 10 weeks gestation. Anti-D Ig not given.

Outcome of index pregnancies reported in 2024 in PP cases n=55

Table 28.21: Outcome of pregnancies reported in 2024

Number of cases	Outcome	Treatment required?
51 0 0 2 2	Live births Miscarriage Stillbirth Termination of pregnancy Outcome data missing	
29 12 2 2 1 1 1 1 2		No treatment Phototherapy Phototherapy and acid folic Phototherapy and top-up transfusion Phototherapy and IV antibiotics Phototherapy, fluid rehydration and IVIg cover Intrauterine transfusion (IUT) Phototherapy, IVIg cover, fluid rehydration and exchange transfusion Phototherapy, IVIg cover, IUT and top up transfusion

References

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