

NORTH WEST GUIDELINE

Hyponatraemia in the intrapartum and immediate postpartum periods

	Issue Date	February 2026	Version	V4
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Role	Name	Contact
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1.	
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3.	

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None to declare

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	2 of 23	

Contents

1	Introduction	3
2	Purpose	4
3	Scope	4
4	Responsibilities	4
5	Management of hyponatraemia	5
	5.1 Risk factors.....	5
	5.2 Clinical features	5
	5.3 Prevention	6
	5.4 Monitoring.....	6
	5.5 Management	8
	5.6 Severe hyponatraemia.....	8
	5.7 Continuous electronic fetal monitoring	10
	5.8 Postpartum	10
	5.9 Pregnancy specific conditions.....	12
	5.10 Drug induced causes of hyponatraemia.....	13
6	Monitoring / Audit	13
7	Appendices	14
	7.1 Appendix 1: Management of hyponatraemia in labour	14
	7.2 Appendix 2: Postpartum management of hyponatraemia identified in labour.....	15
	7.3 Appendix 3: Management of asymptomatic severe hyponatraemia	16
	7.4 Appendix 4: Management of symptomatic hyponatraemia	17
	7.5 Appendix 5: Glasgow Coma Scale	19
8	Supporting references & national guidance	20
9	Equality Impact Assessment	21

1 Introduction

Severe hyponatraemia in labour is an increasingly recognised phenomenon, due to national reporting of morbidity such as seizures. Furthermore, fetuses of hyponatraemic mothers will also become hyponatraemic, potentially resulting in serious adverse neonatal outcomes.

The symptoms of hyponatraemia occurs due to the acute drop in sodium, which can in turn lead to cerebral oedema, and subsequently seizures. The most common cause of hyponatraemia in labour is hypotonic hyponatraemia or dilutional hyponatraemia, although it is important to consider other causes.

During intrapartum care, individuals are at a greater risk of hyponatraemia due to a lower baseline in sodium in pregnancy, a reduced ability to excrete water in the 3rd trimester, and the anti-diuretic effect of (both endogenous and exogenous) oxytocin. This is compounded by the risk of over hydration for women receiving intravenous fluids directly, and fluid as part of infusions e.g. oxytocin, as well as oral replacement. Hypotonic solutions such as dextrose used in variable rate insulin infusion regimes, have a greater dilutional effect so are an individual risk factor.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	3 of 23	

Hyponatraemia has been demonstrated in 26% of women who receive >2500ml in labour, compared to 1% who received <1000ml, illustrating the need to identify these women at risk.

Neonatal seizures caused by hyponatraemia occur because water diffuses freely across the placenta. The fetus' sodium concentration will then decrease with their mother's. Seizures secondary to hyponatraemia are similar to those caused by hypoxic ischaemic encephalopathy, and infants are likely to require cooling. Concerningly, the majority of neonates suffering from severe hyponatraemia had mothers who were asymptomatic or only mildly symptomatic; despite having severe biochemical hyponatraemia.

These severe cases are rare; however, hyponatraemia is a condition that has identifiable risk factors and can be effectively monitored once identified.

2 Purpose

This guideline aims to raise awareness of hyponatraemia in labour and its investigations and management. It also provides guidance on the initial management of patients with hyponatraemia in the immediate postpartum period, with advice about other potential cause of hyponatraemia to consider.

3 Scope

This guideline should be used for all patients in active labour, and for initial management of those with persistent hyponatraemia in the immediate postpartum period.

This guideline is not applicable to those patients where there is a concern about an underlying medical condition. If there are concerns about an underlying medical condition causing hyponatraemia, it is recommended to follow local hyponatraemia guidelines and seek expert medical advice.

4 Responsibilities

Clinical staff are expected to take the needs, preferences and values of patients alongside the application of this guidance.

“Guidance does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them, their families and carers or guardian.” (NICE, 2022)

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	4 of 23	

5 Management of hyponatraemia

5.1 Risk factors

Risk factors for hyponatraemia
Positive fluid balance $\geq 1500\text{ml}$ Oxytocin infusion Variable rate insulin infusions Medications (See section 5.9) <ul style="list-style-type: none"> • Antidepressants • Diuretics • Anticonvulsants • Proton pump inhibitors

5.2 Clinical features

Severity of hyponatraemia	Symptoms
Early signs (mild to moderate hyponatraemia)	Headache Muscle cramps Lethargy Anorexia Nausea
Late signs (severe hyponatraemia)	Vomiting Confusion Reduced consciousness Seizures Non cardiogenic pulmonary oedema Respiratory arrest

Hyponatraemia is a low serum sodium level.

However, it is a disorder of water imbalance rather than sodium, as water flows down an osmotic gradient. In hyponatraemia the serum sodium is more dilute than the intracellular sodium, so the water moves into the cells to dilute the intracellular sodium to the serum level. If this occurs in the brain it causes cerebral oedema and raises the intracranial pressure causing symptoms.

The speed and severity of the change in serum sodium correlates with the degree of cerebral oedema and therefore symptoms. The labouring population are usually fit and are able to tolerate hyponatraemia without clinical signs, however neonates are more vulnerable and not able to adapt to these changes.

Additionally, many of the early signs overlap with symptoms of normal labour, for example nausea or lethargy, emphasising the need for clinical awareness.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	5 of 23	

Assessing fluid status	
Hypovolaemic (reduced fluid levels)	Dry mucous membranes Reduced skin turgor Oliguria Tachycardia
Euvolaemic (normal fluid levels)	Unremarkable examination
Hypervolaemia (increased fluid levels)	Oedema Raised jugular venous pressure Shortness of breath

Hypervolaemic hyponatraemia is the most common cause of hyponatraemia in labour and is also known as “water intoxication.” It is often caused by a combination of the anti-diuretic effect of oxytocin, combined with overhydration from oral intake and intravenous fluid. In extreme cases these patients may be clinically overloaded on examination, however in many individuals the signs are more subtle and they may appear euvolaemic.

However, hyponatraemia can also be caused by hypovolaemic conditions, the most common of which is dehydration, usually from gastrointestinal loss. Rarely it may be as a result of mineralocorticoid deficiency such as Addison’s disease and renal pathology.

5.3 Prevention

As in many other conditions, prevention is often the most effective management. Preventing a significantly positive fluid balance is covered in section 5.4; but vomiting is also a simply managed issue. Given vomiting itself can cause hyponatraemia, or can lead to over-correction of fluid balance with over generous IV fluids; proactively managing vomiting with anti-emetics will reduce rates of hyponatraemia. Similarly encouraging women to drink carbohydrate rich beverages in labour has been demonstrated to reduce vomiting.

It is recommended that as required (PRN) antiemetics are prescribed for labouring women, and offered to any nauseous or vomiting patient.

5.4 Monitoring

Cases of hyponatraemia in labour have increased since guidance for women to remain fasted in labour has been relaxed. This does not mean that fasting should return to routine practice; instead, it emphasises the risk of overhydration especially when many patients receive intravenous infusions e.g. oxytocin for induction or augmentation. A consistent theme in adverse outcomes was the lack of accurate fluid balance recording.

Risk factors for hyponatraemia in labour
Receiving an oxytocin infusion (for induction of labour, augmentation of labour, or postpartum haemorrhage prophylaxis) ≥1500ml positive fluid balance

Final Version	Issue Date	February 2026	Version	V4
	Review Date	February 2029		6 of 23

Receiving intravenous dextrose and insulin
Known sodium ≤ 130

5.4.1 Without risk factors

Emphasis on avoiding an overly positive fluid balance, by keeping an accurate account of intake and output. Given that an average person has 800ml of insensible water loss through sweating, breathing and faeces; women should not be kept in a strict neutral fluid balance. However, if they are identified as developing a risk factor such as being in a 1500ml positive balance, they should be investigated for hyponatraemia.

Guidance

1. Educate all women about the importance of drinking to thirst and fluid balance
2. Fluid balance should be assessed and recorded at least 4 hourly
3. If there is a positive fluid balance of ≥ 1500 ml then sodium should be checked via urea & electrolytes from a limb not attached to IV fluid, or they should be moved to obstetrician led care
4. If sodium is ≥ 130 mmol/L continue as above
5. If sodium is < 130 mmol/L they should have an obstetric review, move to enhanced maternal care, and start on the peripartum sodium monitoring pathway

If it is not possible to measure the fluid balance e.g. in community settings

1. Fluid intake should be recorded
2. If there is excessive fluid intake e.g. ≥ 500 ml an hour over 2 consecutive hours or ≥ 1000 ml in 1 hour then advise assessment in hospital to check sodium levels
3. If a healthcare practitioner is concerned about the volume of fluid drunk by a women without meeting the above thresholds, it is still advised to attend hospital to assess sodium levels

5.4.2 With risk factors

Guidance

1. Check sodium level when risk factors identified or when in labour with a known sodium of < 130 mmol/L
 - a. E.g. when commencing an oxytocin infusion, when commencing an insulin and dextrose infusion, when a positive fluid balance of 1500ml has been identified
2. Follow the peripartum sodium monitoring pathway in appendix 1
 - a. Monitor every 8 hours if sodium ≥ 130 mmol/L
 - b. Monitor every 4 hours if sodium 126-129 mmol/L
 - c. Monitor every 2 hours if sodium ≤ 125
 - d. See appendix 1 for flow chart
3. Educate all women about the importance of drinking to thirst and fluid balance
4. Accurate fluid balance measurement
5. Ensure women void urine a minimum of 4 hourly, and urine output is measured

5.4.3 Point of care testing

Point of care testing using a venous blood gas is encouraged, due to the short time period between monitoring for severe hyponatraemia.

See section 5.3.2 or appendices 1 and 2 for frequency of monitoring

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	7 of 23	

5.4.4 Ketones

Do not treat urinary ketosis with IV fluids in non-diabetic women

Ketones are produced when starvation induced (>12 hour) reduction in carbohydrate metabolism, triggers lipid breakdown, which produces ketones as a by-product. Ketone body production is more marked in the third trimester due to increased metabolic demand, and increased insulin resistance.

To summarise, this means that ketones are produced due to reduced food intake, not dehydration.

Therefore, IV fluids will not treat the underlying cause of ketosis, but will still increase the risk of hyponatraemia, so are not recommended. Instead, women are advised to drink to thirst and continue eating a light diet.

5.5 Management

See appendix 1 for quick reference guide

As dilutional hyponatraemia is by far the most common cause of hyponatraemia in labour; if the serum sodium is 126-129 mmol/L, the initial steps involve restricting further fluid to 80ml/hour in order to prevent the situation from worsening.

The patient should also be reviewed clinically by an ST3+ obstetrician to assess for any alternative causes of hyponatraemia. If required, this can then be discussed with the medical registrar and escalated to an endocrine or renal medicine specialist if needed. Alternatively it can be discussed with an obstetric physician if available locally.

The neonatal team should be informed.

Sodium should be monitored every 4 hours due to the potential for the condition to progress to severe hyponatraemia.

If serum sodium levels drop to 125mmol/L or below, oxytocin should be stopped, fluid intake restricted to 30ml/hr and the levels repeated in 2 hours. The patient should also be reviewed by an appropriate multidisciplinary team of obstetricians, anaesthetists, and medical specialists. The neonatal team need to be updated.

5.6 Severe hyponatraemia

See appendix 3 for severe hyponatraemia quick reference guide.

5.6.1 Overview

Severe hyponatraemia is defined as serum sodium less than 120mmol/L without symptoms or less than 125mmol/L with symptoms (headache, vomiting, altered consciousness, seizures). It is highly unlikely to occur with sodium levels over 125mmol/L. Severe hyponatraemia is a medical emergency.

These patients require an urgent obstetric and anaesthetic review, and referral to the critical care team.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	8 of 23	

Patients with severe symptoms (altered consciousness, seizures, or cardiorespiratory arrest) require immediate treatment with hypertonic saline. Ideally this would be in a level 2 care setting, but transfer to critical care should not delay treatment.

The aim of treatment is to increase serum sodium levels by 5 mmol/L within the first hour to reduce the risk of cerebral oedema.

5.6.2 Immediate management

Treatment involves senior medical staff administering 150ml 2.7% sodium chloride (hypertonic saline) over 20 minutes via large bore cannular. Following this a repeat sodium should be checked with a venous blood gas and formal laboratory sample. These must be taken from the opposite side to the infusion.

If there has not been a 5 mmol/L increase in sodium levels, then a further 150ml 2.7% sodium chloride should be administered. Central venous access should be acquired if multiple infusion of 2.7% sodium chloride are likely to be required, but this should not delay treatment.

5.6.3 If there is clinical improvement after hypertonic saline

If there has been a 5 mmol/L or greater increase in serum sodium with clinical improvement, the 2.7% sodium chloride infusion should be stopped. This is because rapid sodium correction can potentially cause neuronal demyelination, due to the rapid fluid shifts damaging the myelin sheath surrounding neurons (osmotic demyelination syndrome).

Sodium increase should be limited to 10 mmol/L in the first 24 hours, and limited to 8 mmol/L every 24 hours thereafter.

Sodium should be checked every 6, 12 and 24 hours until clinically and biochemically stable; and this should be done using the same method, for example if using a blood gas analyser, continue using this for ongoing monitoring until the sodium is stable.

The IV line should be kept patent with the minimal volume of 0.9% sodium chloride.

Ongoing management should involve treating the underlying cause, and continuing fluid restriction as per appendix 1.

5.6.4 If there is no clinical improvement after hypertonic saline

If there is no clinical improvement despite a 5mmol/L increase in sodium levels, further 2.7% sodium chloride should be administered, aiming for an additional 1 mmol/L sodium increase.

Multiple infusions can be given, providing there is no clinical improvement and the total sodium increase is ≤ 10 mmol/L.

The infusion should be stopped if one of the following criteria are met:

- symptoms improve
- the total sodium increase is > 10 mmol/L
- sodium levels are ≥ 130 mmol/L

Alternative causes for symptoms must explored while the further 2.7% sodium chloride is being infused, as sodium levels ≥ 126 mmol/L are unlikely to cause symptoms.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	9 of 23	

5.6.5 Ongoing management

Patients being treated for severe hyponatraemia require full observations, including a Maternity Obstetric Early Warning Score (MOEWS) and Glasgow coma scale (see appendix 5) every 20 minutes. These observations should be recorded by the midwifery team whilst on labour ward, and the critical care nurses following transfer to critical care.

They should also be catheterized to help record an accurate fluid balance status. Hypertonic saline can cause tissue damage if extravasation occurs, due to its high osmolarity. Therefore if a peripheral cannula is being used, it should be regularly checked for signs of phlebitis.

If osmotic demyelination syndrome does occur it usually presents 48 hours after the initial over-correction. Because of this, patients who have had an increase of >10 mmol/L of sodium in <24 hours should stay as an inpatient until they have been discussed with an endocrinology specialist.

5.7 Continuous electronic fetal monitoring

There is currently no research describing cardiotocographic features consistent with severe maternal hyponatraemia. There have been reports of pathological or non-reassuring CTG changes in fetuses who subsequently developed hyponatraemia related complications, however other studies have not found any changes.

Due to the paucity of evidence of CTG changes and how to manage them, for example if correcting the hyponatraemia with CTG changes improves outcomes; it is not currently advised to perform a CTG purely for maternal hyponatraemia.

5.8 Postpartum

See appendix 2 for quick reference guide.

Inform the neonatal team of any delivery when the mother's most recent sodium level was <130 mmol/L.

If a woman has given birth and her sodium has returned to ≥ 130 mmol/L, any previous hyponatraemia was likely secondary to dilutional hyponatraemia and has now corrected itself. No further sodium monitoring or investigations are required unless there are ongoing clinical concerns e.g. over-rapid correction of sodium.

On the other hand, if the patient's sodium remains <130mmol/L and is not increasing, other causes need to be considered. Please see the diagram and table below for a list of conditions and potential medications that can cause hyponatraemia. But remain aware that excess fluid intake is by far the most common cause.

Initial investigations should include a blood glucose, urinary sodium and paired (collected at the same time) serum and urinary osmolarities. Hyponatraemia is primarily a disorder of water imbalance and is driven by solutes within the blood. Hyperglycaemia can therefore cause hyponatraemia, as water can flow down an osmotic gradient to dilute the glucose but will also dilute the sodium.

A normal serum osmolality with abnormal urinary osmolality suggests a lab artifact caused by high level of protein or lipid rather than a true hyponatraemia. Please note, the serum and

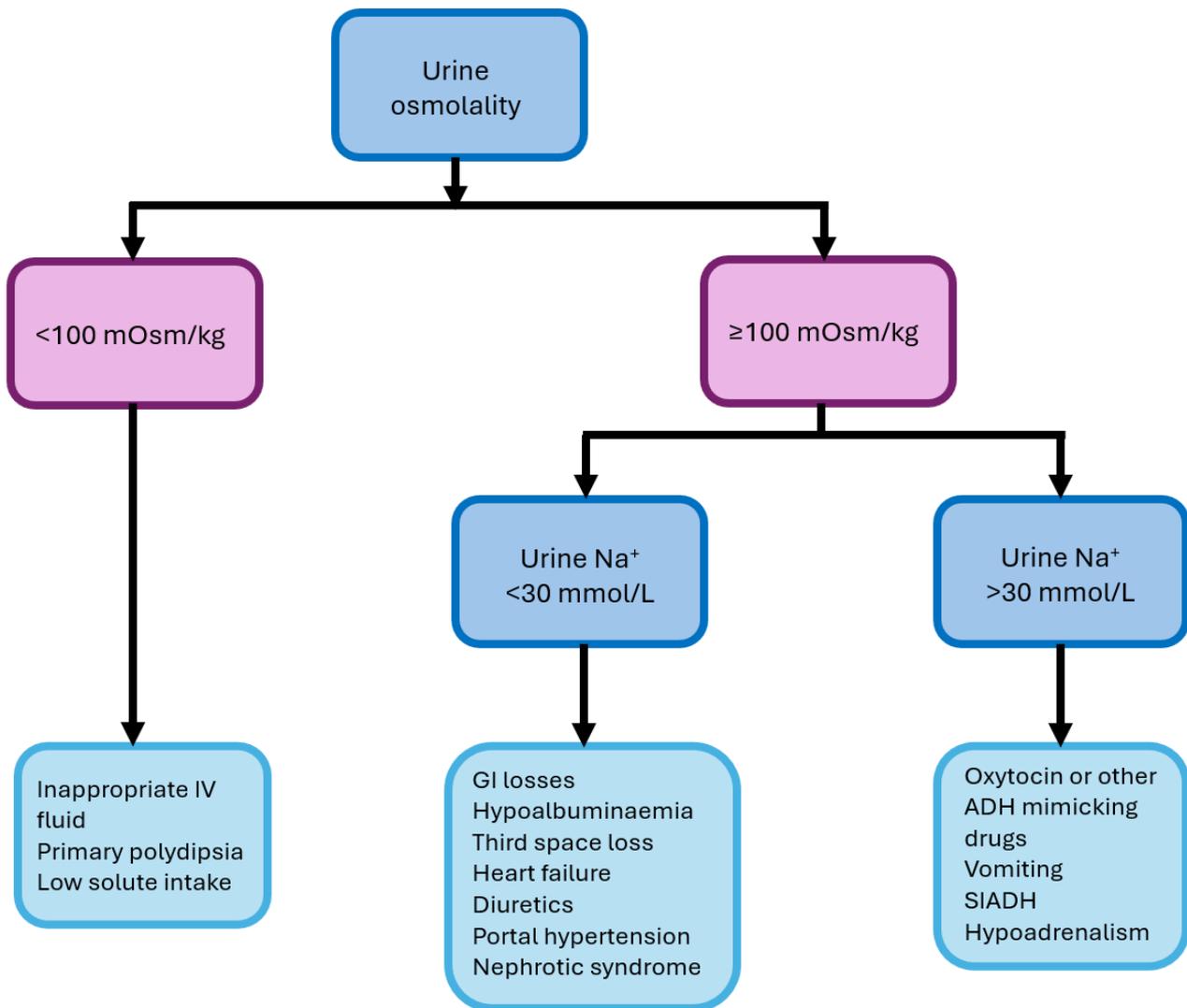
	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	10 of 23	

urine samples need to be taken at the same time in order for this comparison to be made.

If a true hyponatraemia is urinary sodium, thyroid function tests and 9am cortisol levels should be taken to identify the pathology.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	11 of 23	

Figure 1. Diagnostic algorithm for hyponatraemia



5.9 Pregnancy specific conditions

Pre-eclampsia can rarely cause syndrome of inappropriate antidiuretic hormone secretion (SIADH), this is usually noted antenatally but there are some case reports of severe hyponatraemia with otherwise mild pre-eclampsia.

SIADH leads to fluid retention, which can result in hypervolaemic hyponatraemia. Therefore initial management is fluid restriction.

However given the rarity of this condition, it is still reasonable to treat any unrecognised seizures in pregnancy as eclampsia and manage with magnesium sulphate.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	12 of 23	

5.10 Drug induced causes of hyponatraemia

Drug class	Examples that can cause hyponatraemia
SSRI and SNRIs	Citalopram Fluoxetine Paroxetine Sertraline Venlafaxine
Tricyclic antidepressants	Amitriptyline Clomipramine Nortriptyline Trazadone
Anti-convulsants	Carbamazepine Lamotrigine Sodium valproate
Proton pump inhibitors	Lansoprazole Omeprazole
Recreational	MDMA (Ecstasy)
Thiazide diuretics	Bendroflumethiazide diuretics Indapamide
Potassium sparing diuretics	Amiloride Spironolactone

Many drug classes that act centrally can cause SIADH, including anti-depressants and anti-convulsants. This likely to be chronic in nature but can be exacerbated by oxytocin and overhydration that may occur in labour.

6 Monitoring / Audit

This guideline has been peer reviewed by the North West:

- Regional guidelines group
- Maternal medicines network team

The guideline will be reviewed regularly by the Regional Guidelines group, and updates will occur as per the Regional Guideline's group policies. These reviews will occur ahead of the regular update cycle if there is a change to national guidance.

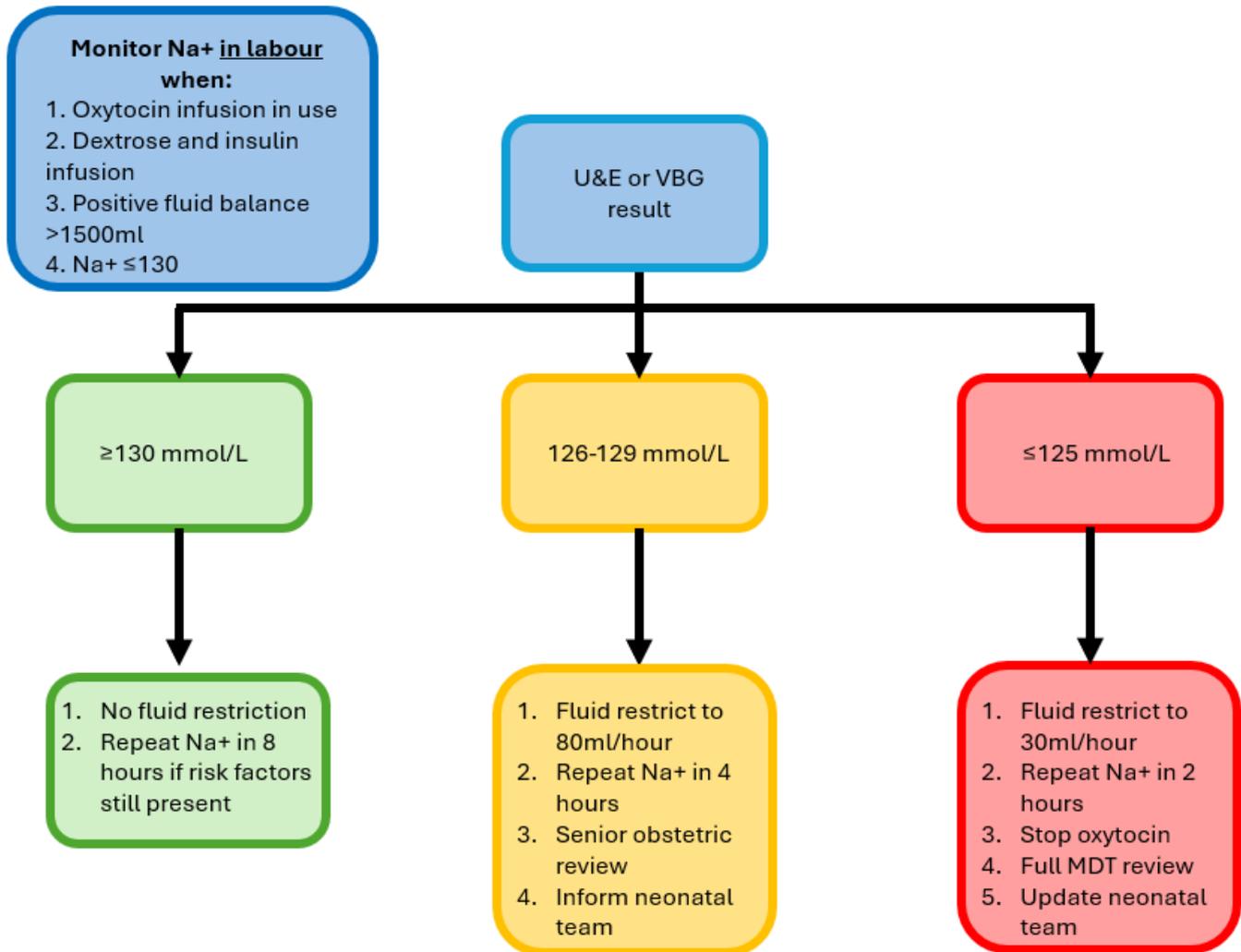
Suggested audit criteria:

- Fluid/balance monitoring occurred in labour
- Patients with risk factors having baseline U&E taken
- Repeat U&E in appropriate time frame
- Recommended management (fluid restriction +/- stopping oxytocin) implemented
- Obstetric review for hyponatraemia
- Critical care involvement in severe hyponatraemia

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	13 of 23	

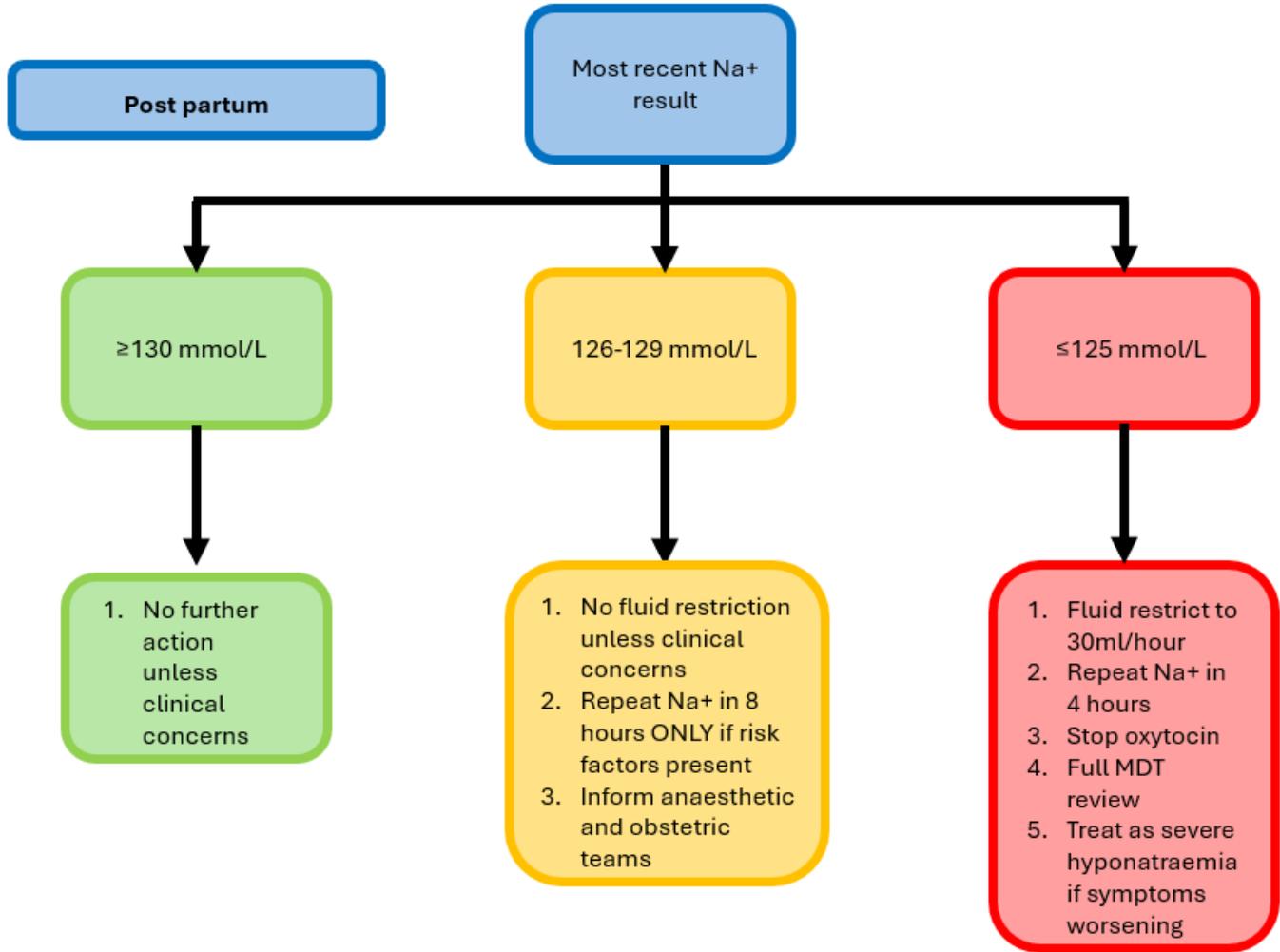
7 Appendices

7.1 Appendix 1: Management of hyponatraemia in labour



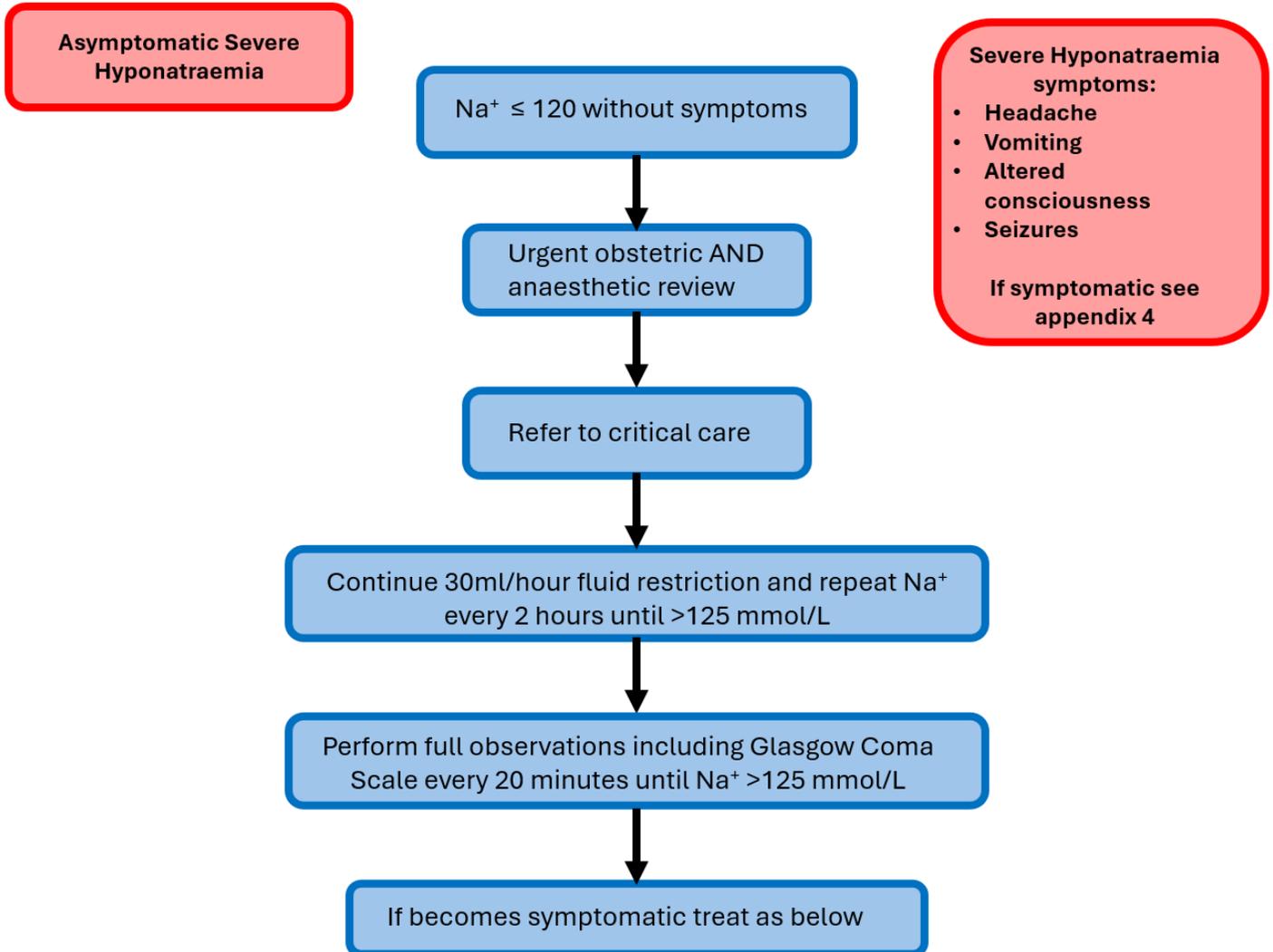
	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	14 of 23	

7.2 Appendix 2: Postpartum management of hyponatraemia identified in labour



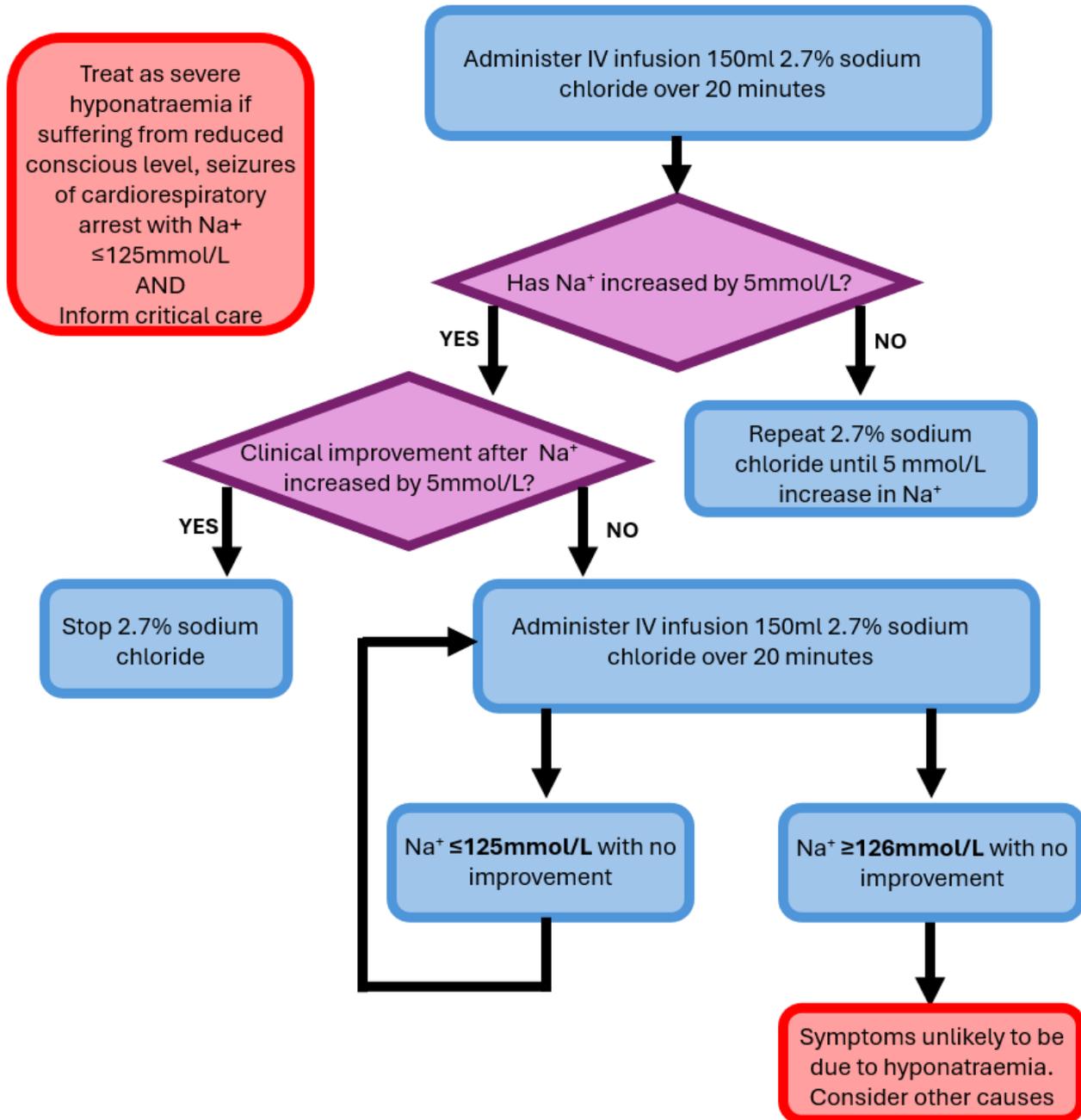
	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	15 of 23	

7.3 Appendix 3: Management of asymptomatic severe hyponatraemia



	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	16 of 23	

7.4 Appendix 4: Management of symptomatic hyponatraemia



Final Version	Issue Date	February 2026	Version	V4
	Review Date	February 2029		17 of 23

Management after initial 150ml 2.7% sodium chloride

- Check Na⁺ with blood gas analyser and send serum sample to laboratory; the sample taken to measure Na⁺ must be taken from **a different limb to the one receiving the infusion**
- Administer a further 150ml 2.7% sodium chloride over 20 minutes if the Na⁺ **has not increased by 5 mmol/L**
- Consider central venous access if multiple infusions are likely to be required
- Monitoring of Na⁺ should be done via a blood gas analyser as the result are obtained instantly, further decisions on management should be supported by Na⁺ values obtained by the same method e.g. from a blood gas analyser

Observations required during (and after) administration of 2.7% sodium chloride

- Patients receive hypertonic saline (2.7% sodium chloride) due to being severely unwell, and therefore require level 2 care and monitoring
- Ideally the administration of hypertonic saline should take place in a level 2 care setting, but treatment should not be delayed to accommodate this, and it may be given whilst transfer to such a setting is being arranged
- Severe symptoms of hyponatraemia are due to cerebral oedema and raised intracranial pressure. As such these patients are likely to have a reduced conscious level and are at risk of fitting
- A full set of observations (including a MOEWS and Glasgow Coma Scale score) should be performed every 20 minutes for the first 2 hours
- Accurate fluid balance is needed, including indwelling urinary catheter

Management after 5 mmol/L increase in Na⁺

- **STOP** 2.7% sodium chloride infusion
- Keep IV line patent with minimum volume of 0.9% sodium chloride required
- Treat the underlying cause
- Limit **total increase in Na⁺ to 10 mmol/L in the first 24 hours**
- Limit the increase in Na⁺ to an additional 8 mmol/L every 24 hours afterwards (day 2 onwards until Na⁺ 130 mmol/L)
- Check Na⁺ every 6, 12 and 24 hours until clinically and biochemically stable using the same method e.g. blood gas analyser

Management after 5 mmol/L increase in Na⁺ without clinical improvement

- Administer 150ml of 2.7% sodium chloride over 20 minutes
- Measure Na⁺ immediately after infusion, aiming for additional **1 mmol/L increase** in Na⁺
- Stop infusion if:
 - Symptoms improve
 - OR
 - Na⁺ increases >10 mmol/L in total
 - OR
 - Na⁺ reaches 130 mmol/L
- **Explore alternative causes of symptoms**

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	18 of 23	

7.5 Appendix 5: Glasgow Coma Scale

GLASGOW COMA SCALE : Do it this way

Institute of Neurological Sciences NHS Greater Glasgow and Clyde



CHECK

For factors Interfering with communication, ability to respond and other injuries



OBSERVE

Eye opening , content of speech and movements of right and left sides



STIMULATE

Sound: spoken or shouted request
Physical: Pressure on finger tip, trapezius or supraorbital notch



RATE

Assign according to highest response observed

Eye opening

Criterion	Observed	Rating	Score
Open before stimulus	✓	Spontaneous	4
After spoken or shouted request	✓	To sound	3
After finger tip stimulus	✓	To pressure	2
No opening at any time, no interfering factor	✓	None	1
Closed by local factor	✓	Non testable	NT

Verbal response

Criterion	Observed	Rating	Score
Correctly gives name, place and date	✓	Orientated	5
Not orientated but communication coherent	✓	Confused	4
Intelligible single words	✓	Words	3
Only moans / groans	✓	Sounds	2
No audible response, no interfering factor	✓	None	1
Factor interfering with communication	✓	Non testable	NT

Best motor response

Criterion	Observed	Rating	Score
Obeys 2-part request	✓	Obeys commands	6
Brings hand above clavicle to stimulus on head/neck	✓	Localising	5
Bends arm at elbow rapidly but features not predominantly abnormal	✓	Normal flexion	4
Bends arm at elbow, features clearly predominantly abnormal	✓	Abnormal flexion	3
Extends arm at elbow	✓	Extension	2
No movement in arms / legs, no interfering factor	✓	None	1
Paralysed or other limiting factor	✓	Non testable	NT

Sites For Physical Stimulation

Finger tip pressure



Trapezius Pinch



Supraorbital notch



Features of Flexion Responses

Modified with permission from Van Der Naalt 2004
Ned Tijdschr Geneesk

Abnormal Flexion

Slow Stereotyped
Arm across chest
Forearm rotates
Thumb clenched
Leg extends



Normal flexion

Rapid
Variable
Arm away from body

For further information and video demonstration visit www.glasgowcomascale.org

Graphic design by scapart.org based on text and illustrations from medical illustration art - 2000s
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Final Version	Issue Date	February 2026	Version	V4
	Review Date	February 2029		19 of 23

8 Supporting references & national guidance

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	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	20 of 23	

9 Equality Impact Assessment

Section 1: Equality Impact Assessment (EIA) Form

The EIA process allows the group to identify where a policy or service may have a negative impact on an individual or particular group of people.

Information Category	Detailed Information
Name of the strategy / policy / proposal / service function to be assessed:	Full title and version number
Directorate and service area:	Department/Speciality and Care Group or Corporate Group
Is this a new or existing Policy?	New / Existing – delete as appropriate
Name of individual completing EIA (Should be completed by an individual with a good understanding of the Service/Policy):	Name and Job Title
Contact details:	Number in full, not extension only

Information Category	Detailed Information
1. Policy Aim - Who is the Policy aimed at? (The Policy is the Strategy, Policy, Proposal or Service Change to be assessed)	
2. Policy Objectives	
3. Policy Intended Outcomes	
4. How will you measure each outcome?	
5. Who is intended to benefit from the policy?	
6a. Who did you consult with? (Please select Yes or No for each category)	<ul style="list-style-type: none"> • Workforce: Choose an item. • Patients/ visitors: Choose an item. • Local groups/ system partners: Choose an item. • External organisations: Choose an item. • Other: Choose an item.
6b. Please list the individuals/groups who have been consulted about this policy.	Please record specific names of individuals/ groups:

Final Version	Issue Date	February 2026	Version	V4
	Review Date	February 2029		21 of 23

Information Category	Detailed Information
6c. What was the outcome of the consultation?	
6d. Have you used any of the following to assist your assessment?	National or local statistics, audits, activity reports, process maps, complaints, staff, or patient surveys:

7. The Impact
 Following consultation with key groups, has a negative impact been identified for any protected characteristic? Please note that a rationale is required for each one.

Where a negative impact is identified without rationale, the key groups will need to be consulted again.

Protected Characteristic	(Yes or No)	Rationale
Age	Choose.	
Sex (male or female)	Choose.	
Gender reassignment (Transgender, non-binary, gender fluid etc.)	Choose.	
Race	Choose.	
Disability (e.g. physical or cognitive impairment, mental health, long term conditions etc.)	Choose.	
Religion or belief	Choose.	
Marriage and civil partnership	Choose.	
Pregnancy and maternity	Choose.	
Sexual orientation (e.g. gay, straight, bisexual, lesbian etc.)	Choose.	

A robust rationale must be in place for all protected characteristics. If a negative impact has been identified, please complete section 2. If no negative impact has been identified and if this is not a major service change, you can end the assessment here.

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	22 of 23	

Name of person confirming result of initial impact assessment: [Name to be included here.](#)

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	Issue Date	February 2026	Version	V4
Final Version	Review Date	February 2029	23 of 23	