Recommendations

Health equity

These general points apply to all recommendations so are summarised here rather than repeated for each recommendation. Additional points are listed under specific recommendations where relevant.

Health equity for Māori

Health professionals must apply this guideline equitably to prevent harm and ensure accountability in implementing recommendations for Māori as part of a pro-equity approach. Pākehā benefit from health system privileges, while Māori face systemic racism, leading to reduced health benefits. Health equity can be improved if Māori receive effective interventions.

Ensure Māori whānau are fully informed about their healthcare options as a part of a mana motuhake (self-determination), including prevention, monitoring and treatment options, health benefits and potential risks. Detailed explanations of all interventions, their necessity, and results should also be provided to help achieve equitable health outcomes. Ensure whānau are provided with information in multiple formats (oral, written, online, video) that align with cultural values.

Whānau living in rural areas may face additional financial costs and barriers to accessing specialist services. Proactively support these whānau by informing and supporting them to access available financial assistance and resources to access specialist services.

Health equity for other groups

Health professionals must apply this guideline equitably to prevent harm. Health equity can be improved if all whānau receive effective interventions.

Many groups, including Pacific, Asian, migrant and rural communities, also face significant health inequities. These groups often encounter barriers such as language difficulties, lower health literacy, and challenges in understanding their healthcare options. It is important that all whānau are fully informed about their healthcare options, including prevention, monitoring and treatment options, health benefits and potential risks. Detailed

explanations of all interventions, their necessity, and results should also be provided to help achieve equitable health outcomes. Culturally appropriate communication, use of interpreter services where required, along with the use of multiple formats (oral, written, online, video), can help improve engagement with health services.

Rural communities may also experience additional challenges, such as increased travel costs and limited access to specialist care. Providing proactive support, including information about and assistance to access financial and other resources to help access specialist services, is crucial to reducing these inequities and improving health outcomes. Specific additional issues are addressed under the recommendations and Evidence to Decision Tables (EtDs) where relevant.

Question1. Does antenatal expression of breastmilk reduce the risk of neonatal hypoglycaemia?

PICO (Population, Intervention, Comparison, Outcome): Should antenatal expression of breastmilk vs. no expression of breast milk be used for preventing neonatal hypoglycaemia?

Recommendation 1:

Expression of breastmilk may be considered after 36 weeks' gestation in pregnant women whose baby is likely to be at risk of neonatal hypoglycaemia and who have no contraindications. [Conditional recommendation]

Justification: Moderate to very low certainty of evidence suggests that antenatal expression of breastmilk may lead to a small reduction in neonatal hypoglycaemia, a moderate increase in fully breastfeeding at hospital discharge, and a moderate decrease in the duration of the initial hospital stay.

The acceptability of this practice varies due to some women experiencing difficulties and discomfort with antenatal expression.

Antenatal expression of breast milk may encourage mothers to breastfeed, and have an additional positive effect on their hinengaro (mental health) through providing nutrition for their baby.

Implementation considerations: Breast pumps are not appropriate for antenatal expression; hand expression suffices for this purpose.

Expression of breastmilk should not be considered in at risk pregnancies. For contraindications consult local guidelines, lead maternity carer (LMC), diabetes specialist, obstetrician or lactation consultant.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

The effects of expressing milk on maternal well-being, including factors such as stress from the inability to express colostrum.

Health equity: Provide mother and the whānau she wishes to involve with resources and support for antenatal expression of breastmilk that align with their cultural values. Ensure whānau have access to reliable refrigeration or freezer for storing expressed breastmilk.

Evidence to decision table: refer to Appendix G

Question 2. Does tight maternal glycaemic control reduce the risk of neonatal hypoglycaemia?

PICO: Should tighter maternal glycaemic control during pregnancy in women with diabetes vs. less-tight maternal glycaemic control during pregnancy be used for preventing neonatal hypoglycaemia?

Recommendation 2:

Tighter glycaemic control during pregnancy is suggested for women with diabetes. Follow recommendations of the national guideline – "Testing for, diagnosing and managing gestational diabetes (diabetes of pregnancy) Te whakamātau, te tautohu me te whakahaere i te mate huka hapūtanga"(1). [Conditional recommendation]

Justification: Low certainty evidence showed that tight maternal glycaemic control during pregnancy compared to less tight had little to no effect on neonatal hypoglycaemia, but resulted in a small reduction in mortality and morbidity, and admissions to (neonatal intensive care unit (NICU).

However, adverse effects for mothers when using tight targets should be considered. Women may have difficulty in adhering to tighter glycaemic targets.

Implementation considerations: See the national guideline "Testing for, diagnosing and managing gestational diabetes (diabetes of pregnancy) Te whakamātau, te tautohu me te whakahaere i te mate huka hapūtanga"(1).

Monitoring and evaluation: The the national guideline "Testing for, diagnosing and managing gestational diabetes (diabetes of pregnancy) Te whakamātau, te tautohu me te whakahaere i te mate huka hapūtanga"(1) suggests that tight targets are frequently harder to achieve, which may explain poor adherence to tight targets (1). Monitoring of adherence is recommended.

Research priorities:

Studies are needed on:

1. The effect of tight maternal glycaemic control on neonatal hypoglycaemia and long-term childhood outcomes.
2. Factors influencing adherence to tight glycaemic control targets in pregnancy and how whānau can be supported to achieve these, particularly in specific populations.
3. Patient values and preferences surrounding tight glycaemic control in pregnancy.
4. The cost-effectiveness of employing tight glycaemic control in pregnancy.

Health Equity: Gestational diabetes occurs at higher rates in Māori, Pacific, Asian, and Indian populations. Health professionals working alongside these population groups need to work towards tight glycaemic control in a pro-equity approach to improve outcomes. Health professionals should ensure that glycaemic targets are based on clinical guidelines and individual patient needs prioritising those who are most affected by issues such as access and systemic privilege, to avoid potential harm and ensure equitable care.

Evidence to decision table: refer to Appendix G

Question 3. Does tight intrapartum glycaemic control reduce the risk of neonatal hypoglycaemia?

PICO: Should tight intrapartum glycaemic control vs. less tight or no intrapartum glycaemic control be used for neonatal hypoglycaemia?

Recommendation 3:

For intrapartum glycaemic control, follow recommendations of the national guideline "Testing for, diagnosing and managing gestational diabetes (diabetes of pregnancy) Te

whakamātau, te tautohu me te whakahaere i te mate huka hapūtanga"(1). [Conditional recommendation for either opition]

Justification: Very low certainty of evidence showed potential benefit in reducing neonatal hypoglycaemia and admission to NICU, but also potential harm including increased caesarean section and reduction in exclusive breastfeeding.

Implementation considerations: Tighter glycaemic control during labour may be more relevant for women with type I and type II diabetes than women with GDM. Clinical decision-making should determine the appropriate level of intrapartum control and monitoring on an individualised basis.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

The effects of tight glycaemic control during labour for women with Type I and Type II diabetes, and GDM, including short-term and long-term maternal and neonatal/childhood outcomes. Given the potential iatrogenic harms associated with this treatment approach, separate recommendations may be necessary for each group.

Health Equity: People living in rural areas face challenges in accessing specialised care. Although women with diabetes often give birth at specialist centres, some may not have received a timely diagnosis during pregnancy, potentially leading to inequitable access to appropriate care and interventions. The responsibility lies with the system to facilitate equitable access, removing barriers rather than placing the burden on whānau.

Evidence to decision table: refer to Appendix G

Question 4. Are babies who had delayed cord clamping less likely to develop neonatal hypoglycaemia?

PICO: Should delayed cord clamping vs. early cord clamping be used for the prevention of neonatal hypoglycaemia?

Recommendation 4:

Umbilical cord clamping should occur not earlier than 1 minute after birth if the baby's condition allows. [**Conditional recommendation**]

Justification: Low certainty evidence shows that delayed cord clamping may result in small reduction in neonatal hypoglycaemia, moderate reduction in neurodevelopmental impairment at 12 to 24 months, moderate reduction in neonatal mortality, and small increase in fully breastfeeding at hospital discharge.

The New Zealand College of Midwives (2024) guidelines suggest delaying cord clamping for 3 minutes or until the umbilical cord stops pulsating (whichever occurs later) for term and pre-term babies who do not require resuscitation at birth, as this is associated with improved neonatal outcomes (2). WHO (2023) also recommends delayed umbilical cord clamping (not earlier than 1 minute after birth) for improving maternal and infant health and nutrition outcomes (3).

Implementation considerations: If the baby becomes hypothermic, this could increase the chances of hypoglycaemia. Place the baby directly on the mother's chest immediately after birth and cover both with a warm blanket.

Monitoring and evaluation: If the baby is unwell and needs resuscitation, cord clamping before one minute after birth might be required.(4).

Research priorities: Nil.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 5. Does skin-to-skin contact reduce the risk of neonatal hypoglycaemia?

PICO: Should skin-to-skin contact vs. no skin-to-skin contact be used for the prevention of neonatal hypoglycaemia?

Recommendation 5:

Encourage skin-to-skin contact between mother and baby as early as possible after birth.

[Conditional recommendation]

Justification: Low certainty of evidence shows skin-to-skin contact may result in a large reduction in neonatal hypoglycaemia and duration of hospital stay, a small reduction in admission to NICU, less separation from the mother for treatment of hypoglycaemia before discharge home and a large increase in breastfeeding.

Skin-to-skin is largely acceptable and feasible as it is already standard practice in Aotearoa New Zealand. Cost is negligible.

WHO also recommends that early and uninterrupted skin-to-skin contact between mothers and babies should be facilitated and encouraged as soon as possible after birth (5).

Implementation considerations: Place the baby directly on the mother's chest immediately after birth and cover both with a warm blanket. United Nations International Children's Emergency Fund (UNICEF) recommends that babies should have skin-to-skin contact at least until after their first feed (6).

Skin-to-skin contact might not be appropriate for all babies, depending on the clinical condition of the mother and baby.

Monitoring and evaluation: All babies should be routinely monitored whilst in skin-to-skin contact. Observations should include checking of airway and breathing, colour, tone and temperature (7).

If there are any concerns about the baby's oxygen saturation, it should be monitored closely.

Research priorities:

Studies are needed on:

Effect of skin-to-skin contact with adults other than the mother on neonatal hypoglycaemia.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 6. Are babies given thermal care (measures to reduce heat loss) less likely to develop neonatal hypoglycaemia?

PICO: Should thermal care vs. routine care be used for prevention of neonatal hypoglycaemia?

Recommendation 6:

Keep the baby dry and warm after birth. Prioritise skin-to-skin contact with the mother. [Conditional recommendation]

Justification: Low to very low certainty evidence shows skin-to-skin contact may result in a large reduction in hypothermia and neonatal hypoglycaemia and is recommended for all well mother/baby dyads. For very low birthweight (VLBW) babies, low-certainty evidence

shows that plastic wrap or a plastic bag can result in a moderate reduction in hypoglycaemia, a large reduction in the duration of the initial hospital stay, and a large reduction in hypothermia upon admission to the NICU, although it may lead to a small increase in hyperthermia on admission. Plastic wrap is readily available and commonly used for keeping VLBW babies warm.

Very low certainty of evidence shows use of a thermal mattress or thermal blanket had little to no effect on hypoglycaemia, and a large reduction in moderate hypothermia on admission to NICU. Thermal mattresses are expensive and lack of evidence of effectiveness means they are not a routine option.

A study on delayed bathing was considered by the Panel to not be relevant to this recommendation.

Implementation considerations: Consider use of plastic wraps to keep the baby warm when skin-to-skin is not practicable. If a specific neonatal plastic wrap is not available, clingfilm can be used.

Monitoring and evaluation: Monitor baby's temperature to avoid hyperthermia.

Research priorities:

Studies are needed on:

The most effective strategies for preventing hypothermia and consequent hypoglycaemia, particularly in term babies and those at risk of hypoglycaemia, and when skin-to-skin is not feasible.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 7. Does early feeding reduce the risk of neonatal hypoglycaemia?

PICO: Should early feeding vs. delayed feeding be used for the prevention of neonatal hypoglycaemia?

Recommendation 7:

Feeding should be initiated in the first hour after birth. [Conditional recommendation]

Justification: Low certainty of evidence shows early feeding may be associated with a large reduction in hypoglycaemia, a small to moderate reduction in neonatal mortality, and a large increase in fully breastfeeding at hospital discharge.

Early feeding is widely acceptable and feasible in Aotearoa New Zealand.

Early breastfeeding is associated with higher rates of exclusive breastfeeding, with the associated benefits.

WHO also recommends all mothers should be supported to initiate breastfeeding as soon as possible after birth, within the first hour (5).

Implementation considerations: If the mother wants to breastfeed but is unable to in the first hour, consider expression of breastmilk at this time to support establishment of lactation and encourage breastfeeding.

It is important to ensure that the baby whose mother plans not to breastfeed is fed a formula that is safe, suitable and properly prepared (8, 9).

Monitoring and evaluation: Nil.

Research priorities: Nil.

Health Equity: Ensure whānau are fully informed and supported about the benefits of pēpi's first feed being from the breast. Discuss with whānau if they have cultural practices that are important to carry out following the birth, and support this to be woven into care together with clinician activities. Harm occurs when health professionals do not engage with whānau about their cultural preferences.

Evidence to decision table: refer to Appendix G

Question 8. Are babies given expressed breast milk (mother's own or donor human milk) less likely to develop neonatal hypoglycaemia?

PICO: Should expressed breastmilk vs. other or no intervention be used for preventing or treating neonatal hypoglycaemia?

Recommendation 8:

Prioritise breastfeeding where possible rather than expression of breastmilk for preventing or treating neonatal hypoglycaemia in the first 48 hours after birth.

[**Conditional recommendation**]

Justification: Very low certainty evidence from one randomised controlled trial (RCT) suggests that supplementation of breastfeeding with donor breastmilk or formula, but not mother's own breastmilk, may increase blood glucose concentrations in hypoglycaemic babies in the first 48 hours after birth.

However, breastfeeding hypoglycaemic babies in the first 48 hours reduced the likelihood of hypoglycaemia recurring. Thus, mothers should be encouraged to breastfeed rather than to express breastmilk to feed to their baby.

Implementation considerations: Mothers should be well supported to breastfeed in preference to breastmilk expression. The increase in blood glucose concentration after breastfeeding is greater after longer feeds (>30 minutes) and after feeding from both breasts, so encouraging these practices may be helpful for babies at risk of or experiencing neonatal hypoglycaemia.

Expression of breastmilk may help support lactation if effective breastfeeding is not possible, although there is no evidence the expressed breastmilk will help prevent hypoglycaemia. If a baby is already hypoglycaemic, give oral dextrose gel and offer a feed, which could include expressed breastmilk if breastfeeding is not appropriate.

Many mothers face challenges and negative experiences when trying to express breastmilk, but some mothers of unwell or preterm babies may find it empowering to contribute to their baby's well-being through expressing milk.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

1. The effectiveness of donor milk for preventing and treating hypoglycaemia.
2. The effectiveness of expressed breastmilk (mother’s or donor milk) for treating neonatal hypoglycaemia.

Health Equity: The acceptability of donor milk is individual for whānau Māori, so each whānau group should be asked what their preference is, including acceptability of donor milk before giving to pēpi. Harm occurs when health professionals do not engage with whānau about their cultural preferences.

Accessibility of donor milk is a concern, especially outside major centres where NICUs and milk banks are scarce. In Aotearoa New Zealand, systemic inequities impact access to lactation consultants and the establishment of donor milk banks.

Evidence to decision table: refer to Appendix G

Question 9. Are babies given prophylactic oral dextrose gel less likely to develop neonatal hypoglycaemia?

PICO: Should oral dextrose gel vs. placebo be used for preventing neonatal hypoglycaemia?

Recommendation 9:

Oral dextrose gel should not be given *routinely* to at-risk babies to prevent neonatal hypoglycaemia. [Conditional recommendation]

Justification: Prophylactic oral dextrose gel reduces the risk of neonatal hypoglycaemia in at-risk babies but does not reduce NICU admission or need for intravenous treatment. It may make little to no difference to the risk of neurodevelopmental impairment at two years, but the confidence intervals include the possibility of substantial benefit or harm. Evidence at six to seven years is limited to a single small study.

In view of its limited short-term benefits, and potential applicability to a very large proportion of all newborn babies (approximately 30%), prophylactic oral dextrose gel should not be incorporated into routine practice until additional information is available about the balance of risks and harms for later neurological disability.

Implementation considerations: Consider offering prophylactic dextrose if risk of hypoglycaemia is considered to be high by practitioner or family and they are well-informed about available evidence, including benefits and risks.

Draw up the prescribed dose (0.5ml/kg or 200 mg/kg 40% dextrose gel) into an enteral syringe and administer at 1 hour of age, using the procedures as for dextrose gel treatment (see recommendation 22).

Prophylactic dextrose gel can be given to a baby while having skin-to-skin care.

Monitoring and evaluation: All babies at risk of hypoglycaemia require clinical monitoring and testing for hypoglycaemia, whether or not they have received prophylactic dextrose gel.

Research priorities:

Studies are needed on:

1. Effect of prophylactic oral dextrose gel for neonatal hypoglycaemia on later neurological disability.
2. The effectiveness of prophylactic oral dextrose gel compared to other preventative interventions such as harvested colostrum, donor milk or infant formula.

Health Equity: Māori, Pacific, and Asian whānau are likely to accept oral dextrose gel treatment, especially if the mother has experienced diabetes. Discuss with whānau if they have cultural practices that are important to carry out following the birth, and support this to be woven into care together with clinician activities. Harm occurs when health professionals do not engage with whānau about their cultural preferences.

Evidence to decision table: refer to Appendix G

Question 10. Are babies given formula less likely to develop neonatal hypoglycaemia?

PICO: Should formula vs. control be used for preventing neonatal hypoglycaemia?

Recommendation 10:

Formula should not be given to at-risk babies to prevent neonatal hypoglycaemia.

[Conditional recommendation]

Justification: Very low certainty of evidence shows uncertain effect on of formula on the prevention of neonatal hypoglycaemia, fully breastfeeding at hospital discharge or length of hospital stay, and uncertain effects on blood glucose concentrations.

Implementation considerations: Whānau should be provided with breastfeeding support, particularly for at-risk babies, ensuring that breastfeeding is promoted as the first line of prevention for neonatal hypoglycaemia. Implementation should account for cultural preferences and the importance of breastfeeding in different communities.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

Effectiveness of formula feeding in preventing neonatal hypoglycaemia.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 11. What are the benefits and risks of testing?

PICO: Should testing for neonatal hypoglycaemia vs. not testing be used for babies at risk of neonatal hypoglycaemia?

Recommendation 11:

Blood glucose measurements should be offered for babies with identified risk factors of neonatal hypoglycaemia (see recommendation 12). [Conditional recommendation]

Justification: Most babies with hypoglycaemia have no clinical signs, so blood testing is the only way to detect low glucose concentrations.

It is common practice to test babies considered at risk of neonatal hypoglycaemia and there is no evidence to support changing this approach.

There is no robust evidence of benefit for at-risk babies and some evidence of harm, primarily from painful procedures and a reduction in breastfeeding. Nevertheless, the potential for death and brain damage from undiagnosed hypoglycaemia was considered to outweigh the pain and distress caused by testing.

Although resource requirements are substantial, with current screening criteria applicable to 26-28% of all babies, it is feasible as it is currently being done.

Implementation considerations: Whānau should be fully informed about the reasons for testing and encouraged to participate in decisions about pain relief (see recommendation 13). Provide easily understandable information in a range of formats, including videos and apps. Address how babies can be supported during tests, and how the test can be made less painful for the baby (see recommendation 14).

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

Outcomes in children whose whānau declined screening for neonatal hypoglycaemia and the reasons for declining.

Health Equity: Screening rates for babies delivered rurally or from underrepresented groups are not known. However, if testing is implemented equitably, this is likely to increase health equity. Ask whānau what their preferences are for painful procedures. Some whānau may wish to use rongoā Māori (traditional Māori medicine that takes a holistic approach) e.g. waiata, karakia, oriori to support pēpi during a painful procedure.

Evidence to decision table: refer to Appendix G

Question 12. Who to test?

i) Which babies are at increased risk of neonatal hypoglycaemia?

ii) Which babies should be tested for neonatal hypoglycaemia?

iii) Which signs and symptoms are indications for testing?

PICO: Should expanded or restricted criteria vs. current criteria be used for screening for neonatal hypoglycaemia?

Recommendation 12:

Screening is recommended for babies with the following risk factors:

- Maternal diabetes (any type);
- Preterm birth (<37 weeks' gestation);
- Small for gestational age (<10th percentile using customised or population growth charts);
- Large for gestational age (>90th percentile using customised or population growth charts);
- If gestation unknown: low birthweight (<2500 g) or macrosomia (>4500 g);
- Unwell (e.g. respiratory distress, history of fetal distress or asphyxia, hypothermia, delayed or poor feeding);
- Maternal use of antidepressant medications, alpha or beta blocker medications, amphetamines (both prescribed and not prescribed), anti-psychotic medications.

Screening is recommended for babies with any clinical signs potentially related to hypoglycaemia including: jitteriness, seizures, poor feeding, lethargy, irritability, cyanosis, hypotonia, apnoea, tachypnoea, hypothermia, respiratory distress, asphyxia, abnormal cry, pallor, and vomiting. **[Conditional recommendation]**

Justification: These criteria are similar to those already in use around Aotearoa New Zealand.

The cost of testing is likely to be small compared to the cost of brain injury from undetected hypoglycaemia for the individual, although the evidence that prompt detection and treatment of hypoglycaemia alters neurodevelopmental outcomes is very uncertain.

Implementation considerations:

Testing should be undertaken using a reliable analyser (see recommendation 14).

Address how babies can be supported during tests, and how the test can be made less painful for the baby (see recommendation 13).

A full assessment, including clinical history, should be made for babies exhibing any signs of neonatal hypoglycaemia. Consider prompt referral to a paediatrician if a baby is unwell or shows clinical signs associated with neonatal hypoglycaemia. However, testing and treatment if required should not be delayed pending such referral (see recommendation 21).

The Small for Gestational Age / Fetal Growth Restriction Guidelines of Aotearoa New Zealand recommend using customised centiles to define small for gestational age (10).

Monitoring and evaluation: Nil

Research priorities:

Studies are needed on:

Outcomes of screening versus not screening large-for-gestational age babies.

Health Equity: The frequency of risk factors for hypoglycaemia varies with ethnicity. Ensure whānau are fully informed of the reasons for testing, health benefits and potential adverse effects of blood glucose testing, and the results of any tests. Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 13. When to test?

i) At what age should testing start?

ii) How often should testing be performed?

iii) When should testing stop?

PICO: Should other timings vs. start at 1-2 hours, intervals of 3-4 hours, finish after 12 hours of glucose concentrations above the threshold be used for testing neonatal hypoglycaemia?

Recommendation 13:

Test the blood glucose concentration of babies at risk of neonatal hypoglycaemia at 1-2 hours after birth, (preferably after the first feed but before 2 hours) then at intervals of 3-4 hours, independent of feeding schedule. [**Conditional recommendation**]

Stop testing after glucose concentrations have remained ≥2.6 mmol/L for 12 hours from birth or from the first normal test (≥2.6 mmol/L) after any low glucose concentrations (<2.6 mmol/L) provided the baby is feeding adequately.

Justification: There is a physiological nadir in blood glucose concentrations at approximately 30-90 minutes after birth. In many babies, low glucose concentrations during this period will resolve spontaneously. Limited evidence suggests that low glucose concentrations are more common at 1 hour than at 2 hours and become less common thereafter.

A relatively small proportion (0.3-1.1%) of cases of neonatal hypoglycaemia may be missed if screening ends at 12 hours.

Severe hypoglycaemia is most common within the first 12 hours after birth.

Limited evidence suggests that 10 – 17% of episodes occur between the initial test at 1–2 hours and the second test, approximately 3–4 hours later, so repeated testing is required.

There is very little change in blood glucose concentrations with feeding in the first 48 hours, so timing of testing can be independent of feeding.

Implementation considerations: The criteria for stopping testing should be 12 hours of blood glucose concentrations ≥2.6 mmol/L with adequate feeding, not the number of tests conducted.

Monitoring and evaluation: Babies who have required intravenous dextrose or supplemental feeds for the treatment of neonatal hypoglycaemia should have 12 hours of blood glucose concentrations ≥2.6 mmol/L after these additional measures have ended before testing is stopped.

Research priorities: The correct time to stop testing is not known. The GLOW study showed that healthy term babies continued to have episodes of glucose concentrations <2.6 mmol/L up to 5 days after birth, although few occurred after 3 days.

Studies are needed on:

1. whether extending screening beyond 12 hours improves outcomes.
2. the frequency and clinical significance of glucose concentrations <2.6 mmol/L after 12 hours in babies who previously had glucose concentrations ≥2.6 mmol/L.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question14. What is the best care for babies while being tested?

PICO: Should specific pain management strategies vs. control/ placebo/ no intervention be used for pain management during blood sampling for neonatal hypoglycaemia?

Recommendation 14:

Pain management strategies should be used during blood sampling for neonatal hypoglycaemia. [Conditional recommendation]

Effective pain management strategies include skin-to-skin contact, breastfeeding, and oral sucrose.

Justification: Skin-to-skin contact, breastfeeding, and oral sucrose each result in medium to large reductions in pain scores related to heel-prick testing with minimal or no apparent adverse effects. Expressed breastmilk may also result in a small reduction in pain scores but there are few studies and the evidence is very uncertain.

Implementation considerations: Whānau should be given the opportunity to be involved in the choice of and provision of pain management related to blood testing.

Monitoring and evaluation: Nil.

Research priorities: Nil.

Health Equity: Ask whānau what their preferences are for painful procedures. Some whānau Māori may wish to use rongoā Māori (traditional Māori medicine that takes a holistic approach) e.g. waiata, karakia, oriori to support pēpi during a painful procedure.

Evidence to decision table: refer to Appendix G

Question 15. Which type of device should be used for testing?

PICO: Should a point-of-care testing method be used to screen for hypoglycaemia in neonates?

Recommendation 15:

Testing should use a validated and reliable point-of-care device using a glucose oxidase, glucose dehydrogenase or hexokinase method with electrochemical or amperometric detection. [Strong recommendation]

Justification: Using more reliable testing methods is essential for accurate diagnosis and treatment. It can also reduce the number of heel pricks and is cost saving.

The common practice of using a less accurate device, with confirmation of low glucose concentrations using a more accurate device, is NOT appropriate as it does not address the problem of false negative tests (13-30%), potentially delays treatment, and increases costs. The panel considered that recommending more reliable devices was essential to drive improvements in equity and resource allocation, leading to long-term cost savings despite potentially initial higher costs.

Implementation considerations: Examples of currently available devices meeting these requirements include Elite XL, iSTAT, Freestyle, and ABL 800.

Monitoring and evaluation: A list of currently available devices that are appropriate for neonatal blood glucose testing should be made widely available and updated regularly.

Research priorities: Nil.

Health Equity: It is essential that appropriate analysers are available in all settings where newborn babies are cared for, including in primary units, to avoid potentially widening health inequities.

Evidence to decision table: refer to Appendix G

Question 16. What is the best working definition (operational threshold) of neonatal hypoglycaemia?

PICO: Should higher or lower blood glucose concentrations vs. blood glucose concentration of 2.6 mmol/L be used for defining of neonatal hypoglycaemia?

Recommendation 16:

A blood glucose concentration of <2.6 mmol/L should be used as the definition (operational threshold) for neonatal hypoglycaemia. [Conditional recommendation]

Justification: There is some evidence for supporting the current operational threshold of <2.6mmol/L, and a lack of evidence to justify changing it.

Low certainty evidence from a single RCT shows that using a threshold of <2.0mmol/L has little to no effect on neurodevelopmental outcomes at 18 months but results in a large increase in moderate hypoglycaemia (2.0 – 2.6 mmol/L), and a moderate increase in severe hypoglycaemia (<2.0 mmol/L). The effect on serious adverse effects was uncertain.The panel noted that babies with initial blood glucose concentrations <1.9 mmol/L were

excluded from this trial, and that 18 months was likely too early to detect any effects of hypoglycaemia on neurodevelopmental outcomes of interest.

The operational threshold of blood glucose concentrations <2.6 mmol/L is consistent with WHO guidelines (11).

Implementation considerations: Consider additional investigations (see recommendation 18) and consultation with an paediatric endocrinologist or other relevant specialist if hypoglycaemia persists after 72 hours of age.

Monitoring and evaluation: Blood glucose concentrations should continue to be monitored while babies are being treated for hypoglycaemia and for at least 12 hours after treatment stops and baby is feeding adequately.

Research priorities:

Studies are needed on:

Benefits and harm of changing to a lower or higher glucose threshold, particularly on later neurodevelopmental outcomes at least through to school age.

Health Equity: The impact on health equity is not clear.

Evidence to decision table: refer to Appendix G

Question 17. What clinical observations are needed?

PICO: Should clinical observations vs. other/no clinical observations be used for monitoring babies with neonatal hypoglycaemia?

Recommendation 17:

Clinical observations are recommended for monitoring all babies at risk of or with neonatal hypoglycaemia. [Conditional recommendation]

All newborn babies require clinical observation in the first hours and days after birth. Any signs that are associated with neonatal hypoglycaemia should result in prompt measurement of blood glucose concentrations (see recommendation 11).

Justification: Clear evidence supports the benefits of monitoring, as babies showing clinical signs of hypoglycaemia tend to have poorer outcomes than those who do not.

Some babies who develop severe and potentially brain-threatening hypoglycaemia do not have risk factors or have a recurrence of hypoglycaemia after hospital discharge. These babies will only be identified by clinical signs.

Implementation considerations: It is important to educate whānau of all babies about clinical signs that may indicate hypoglycaemia and how to seek help if these occur. This includes at-risk babies who have normal blood glucose concentrations in the first 12 hours and those whose hypoglycaemia appears to have resolved.

Monitoring and evaluation: Nil.

Research priorities

Studies are needed on:

Optimal protocols for clinical observations in babies at risk of hypoglycaemia, including the best predictors of hypoglycaemia and duration of monitoring.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 18. What is the role of interstitial or transcutaneous glucose measurement?

PICO: Should continuous glucose monitoring vs. intermittent blood glucose testing be used for babies at risk of or diagnosed with neonatal hypoglycaemia?

Recommendation 18:

Continuous glucose monitoring should not be used *routinely* for the diagnosis and monitoring of neonatal hypoglycaemia. [Conditional recommendation]

Justification: In two RCTs in VLBW babies, those with continuous glucose monitoring (CGM) spent more time with blood glucose concentrations in the normal range and underwent fewer blood tests. However, there was little to no effect on the number of hypoglycaemia events.

Current devices are not sufficiently accurate for use in babies (approximately ±1 mmol/L accuracy) and technical difficulties can be time consuming to remedy.

CGM is well tolerated in babies, and insertion may be less painful than heel-prick blood tests.

CGM is cost-effective in adults with diabetes, but its cost-effectiveness in babies is uncertain.

Implementation considerations: Nil.

Monitoring and evaluation: This technology is evolving rapidly, so this recommendation should be reviewed frequently.

Research priorities:

Studies are needed on:

1. The potential utility of CGM when a baby is transitioning from intravenous dextrose to breastfeeding.
2. The utility of CGM in late preterm and term babies at risk of hypoglycaemia.
3. The clinical significance of episodes of low glucose concentrations that would not have been detected without CGM, including their association with neurodevelopmental outcomes, and the effect of treatment on these outcomes.
4. The cost-effectiveness of using CGM in babies whose glucose concentrations are very unstable.
5. Whānau perspectives on use of CGM in babies.

Health Equity: The effect on health equity is not known but is likely to depend on access to the devices and the specialist expertise required to use them. Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 19. Should metabolites other than glucose be measured?

PICO: Should measurement of other metabolites in addition to glucose vs. measurement of glucose alone be used for diagnosing and monitoring of neonatal hypoglycaemia?

Recommendation 19:

Ketones, lactate, and insulin concentrations should not be measured *routinely* in addition to glucose for the diagnosis and monitoring of neonatal hypoglycaemia in the first 72 hours. [Conditional recommendation]

Consider measuring glucose, beta-hydroxybutyrate, and insulin concentrations in babies with hypoglycaemia that persists beyond 72 hours to help distinguish between those with congenital hyperinsulinemia and those with other causes.

Justification: Measuring ketones, lactate or insulin may help uncover uncommon causes of hypoglycaemia but requires additional blood tests, thus causing additional distress to the baby and whānau and incurring additional costs.

Since most neonatal hypoglycaemia is transitional, testing before 72 hours may show concerning findings (e.g. detectable insulin concentrations at the time of low glucose concentrations) that will resolve spontaneously and therefore should not alter management for most babies.

Preliminary evidence suggests that measuring ketones at approximately 72 hours may help distinguish the cause of the hypoglycaemia (12).

If hyperinsulinism is suspected and there are no risk factors for hypoglycaemia, insulin concentrations might be measured earlier. However, there was uncertainty about whether testing before 72 hours makes a difference even for congenital hyperinsulinism.

The overall consensus was that 72 hours is an appropriate time to consider measuring other metabolites, as testing earlier is unlikely to be useful.

Implementation considerations: Consider measuring insulin before 72 hours if hypoglycaemia is severe (<1.5 mmol/L) and the baby does not have risk factors for hypoglycaemia or has other concerning clinical features. Additionally, consider paediatric endocrinology/metabolic referral for severe hypoglycaemia (<1.5 mmol/L) within the first 72 hours.

Monitoring and evaluation: Nil

Research priorities: Nil

Health Equity: The additional blood tests may not be available at all healthcare facilities, which could potentially worsen inequities for those with limited access. However, it is possible to collect the samples at any facility and have them analysed at a different location, helping to reduce some of the access barriers.

Evidence to decision table: refer to Appendix G

Question 20. What neurological monitoring/ imaging is needed?

PICO: Should neurological monitoring/ imaging vs. no neurological monitoring/ imaging be used for monitoring babies with neonatal hypoglycaemia?

Recommendation 20:

Neurological monitoring and brain imaging should not be used *routinely* for monitoring babies with neonatal hypoglycaemia. [Conditional recommendation]

Consider using early MRI (within 6 days of onset of hypoglycaemia) for babies with severe (<1.0 mmol/L) or persistent hypoglycaemia to assist with counselling and prognosis.

Justification: Early MRI findings, particularly diffusion-weighted imaging, are moderately predictive of later neurodevelopmental outcomes after neonatal hypoglycaemia. This may be helpful in some cases, e.g. for counselling whānau, guiding management decisions, supporting Accident Compensation Commission claims and access to early neurodevelopmental therapy to optimise outcomes.

One study found that changes in cotside aEEG were not clinically useful for monitoring brain function in relation to neonatal hypoglycaemia.

Implementation considerations: Timely access to MRI can be challenging due to the high cost and limited availability. It is important to discuss this decision with a neonatologist, as this may involve transfer to a secondary or tertiary centre.

Monitoring and evaluation: Nil.

Research priorities: Nil.

Health Equity: Health equity may be increased if all whānau are offered access to MRI and are appropriately informed about the risks and benefits.

Evidence to decision table: refer to Appendix G

Question 21. What is the target blood glucose range for babies diagnosed with neonatal hypoglycaemia?

PICO: Should higher or lower minimum target blood glucose concentration vs. the most common minimum target during treatment (2.6 mmol/L) be used for babies being treated for neonatal hypoglycaemia?

Recommendation 21:

A target blood glucose of ≥2.6 mmol/L should be used for treating neonatal hypoglycaemia within the first 72 hours after birth. [Conditional recommendation]

A target blood glucose of ≥3.4 mmol/L should be used for treating neonatal hypoglycaemia after the first 72 hours after birth.

Justification: There is some evidence supporting the most common target for treatment of ≥2.6 mmol/L and a lack of evidence to justify changing it.

Very low certainty evidence shows that using a lower threshold than 2.6 mmol/L has little to no effect on neurodevelopmental outcomes at 18 months. Low certainty evidence shows use of lower thresholds may result in a large increase in moderate hypoglycaemia (2.0 – 2.6 mmol/L), and a moderate increase in severe hypoglycaemia (<2.0 mmol/L).

Most guidelines recommend a target of ≥2.6 mmol/L for hypoglycaemia in babies, but some advocate for a higher target threshold in older babies. This is because severe and prolonged hypoglycaemia can sometimes indicate congenital hyperinsulinism, which is associated with a high risk of neurodevelopmental impairment.

A blood glucose concentration of 3.3 mmol/L is the threshold for onset of autonomic symptoms in adults experiencing hypoglycaemia, and is the lower target recommended by some for babies with persistent hypoglycaemia (13). It was estimated that this would apply to approximately 4 per 1000 babies so would not have a large impact on feasibility or costs.

Implementation considerations: Consider additional investigations (see recommendation 18) and consultation with an paediatric endocrinologist if hypoglycaemia persists after 72 hours of age.

There are no data on resources required, but with a higher threshold, longer treatment would most likely be necessary.

Monitoring and evaluation: Blood glucose concentrations should be monitored regularly while babies are being treated for hypoglycaemia and for at least 12 hours after treatment stops and the baby is feeding adequately.

Research priorities:

Studies are needed on:

Outcomes of using the target of ≥2.6 mmol/L compared to lower or higher targets.

Health Equity: The impact on health equity is not clear.

Evidence to decision table: refer to Appendix G

Question 22. What are the benefits and risks of buccal dextrose gel for babies diagnosed with neonatal hypoglycaemia?

PICO: Should buccal dextrose gel vs. placebo gel or no gel be used for babies with neonatal hypoglycaemia?

Recommendation 22:

Babies diagnosed with neonatal hypoglycaemia should be treated with 40% oral dextrose gel. [Conditional recommendation]

Justification: Moderate certainty evidence shows that buccal dextrose gel results in a large increase in correction of hypoglycaemia, moderate reduction in admission to NICU and large reduction in separation of mother and baby for treatment of hypoglycaemia. No adverse effects were reported.

Treatment is feasible as it is already being used, and acceptable to caregivers and whānau. Gel is inexpensive, cost effective, and can be used in any care setting.

Conditional recommendation because there is no information on babies born before 34 weeks' gestation, or effect of different doses and different timings of administration.

Implementation considerations: If baby is clinically stable and able to feed, administer 0.5 ml/kg (200 mg/kg) 40% dextrose gel.

Draw up the prescribed dose in an enteral syringe. Dry the buccal mucosa using a gauze swab. Apply gel to the buccal mucosa in small aliquots using a gloved finger, and massage it in gently. Offer the baby a feed immediately after administering the gel.

If the blood glucose concentration is <2.0mmol/L, dextrose gel alone is unlikely to be sufficient treatment. Administer dextrose gel while arranging transfer to a facility where IV infusion is available.

Dextrose gel can be given to a baby while having skin-to-skin care.

Monitoring and evaluation: Repeat blood glucose concentration testing 30-60 minutes after administering dextrose gel and beginning the feed.

If the repeat blood glucose is < 2.6 mmol/L, repeat the dextrose gel and offer a feed, then test again 30-60 minutes after administering the second dose.

Continue clinical observations. If any subsequent blood glucose concentration is < 2.6 mmol/L, the clinical condition of the baby should be reviewed and referral considered for further investigation and treatment.

Research priorities:

Studies are needed on:

1. The effect of buccal dextrose gel for treatment of neonatal hypoglycaemia on long-term neurodevelopmental impairment.
2. The effect of buccal dextrose gel for treatment of babies born <34 weeks' gestation.
3. The most effective dose, frequency and mode of administration of buccal dextrose gel.

Health Equity: Severe or symptomatic hypoglycaemia is a medical emergency. Not all babies at risk of neonatal hypoglycaemia can be identified before birth, and hypoglycaemia can occur in babies without risk factors. Dextrose gel and capacity accurately to measure blood glucose concentrations should therefore be available as standard emergency equipment wherever newborns are cared for, including in community settings. Carers need appropriate education and resourcing for this.

Provide whānau with information on health benefits and potential adverse effects of dextrose gel treatment. Whānau should also be provided with resources that align with their cultural values. Provide whānau with information on dextrose treatment in multiple mediums (e.g., written, oral, visual).

Evidence to decision table: refer to Appendix G

Question 23. Should formula vs. control be used for treating neonatal hypoglycaemia?

Recommendation 23:

Formula may be considered as a treatment option for babies diagnosed with neonatal hypoglycaemia. [Conditional recommendation]

Justification: Low to very low certainty of evidence shows large to moderate effect of formula on the correction of neonatal hypoglycaemia, and reduction in recurrent hypoglycaemia.

The cost of formula for treatment of hypoglycaemia is likely comparable to that of dextrose gel and significantly lower than intravenous dextrose. Formula is widely available, but acceptability varies among different populations.

Use of formula as a treatment option for neonatal hypoglycaemia could help reduce the need for intravenous dextrose, which is more invasive, costly, and commonly involves NICU admission, with associated economic, emotional and social costs.

Implementation considerations: Consider giving formula 5 to 7 ml/kg as an alternative to intravenous dextrose for babies whose hypoglycaemia persists after two doses of dextrose gel plus breastfeeding.

Whānau should be fully informed about the risks and benefits of both treatment options and be involved in joint decision making.

Ensure that formula is readily available in clinical settings with appropriate protocols to manage the supply and administration of formula as a treatment option for neonatal hypoglycaemia (8, 9).

Carers should ensure that formula use does not undermine breastfeeding efforts, offering guidance to mothers on how to maintain or transition back to breastfeeding after the hypoglycaemia is corrected. Encourage mothers to express breast milk when formula is given as treatment to maintain breast milk supply.

Monitoring and evaluation: Repeat blood glucose concentration testing 60 minutes after administering the formula. Do not repeat formula if blood glucose concentration is ≥2.6 mmol/L. If the repeat blood glucose concentration is <2.6 mmol/L, prompt referral is required for consideration of intravenous dextrose.

Research priorities:

Studies are needed on:

1. Effect of formula compared to intravenous dextrose or donor human milk on correcting neonatal hypoglycaemia, NICU admission rates, and breastfeeding at hospital discharge.
2. The cultural acceptability to whānau of using formula for the treatment of neonatal hypoglycaemia.
3. The optimal amount of formula to be given for the treatment of neonatal hypoglycaemia.
4. The long-term neurological effects on infants treated with formula for neonatal hypoglycaemia.

Health Equity: Communication strategies should be adapted to align with the cultural values and preferences of whānau, particularly in communities where breastfeeding is strongly preferred. Whānau should be fully informed about the advantages and disadvantages of using formula as a treatment for hypoglycaemia.

Evidence to decision table: refer to Appendix G

Question 24. Should intravenous dextrose vs. other treatment or no treatment be used for treatment of neonatal hypoglycaemia?

Recommendation 24:

Intravenous (IV) dextrose should be given if blood glucose concentration remains < 2.6 mmol/L despite treatment with increased feeding and buccal dextrose gel. Do not give an initial bolus of IV dextrose *routinely*. [Conditional recommendation]

Justification: Using IV dextrose is typically reserved for cases where oral treatment options have been exhausted, but there is very little evidence of benefits and harms.

There is some evidence that treatment of hypoglycaemic babies with an IV bolus is associated with more rapid change in blood glucose concentrations, including increased incidence of high glucose concentrations, and that these are associated with adverse neurodevelopmental outcomes.

One before-and-after study showed that tailoring the dose of IV dextrose and use of an initial bolus depending on the glucose concentration resulted in similar time to resolution of hypoglycaemia but shorter NICU stay and reduced costs.

While IV dextrose itself is inexpensive, the costs associated with NICU care, including administration and staffing, can be significant.

The panel considered that evidence from randomised trials of IV dextrose compared to oral sucrose were not relevant when formulating this recommendation.

Implementation considerations: Start treatment with 30-60ml/kg/d 10% dextrose.

Continue feeding if possible.

Consider an initial bolus of 1-2ml/kg of 10% dextrose over 10min only if the initial blood glucose concentration is very low (< 1 mmol/L) or the baby has severe symptomatic hypoglycaemia (seizures or reduced consciousness).

It is important to have an open and honest discussion with parents about the uncertainty regarding the benefits of IV dextrose.

Monitoring and evaluation: Check blood glucose concentration after 1 hour and adjust infusion rate as necessary.

Continue regular monitoring of blood glucose concentrations during IV treatment.

Research priorities:

Studies are needed on:

1. The effects of IV dextrose bolus administration on short and longterm outcomes.
2. The optimal dosage and methods for administering IV dextrose
3. The optimal strategies for weaning babies off IV dextrose and onto full oral feeds.

Health Equity: IV treatment may not be available at all healthcare facilities, so may worsen inequities for those with limited access. Ensure that all babies at risk of neonatal hypoglycaemia and their whānau have prompt access to facilities that can provide IV treatment if needed.

Evidence to decision table: refer to Appendix G

Question 25. Should diazoxide vs. placebo be used for treating neonatal hypoglycaemia?

Recommendation 25:

Consider use of diazoxide if hypoglycaemia persists despite treatment with intravenous dextrose and is severe (<1.5 mmol/L) or unstable. [Conditional recommendation]

Justification: One randomised trial found that a low dose of diazoxide (3 mg/kg/day) for early management of severe or recurrent neonatal transitional hypoglycaemia may result in a large increase in the correction of hypoglycaemia after completing the loading dose (5 mg/kg). However, diazoxide did not reduce the time to resolution of hypoglycaemia.

One randomised trial conducted in India did not report on critical or important outcomes related to diazoxide use.

Evidence from five observational studies indicated that 71% of babies responded to diazoxide.

Diazoxide may be associated with serious side effects, including pulmonary hypertension, congestive heart failure, oedema, hypertrichosis (excessive hair growth), and necrotising enterocolitis. Most side effects resolve upon discontinuation of the drug, although hypertrichosis may persist for several weeks.

The cost of liquid diazoxide is moderate to high, at $620 per bottle, but costs are much lower (<$1) if prepared by a hospital pharmacy from tablets.

Oral administration of diazoxide may be preferable to parents compared to intravenous administration.

Implementation considerations: Diazoxide is not recommended as a first-line treatment due to significant potential adverse effects.

Discussions with whānau should include detailed information on dosing and possible side effects.

Input from endocrinology specialists is recommended for decision-making, and if hyperinsulinaemic hypoglycaemia is suspected.

Monitoring and evaluation: Plasma insulin concentration should be measured before starting diazoxide.

Babies should be monitored carefully for possible side effects of diazoxide.

Research priorities:

Studies are need on:

1. The long-term effect diazoxide
2. The optimal dosage of diazoxide to minimise the risk of side effects.

Health Equity: Whānau need to be fully informed of the health benefits and potential adverse effects of diazoxide. Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 26. Should glucagon vs. control be used for neonatal hypoglycaemia?

Recommendation 26:

Consider use of intramuscular glucagon for short-term management of neonatal hypoglycaemia until IV access can be established. [Conditional recommendation]

Justification: Three non-randomised studies showed a large effect in correcting hypoglycaemia, with a large increase in blood glucose concentrations.

The safety of glucagon for treatment of hypoglycaemia has been established in adults, and there is no evidence of differing safety in babies.

Nausea is reported by some adults using glucagon, but it is uncertain whether babies may experience this.

The cost of glucagon was considered moderate to negligible.

Long-term outcomes and safety in babies remain uncertain, necessitating comprehensive information sharing with families for informed decision-making.

Implementation considerations: Severe or symptomatic hypoglycaemia is an emergency. If there is difficulty or delay in starting IV glucose, give glucagon 0.2 mg/kg as an intramuscular injection. Establish an IV infusion as soon as possible. Intramuscular glucagon may not be effective in situations outside of hyperinsulinism, and IV glucose may still be necessary.

The increase in glucose concentration usually occurs within 5-20 minutes. The dose can be repeated after 1 hour if IV access remains problematic, but there may be a smaller increase in glucose concentration in response to the second dose.

In refractory hypoglycaemia, glucagon infusion 5-20 microgram/kg/h may be considered (14).

Monitoring and evaluation: Measuring blood glucose concentration 30 minutes after giving IM glucagon.

Research priorities:

Studies are needed on:

The benefits, adverse effects and long-term outcomes of glucagon use in babies, including optimal dose and route of administration.

Health Equity: Whānau need to be fully informed of the health benefits and potential adverse effects of glucagon. Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 27. What care settings are appropriate?

PICO: Should secondary or tertiary level care settings vs. primary care setting be used for monitoring babies with neonatal hypoglycaemia?

Recommendation 27:

Consider caring for babies who require monitoring for neonatal hypoglycaemia at a primary care setting if timely and accurate blood glucose monitoring is possible, treatment can be initiated if required, e.g. with buccal dextrose gel, and the baby can be transferred promptly to a secondary or tertiary facility if necessary. [Conditional recommendation for either option]

Justification: Based on a UK study, the panel considered that even if all babies were cared for in a tertiary care unit, not all cases of hypoglycaemia would be detected.

Primary care settings are associated with better breastfeeding outcomes, while quicker access to hypoglycaemia treatment in secondary or tertiary settings may lead to improved outcomes.

However, the costs associated with transferring to secondary or tertiary care are considered moderate to high.

There is considerable variability in parental preferences, with some preferring a secondary or tertiary care setting regardless of distance, while others may prioritise proximity to home

Implementation considerations: Other considerations, including maternal health and stability of diabetes management, may play a role in the decision about place of birth.

All babies at risk of hypoglycaemia should have access to accurate blood glucose monitoring. Prompt treatment of hypoglycaemia is essential, so initial treatment such as dextrose gel should be available immediately.

If the blood glucose concentration is <2.0mmol/L, dextrose gel alone is unlikely to be sufficient treatment. Administer dextrose gel while arranging transfer to a facility where IV infusion is available.

Ensure that appropriate glucose analysers and dextrose gel for treatment of neonatal hypoglycaemia are available in all settings where newborn babies are cared for, including in primary units, to avoid potentially widening health inequities.

Monitoring and evaluation: Nil.

Research priorities: Nil.

Health Equity: Refer to health equity summary on Page 31.

Evidence to decision table: refer to Appendix G

Question 28. Which babies are at increased risk of adverse long-term outcomes as a result of neonatal hypoglycaemia?

PICO: Should risk factors for adverse long-term outcomes vs. no risk factors for adverse long-term outcomes be used for guiding management of babies at risk of neonatal hypoglycaemia?

Recommendation 28:

No recommendation made.

Justification: In the follow-up of the hPOD trial, associations between neonatal hypoglycaemia and neurodevelopmental problems at 2 years were identified in children whose mothers had diabetes, but it was not possible to analyse outcomes separately for other risk groups.

Implementation considerations: Nil.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

The long-term outcomes of neonatal hypoglycaemia for individual risk groups, and the effects of treatments of neonatal hypoglycaemia on these.

Health Equity: There are no data about whether Māori or other groups are at increased risk of adverse long-term outcomes after neonatal hypoglycaemia, so the effect on health equity is unknown.

Evidence to decision table: refer to Appendix G

Question 29. What care should be provided after the hypoglycaemia is resolved? (when to discharge, what follow-up is required, need for ongoing monitoring).

Recommendation 29:

Whānau of all babies born at risk, whether or not they develop neonatal hypoglycaemia, should be well informed before discharge about clinical signs that may indicate hypoglycaemia and how to seek help if these occur. [**Conditional recommendation**]

Heathcare practitioners should be made aware of a history of neonatal hypoglycaemia and its relevance for later developmental surveillance.

Justification: Severe hypoglycaemia can occur after a period of normal glucose concentrations, including after hospital discharge.

Babies born at risk of neonatal hypoglycaemia have a high risk of later neurodevelopmental problems, whether or not they experienced hypoglycaemia.

Implementation considerations: Provide comprehensive information and support for families, including educating them about signs to watch for after discharge and what actions to take if concerned.

Education and resources are required for healthcare practitioners to be able to address parents' concerns and provide explanations for medical procedures like heel pricks.

Consider offering debriefing to address any concerns, provide information about follow-up care, and offer support to families during this transition period.

Monitoring and evaluation: Nil.

Research priorities:

Studies are needed on:

1. Educational resources that parents should receive at discharge that are acceptable and practical for whānau.
2. The effectiveness of community-based interventions for high-risk groups, including the impact of long-term surveillance programs, the best methods and ages for follow-up, and which outcomes are most relevant.
3. The most acceptable and feasible community-based follow-up approaches that iare not overly interventionalist.

Health Equity: Health equity is enhanced by recognising that not all whānau may utilise Well Child/Tamariki Ora services. Therefore, it is important to provide a variety of support options tailored to meet the unique needs of each whānau, ensuring they have the resources and guidance necessary to access the services that best fit their circumstances.

It is important to recognise the variability in whānau ability to ask questions depending on their health literacy and culture, therefore information provided needs to be delivered in a way that meets the needs of the receiver.

There are significant health equity issues regarding access to services, so it is critical to ensure that support reaches those who need it most.

References:

1. Te Whatu Ora Health New Zealand. Testing for, diagnosing and managing gestational diabetes (diabetes of pregnancy): Te whakamātau, te tautohu me te whakahaere i te mate huka hapūtanga. Forthcoming 2024.
2. New Zealand College of Midwives. Consensus Statement: Facilitating the birth of the placenta 2024 [cited 2024 March 14]. Available from: https://www.midwife.org.nz/wp-content/uploads/2024/04/Facilitating-the-Birth-of-the-Placenta-1.pdf
3. Word Health Organization (WHO). Delayed umbilical cord clamping for improved maternal and infant health and nutrition outcomes 2023 [cited 2024 March 14]. Available from: https://www.who.int/tools/elena/interventions/cord-clamping
4. National Institute for Health and Care Excellence. Intrapartum care NICE guideline [NG235] 2023 [updated 29 September 2023; cited 2024 March 14]. Available from: https://www.nice.org.uk/guidance/ng235
5. Word Health Organization (WHO). Early initiation of breastfeeding to promote exclusive breastfeeding 2023 [cited 2024 March 14]. Available from: https://www.who.int/tools/elena/interventions/early-breastfeeding#:~:text=WHO%20Recommendations,the%20first%20hour%20after%20delivery
6. United Nations International Children's Emergency Fund (UNICEF) United Kingdom. Skin-to-skin contact [cited 2024 March 14]. Available from:

https://www.unicef.org.uk/babyfriendly/baby-friendly-resources/implementing-standards-resources/skin-to-skin-contact/
7. Te Whatu Ora Health New Zealand. Observation of Mother and Baby in the Immediate Postnatal Period: Consensus statements guiding practice Hospitals and specialist care, Maternity, Women's health; 2012 [cited 2024 March 14]. Available from: https://www.tewhatuora.govt.nz/publications/observation-of-mother-and-baby-in-the-immediate-postnatal-period-consensus-statements-guiding-practice
8. Te Whatu Ora – Health New Zealand. Cronobacter species invasive disease, Part of the Communicable Disease Control Manual Wellington: Te Whatu Ora – Health New Zealand; 2024 [cited 2024 December 18]. Available from: https://www.tewhatuora.govt.nz/for-health-professionals/clinical-guidance/communicable-disease-control-manual/cronobacter-species-invasive-disease
9. Word Health Organization (WHO) in collaboration with Food and Agriculture Organization of the United Nations. Safe preparation, storage and handling of powdered infant formula: guidelines: World Health Organization; 2012 [cited 2024 December 18]. Available from: https://www.who.int/publications/i/item/9789241595414
10. Te Whatu Ora – Health New Zealand. Small for gestational age and fetal growth restriction in Aotearoa New Zealand He Aratohu Ritenga Haumanu mō te Tōhuatanga Kōpiri me te Pakupaku Rawa. A clinical practice guideline: Summary of recommendations. Wellington: Te Whatu Ora – Health New Zealand; 2023 [cited 2024 December 18]. Available from: https://www.tewhatuora.govt.nz/publications/small-for-gestational-age-fetal-growth-restriction-guidelines
11. World Health Organization (WHO). Guidelines for the management of neonatal hypoglycemia 2019 [cited 2024 March 14]. Available from: https://platform.who.int/docs/default-source/mca-documents/policy-documents/operational-guidance/ARE-MN-62-01-OPERATIONALGUIDANCE-2015-eng-Neonatal-Hypoglycemia-Guideline.pdf
12. Stanley CA, Weston PJ, Harris DL, De Leon DD, Harding JE. Role of beta-hydroxybutyrate measurement in the evaluation of plasma glucose concentrations in newborn infants. Archives of disease in childhood Fetal and neonatal edition. 2024;109(6):580-5.
13. Thornton PS, Stanley CA, De Leon DD, Harris D, Haymond MW, Hussain K, et al. Recommendations from the Pediatric Endocrine Society for evaluation and management of persistent hypoglycemia in neonates, infants, and children. The Journal of Pediatrics. 2015;167(2):238-45.
14. Australian Nursing and Midwifery Federation. Glucagon: Guidelines for practice (Version 2.0). Australian Nursing and Midwifery Federation. ; 2020 [cited 2024 December 18]. Available from: https://www.anmfonline.org/wp-content/uploads/2021/06/glucagon-15122020-2.0.pdf