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# Protecting against brain damage by improving treatment in neonates with hypoglycaemia: ProBrain-D—a study protocol of a prospective longitudinal study

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## ABSTRACT

**Introduction** Although neonatal hypoglycaemia is the most common metabolic problem in neonates, there is no standard guideline for screening. Additionally, treatment of neonatal hypoglycaemia and glucose administration thresholds are discussed controversially. Severe hypoglycaemia can lead to brain damage, but data on the effects of mild hypoglycaemia on neurological development are limited. To our knowledge, this is the first prospective longitudinal cohort study to analyse if the implementation of a new diagnosis and treatment standard for neonatal hypoglycaemia may improve the outcome of neonates at risk for hypoglycaemia, especially concerning neurodevelopment. Furthermore, the acceptance and feasibility of the standard among different professional groups and parents are analysed.

**Methods and analysis** After implementation of a structured standard operating procedure (SOP), detailing preventive measures, blood glucose screening and neonatal hypoglycaemia treatment in a tertiary care hospital, 678 neonates ≥35+0 weeks of gestation will be recruited in a monocentric prospective cohort study. For comparison, 139 children born before the implementation of this new SOP, who had risk factors for neonatal hypoglycaemia or qualified for blood glucose measurements are recruited (retrospective cohort). For the primary end point, comparative analyses between and within the prospective and retrospective cohorts will be performed regarding the neurological outcome at 2–2.5 years of age in Bayley Scales of Infant Development. Furthermore, comprehensive clinical data and data on nutrition and developmental milestones are assessed at different time points (6 weeks, 6, 12, 18 and 24 months) in the prospective cohort. Acceptance and feasibility of the new standard are assessed using questionnaires.

**Ethics and dissemination** The study has been approved by the Ethics Committee of the Medical Faculty of the Heinrich-Heine-University Düsseldorf (20201162). The results of this study will be disseminated through peer-reviewed journals and presented at international conferences.

**Trial registration number** DRKS00024086.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Prospective longitudinal cohort study analysing how the implementation of a new diagnosis and treatment standard improves the outcome of neonates at risk for hypoglycaemia.
⇒ The study analyses a large cohort, comprising a total of 817 children.
⇒ The longitudinal approach with regular assessments of developmental milestones and the standardised neurodevelopmental testing at the age of 2–2.5 years with Bayley Scales of Infant Development improve the informative value of the study.
⇒ A limitation of the study may be that sometimes mild neurodevelopmental delays can manifest at a later age and may not yet be detected at 2–2.5 years of age. However, this can be addressed by following the cohort longer into the future and re-examining at an older age.

## INTRODUCTION

Neonatal hypoglycaemia is a common metabolic condition, affecting up to 15% of all newborns.[1] Several risk factors for neonatal hypoglycaemia are known, including small for gestational age (SGA), large for gestational age (LGA), maternal diabetes/gestational diabetes mellitus (GDM), prematurity, perinatal stress, etc.[1–3] Profound hypoglycaemia as commonly seen in children with persistent or transient congenital hyperinsulinism can lead to irreversible brain damage with severe developmental delay and epilepsy.[4–6] The extent to which mild hypoglycaemia affects neurodevelopment has been poorly studied and understood. Thus, a uniform treatment threshold and a standard for management of neonatal hypoglycaemia do not exist.[7]

van Kempen *et al*, who compared treatment thresholds of 36 mg/dL and 47 mg/

dL (2.0 mmol/L and 2.6 mmol/L) in neonatal hypoglycaemia, showed that psychomotor development at the age of 18 months did not differ between both groups.[8] McKinlay *et al* found no association between hypoglycaemia and adverse neurologic outcome in children aged 2 years;[9] however, they found an association of neonatal hypoglycaemia with an increased risk for poorer executive and visual motor function in children aged 4.5 years.[10] When the same cohort was re-examined at 9–10 years of age, the groups did not differ regarding the neurodevelopmental outcome. However, both groups showed concerningly high rates of poor performance across different measures.[11] Conversely, Kaiser *et al* showed an association of early transient neonatal hypoglycaemia and poorer academic performance at the age of 10 years.[12] It, therefore, remains to be clarified to what extent neonatal hypoglycaemia alone and risk factors such as, for example, maternal gestational diabetes, SGA and LGA themselves lead to developmental delay. Large population studies and meta-analyses have found that children of mothers with diabetes during pregnancy presented with lower school performance results[13] and children experiencing intrauterine growth restriction had worse cognitive outcomes.[14] However, these studies did not address abnormal development or cognitive impairment associated with hypoglycaemia that may have occurred.

There is no consistent international guideline for screening and management of neonatal hypoglycaemia.[15] However, there exist several national guidelines that have in common that they recommend a blood glucose screening for neonates with risk factors for hypoglycaemia or clinical signs of hypoglycaemia.[3 16 17] In Germany, there is only one published guideline that exclusively applies to infants born to diabetic mothers.[18] The lack of a consistent guideline leads to heterogeneity in treatment thresholds and management of neonatal hypoglycaemia,[19] potentially harming the child due to delayed or inadequate treatment.

## Research hypotheses and aims

In March 2020, a new standard operating procedure (SOP) for diagnosis and treatment of neonatal hypoglycaemia was established at the University Children's Hospital Düsseldorf, Germany (figure 1). Before implementation of this new SOP, only neonates of mothers with diabetes/GDM received a blood glucose screening during the first hours of life. In neonates with other risk factors for hypoglycaemia, blood glucose was only measured on individual physician's order.

The overall goal is the development of a validated guideline for the management of neonatal hypoglycaemia that has been shown to balance the prevention of hypoglycaemia-related, even mild brain damage, with a minimum burden on neonates.

A critical aspect is to place the interventional threshold sensitive enough to avoid severe hypoglycaemia. Emphasis was placed on preventive measures such as keeping the neonate warm, early and supplemental feeding and the use of dextrose gel. If profound hypoglycaemia occurs, it should be treated fast and intense, meaning that the duration of the profound hypoglycaemic phase should be kept as short as possible to prevent brain damage. On the other hand, the burden of measures such as blood glucose monitoring or interventions to stabilise blood glucose levels should be kept as low as reasonably possible. Transfer to the neonatal unit and the separation of mother and child should be minimised.

After a comparative analysis of the previously published guidelines, the new SOP for neonatal hypoglycaemia was drafted and clinically tested for its feasibility for several months. During this process, a multiprofessional team of nurses, midwives, neonatologists, paediatric endocrinologists and obstetricians revised and improved it several times. The SOP is adapted from Figure 3 of the 'Swedish national guideline for prevention and treatment of neonatal hypoglycaemia in newborn infants with gestational age ≥35 weeks', Wackernagel *et al* Acta Paediatrica, 2019[16]; with the kind permission of John Wiley & Sons (2019 Foundation Acta Pædiatrica. Published by John Wiley & Sons). The SOP is structured as a flowchart and includes preventive measures, risk stratification and therapeutic measures. The treatment and escalation steps in the SOP intend to standardise and simplify physician orders. Deviations from this are possible on an individual basis depending on the severity of the disease and comorbidities of the child.

We decided to include dextrose gel to the preventive as well as the therapeutic measures of our SOP even though the use of dextrose gel especially as a preventive measure is controversial. Several studies have shown that dextrose gel reduces the need for intravenous dextrose, intravenous fluids, admission to neonatal intensive care unit and increases breast feeding.[20–22] Edwards *et al* recently stated that 'oral dextrose gel is probably an effective and safe first-line treatment for infants with neonatal hypoglycaemia in high-income settings'.[23] However, the use of 'prophylactic oral dextrose gel at 1 hour of age compared with placebo showed no significant difference in the risk of neurosensory impairment at 2 years' corrected age'.[24] Further long-term follow-up studies are required to evaluate the effect of preventive dextrose gel for infants with risk factors for neonatal hypoglycaemia on neurodevelopmental outcome. In our clinical setting, early breast feeding and supplemental feeding in neonates at risks are the preferred preventive measures and dextrose gel is mainly used in case of hypoglycaemia or if the child is not drinking well.

Our SOP includes the off-label use of continuous subcutaneous glucagon infusion for hypoglycaemia treatment. Continuous glucagon therapy is frequently used for the treatment of persistent hypoglycaemia in children with congenital hyperinsulinism and may reduce the need of high volumes of dextrose infusion.[25] However, a recently published meta-analysis by Walsh *et al* who included studies with intravenous administered glucagon showed that the efficiency and safety of glucagon for the treatment

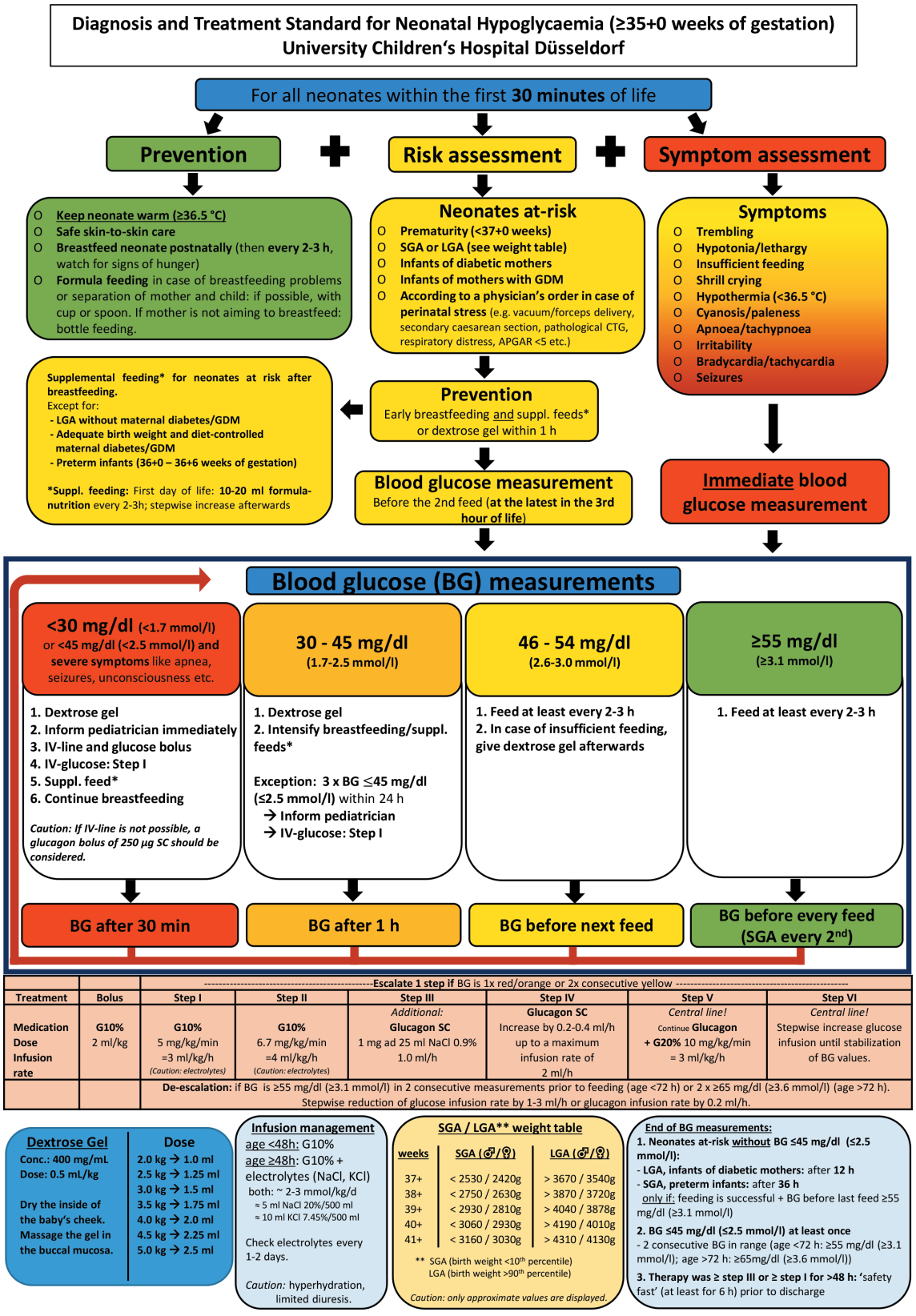


**Figure 1** Diagnosis and treatment standard for neonatal hypoglycaemia (≥35+0 weeks of gestation). BG, blood glucose; CTG, cardiotocography; G10%, Glucose 10%; G20%, Glucose 20%; GDM, gestational diabetes mellitus; IV, intravenous; KCl, potassium chloride; LGA, large for gestational age; NaCl, sodium chloride; SC, subcutaneous; SGA, small for gestational age. This figure is adapted from Figure 3 of the 'Swedish national guideline for prevention and treatment of neonatal hypoglycaemia in newborn infants with gestational age ≥35 weeks', Wackernagel D, Gustafsson A, Edstedt Bonamy AK, *et al*. Acta Paediatrica, 2019[16]; with the kind permission of John Wiley & Sons Ltd. (©2019 Foundation Acta Pædiatrica. Published by John Wiley & Sons Ltd.).

of neonatal hypoglycaemia are still not fully elucidated as high-quality randomised studies are lacking.[26] Still, to avoid fluid overload and the need for a central line, we have decided to use continuous subcutaneous glucagon early in the treatment of persistent hypoglycaemia based on our extensive clinical experience in the treatment of children with congenital hyperinsulinism.

The duration of the blood glucose measurements depends on the respective risk factors and are described in detail on the flowchart.

We hypothesise that neonates with hypoglycaemia/risk factors for hypoglycaemia who are screened and treated according to the new SOP will perform better in neurodevelopmental tests at 2 years of age, compared with infants with neonatal hypoglycaemia/risk factors for hypoglycaemia who were not screened or treated according to the new SOP (superiority). Furthermore, we hypothesise that within our prospective study cohort, neonates who suffer from hypoglycaemia but are treated according to the new SOP have no impairments in long-term neurological development compared with neonates without hypoglycaemia (non-inferiority).

In addition, several exploratory secondary end points will be evaluated, including comprehensive analyses of the occurrence and duration of neonatal hypoglycaemia in relation to nutritional intake as well as alternative energy sources such as β-hydroxybutyrate. Management of hypoglycaemia is analysed in detail, including the rate and duration of transfer to the neonatal unit due to hypoglycaemia. Furthermore, the acceptance and feasibility of the new standard are evaluated by anonymous questionnaires for parents and healthcare employees.

## METHODS AND ANALYSIS

### Study design

The ProBrain-D study is a monocentric prospective longitudinal clinical cohort study. Enrolment of study participants commenced on 18 March 2021. The last follow-up at 2 years of age is scheduled for 31 July 2024.

### Inclusion and exclusion criteria

Neonates screened and treated according to the new SOP (prospective cohort): neonates with at least one risk factor for neonatal hypoglycaemia (maternal diabetes, maternal GDM, SGA or LGA (birth weight <10th or >90th percentile, calculated according to Voigt *et al*[27]), perinatal stress (diagnosed by the responsible physician, eg, in case of vacuum extraction, forceps delivery or pathological cardiotocography), 5 min Apgar-score <5, secondary caesarean section, respiratory distress, 35+0 to 36+6 weeks gestational age) are recruited prenatally or postnatally. Written informed consent is obtained from both parents. Neonates without known risk factors for hypoglycaemia but who had blood glucose measurements, for example, because of clinical signs of hypoglycaemia during the first days of life, are recruited postnatally.

Neonates born before the implementation of the SOP (retrospective cohort): children who are 2–2.5 years old at the time of recruitment, and either had one or more risk factors for neonatal hypoglycaemia (see list of risk factors above) or had at least one plasma glucose level ≤45 mg/dL (≤2.5 mmol/L) during the first days of life. Whether a child meets the inclusion criteria is assessed by retrospective medical chart review. Parents are informed of the study by telephone, e-mail, or letter. Written informed consent is obtained before inclusion.

Exclusion criteria (prospective and retrospective cohort) are lack of written parental consent and birth before 35+0 weeks of gestation. For the analysis of the primary endpoint, all children are excluded who have any known cause of developmental delay unrelated to blood glucose values.

### Study size

Sample sizes were calculated using G*Power.[28] To assess whether the management in the prospective cohort improves the neurological outcome compared with the retrospective cohort, we calculated that with 139 children in each group the study has 80% power to show superiority (Bayley Scales of Infant and Toddler Development-Third Edition; BAYLEY-III scores cross the prespecified limit of 5 points (=1/3 of the SD of 15 of the normative value (100±15))), at a one-sided alpha level of 0.05.

To prove non-inferiority (BAYLEY-III scores do not cross the prespecified limit of −5 points (=minus 1/3 of the SD of 15 of the normative value (100±15))) of neonates with and without hypoglycaemia regarding neurological development within the prospective cohort, we calculated that with 242 children in each group the study will have 95% power at a one-sided alpha level of 0.05. With an expected drop-out rate of 25% in the prospective cohort, a total sample size of 678 children was calculated.

No sample size calculation was performed for the exploratory assessment of acceptability and feasibility of the new standard. The aim is to obtain 25 questionnaires from each professional group (midwives, nurses, physicians) and a total of 100 questionnaires from parents.

### Data sources and measurements

Figure 2 shows an overview of data collection for the prospective and retrospective cohort at designated time points.

#### Prospective cohort

The prospective cohort receives a blood glucose screening and if applicable treatment measures according to the new SOP. Blood glucose is measured using a StatStrip Glucose Meter (Nova Biomedical, Waltham, Massachusetts) as this is the standard point-of-care device in the clinical routine in our hospital. Clinical data are obtained from the medical files, including blood glucose values, blood glucose in arterial cord blood, treatment measures, etc. β-hydroxybutyrate is intended to be determined at each blood glucose measurement using a StatStrip

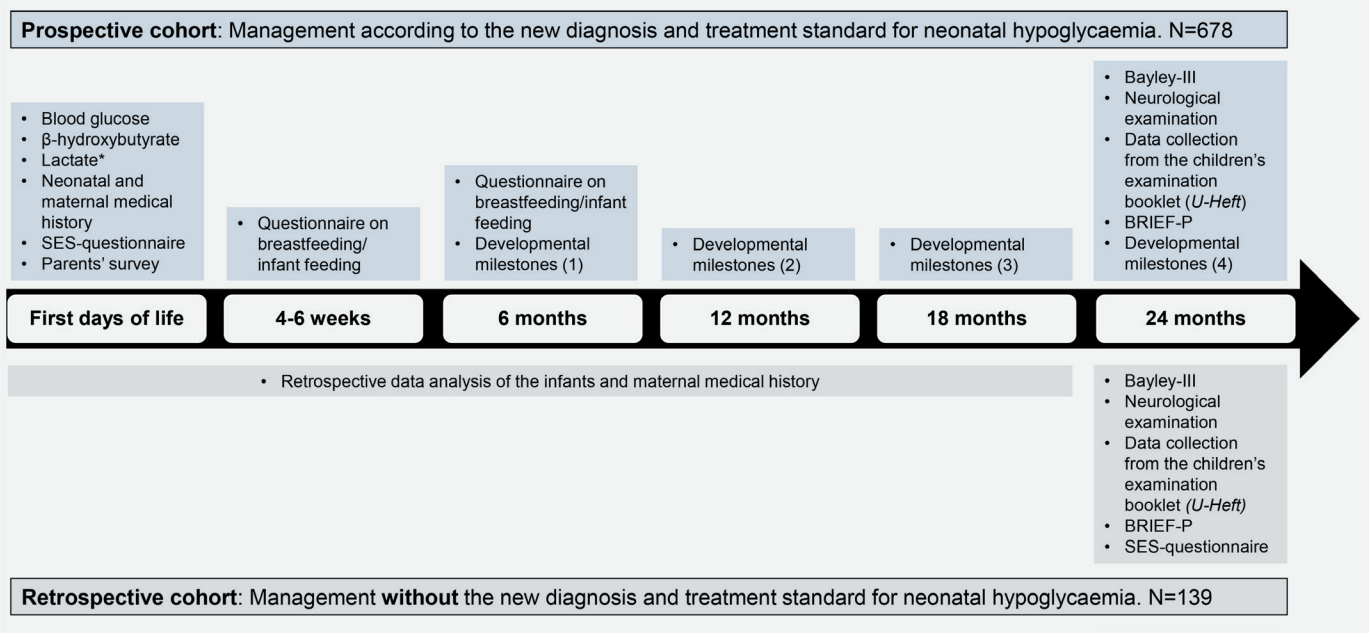


**Figure 2** Overview of data collection at defined time points for the prospective and retrospective study cohort. BRIEF-P, Behaviour Rating Inventory of Executive Function-Preschool Version; N, number; SES, socioeconomic status. *Only in case of blood gas analysis in clinical routine.

Ketone Meter (Nova Biomedical, Waltham, Massachusetts). If a blood gas analysis is performed based on a clinical indication, the lactate level is also analysed. In case of prenatal inclusion of the participants in the study, insulin is determined in arterial cord blood after cord clamping.

During the postpartum inpatient stay, parents fill out an anonymous questionnaire regarding their perspective on the management concept (online supplemental figure 1).

Data on breastfeeding or formula feeding are obtained from parents at 4–6 weeks and 6 months of age by telephone survey (online supplemental figure 2). Furthermore, developmental milestones are assessed by telephone interview at 6, 12, 18 and 24 months of age (online supplemental figure 3).

### Prospective and retrospective cohort

At 2–2.5 years of age, the German version of the Bayley-III (NCS Pearson, 2014) is used to assess developmental functioning.[29 30] The Bayley-III is conducted by trained members of the study team who are blinded to the child's medical history. Furthermore, an evaluative neurological examination is performed blinded by a study physician, and information on any neurological or developmental abnormalities, current medical history, number of siblings, languages spoken with the child and daily care are surveyed. Any abnormalities documented in the children's examination booklet (German *U-Heft*) are collected. The Behaviour Rating Inventory of Executive Function-Preschool questionnaire[31] is filled out by the parents to assess executive functioning. Parental socioeconomic status (SES) is measured according to Lampert *et al* and is based on information about education, occupational status and income.[32]

The acceptance and feasibility of the standard among healthcare professionals are evaluated using anonymous questionnaires completed by nurses, midwives and physicians (online supplemental figures 4 and 5)

### Primary endpoint

Neurological outcome in Bayley Scales of Infant Development[29 30] at 2–2.5 years of age.

### Secondary endpoints

1. Blood glucose
   - Number of measurements.
   - Number and timing of hypoglycaemic episodes.
   - Duration of hypoglycaemia (from time of detection to blood glucose value in target range).
   - Number of severe hypoglycaemia <30 mg/dL (<1.7 mmol/L) despite treatment.
   - Number of rebound hypoglycaemia (hypoglycaemia within 6 hours after initial correction).
   - Age at last routine blood glucose measurement.
2. Hypoglycaemia therapy/nutrition
   - Number/duration of different treatment interventions (dextrose gel, glucagon, intravenous glucose, nutrition) according to the treatment standard.
   - Average duration of therapy.
   - Average increase in blood glucose after intervention according to the standard of care until next measurement.
   - Percentage of fully breastfed infants (at discharge, after 4–6 weeks, at 6 months of age).
   - Nutritional intake in the first days of life (volume and frequency of administration of breast milk, formula, intravenous glucose, dextrose gel).

  - Correlation of β-hydroxybutyrate/lactate concentration and form plus quantity of nutrition (breast milk vs formula).
  - Transfer rate to neonatal unit due to hypoglycaemia treatment and duration.
3. Incidences of risk factors for neonatal hypoglycaemia.
4. Correlation between maternal haemoglobin A1c level (if known) and incidence of neonatal hypoglycaemia.
5. Correlation and postnatal course of blood glucose levels, β-hydroxybutyrate and lactate concentrations.
6. Number of patients with suspected transient hyperinsulinism.
7. Neurological development
  - Correlation of number, duration and severity of hypoglycaemia and delayed achievement of developmental milestones.
  - Occurrence of seizures.
  - Correlation of blood glucose, β-hydroxybutyrate and lactate concentration with the occurrence of seizures, abnormalities in magnetic resonance imaging or electroencephalography visual disturbances at the age of 2 years, hearing disorders at the age of 2 years, cerebral palsy at the age of 2 years, developmental delay at the age of 2 years, disorder of executive function at the age of 2 years, behavioural problems/disorders at the age of 2 years.
8. Acceptance and feasibility of the new diagnosis and treatment standard for hypoglycaemia.
9. Parents' opinion about the procedures carried out within the standard—feeling of safety vs additional worries.

## Statistical analysis plan

IBM SPSS Statistics V.25.0 (IBM, Armonk, New York) will be used for statistical analyses. For group analyses, data will be tested for normal distribution and depending on the results appropriate tests such as student's t test, ANOVA (analysis of variance), Mann-Whitney U test or Kruskal-Wallis test will be applied with post hoc correction, if necessary. For the comparison of categorical data, $\chi^2$ test and Fisher's exact test will be used. For comparison of continuous variables, Spearman or Pearson correlation or regression analysis will be performed when applicable. For comparison of the retrospective and prospective cohort, matching of groups by SES, sex, risk factor for neonatal hypoglycaemia, if any, and presence of older siblings will be conducted.

## Quality assurance of data collection, storage and management

Data collection is based on specified variables in a database created for the study with FileMaker Pro V.19 (Claris, Santa Clara, California). It is stored pseudonymised on a password-protected file on a secure server at the University Hospital Düsseldorf. Only authorised members of the study group have access to the data.

## Patient and public involvement

Patients/parents and public were not involved in the design of the study.

## Ethics and dissemination

The study protocol was approved by the Ethics Committee of the Medical Faculty of the Heinrich-Heine-University Düsseldorf (20201162) according to the Declaration of Helsinki. The study is registered in the German Clinical Trials Register; date of registration: 15 January 2021. Results will be published in peer-reviewed journals and presented at conferences. Anonymised raw data may be shared after completion of the study on reasonable request.

## Summary

Even though neonatal hypoglycaemia is a common metabolic condition, treatment thresholds and screening recommendations are inconsistent across guidelines. Furthermore, only limited reliable evidence is available concerning the neurodevelopmental outcome after neonatal hypoglycaemia. This is the first prospective longitudinal cohort study to systematically evaluate a diagnostic and treatment standard for neonatal hypoglycaemia with a focus on neurodevelopmental outcome. This study extends our knowledge of the effects of neonatal hypoglycaemia on brain function. It also provides a guideline that is not only based on expert opinion but has also been evaluated for its feasibility and potential to balance risk and benefit to standardise and improve the care of neonates with hypoglycaemia in the future.

**Acknowledgements** We would like to thank all individuals of the multiprofessional team who provided important contributions and advice during the development of the standard. In addition, we would like to thank all midwives and nurses for supporting the implementation of the SOP and their continuous efforts to follow the standards screening and treatment recommendations. Finally, we would like to thank the Ilse-Bagel Foundation for the financial support and the parents who help us evaluate the standard by participating in the study.

**Contributors** HH and MR: study concept, study design, writing protocol, writing first draft, data acquisition. RSD and FK: study design, writing protocol, data acquisition. DS and DvZ: writing protocol, data acquisition. EM: study concept, expert support. SK: study concept, study design, writing protocol, supervision. TM: led the conceptualisation and design of the study, writing first draft, supervision. All authors critically revised the manuscript. All authors have read and approved the final manuscript.

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**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Anonymised raw data may be shared after completion of the study upon reasonable request.

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# Parents' questionnaire on the suitability for daily use and practical implementation of the new "Diagnosis and Treatment Standard for Neonatal Hypoglycaemia (≥ 35+0 weeks of gestation)"

Dear parents,

we would like to thank you again for participating in the ProBrain study.

We would like to ask you a few questions about how you experienced the use of the new treatment standard for hypoglycaemia in neonates.

Who completes this questionnaire: ☐ mother ☐ father ☐ both parents

Please indicate to what extent the statements apply to you.

**Example:**

| Statement | strongly disagree ☐ 0 | disagree ☐ 1 | slightly disagree ☐ 2 | slightly agree ☐ 3 | agree ☐ 4 | strongly agree ☐ 5 |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. The blood glucose measurements gave me a sense of reassurance. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 2. I understand the rationale for the blood glucose measurements. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 3. I consider regular blood glucose measurements to detect hypoglycaemia in my baby to be useful. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 4. The measurements made me more concerned and worried about my baby's health. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 5. My baby's blood glucose measurements put additional burden on me. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 6. The blood glucose measurements stressed my baby. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 7. I consider the burden of the measures to be well founded and justified. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 8. The flyer on hypoglycaemia in babies gave me enough information and educated me well on the subject. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 9. The information on the flyer worried me more than it helped me. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 10. Before I participated in the ProBrain study, I already knew that hypoglycaemia could occur in neonates. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 11. I was very worried that my baby would be given formula because of hypoglycaemia and would develop breastfeeding problems. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |



Hoermann H, *et al. BMJ Open* 2022; 12:e063009. doi: 10.1136/bmjopen-2022-063009

| | | | | | | |
|---|---|---|---|---|---|---|
| 12. I think avoiding supplemental feeding of even small amounts of formula is important. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 13. I would like to get more information in person by a doctor and/or nurses. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 14. Following a precise scheme for the detection and treatment of hypoglycaemia in neonates makes me feel that hypoglycaemia in my baby can be detected early. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 15. The standard for detection and treatment of hypoglycaemia in neonates makes me feel that hypoglycaemia in my baby can be treated well. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 16. I would recommend the Department of Obstetrics and Gynaecology at the University Hospital Düsseldorf because babies are cared for very carefully there with regard to hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 17. I will be happy to attend the scheduled follow-up visit when my child is two years old. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

Do you have any remarks/comments or suggestions for improvement?

**Thank you for your participation!**

# Survey Breastfeeding/Nutritional intake – ProBrain-D Study

## Age 4-6 weeks:

**Pseudonymization number:**_____ **Date of phone call:** _____

**Current weight of the baby (kg):**_____ **Current length of the baby (cm):** _____

**1. How is the baby currently nourished?**

☐ **Exclusively breastfed*** *(**without** formula, water, tea etc.)*

☐ **Partially breastfed*** *(**with** formula and water/tea)*

☐ **Exclusively breastfed*** *(**without** formula, but **with** water and/or tea)*

☐ **Not breastfed*** *(**only** formula and water/tea)*

* breastfeeding = feeding with breast milk, this also includes pumped breast milk given by bottle

**If breastfeeding is only partially done or not done at all, give reasons for this.** *(Multiple answers possible)*

☐ Mother doesn't want or is not able to breastfeed
☐ Baby did not get enough breastmilk
☐ For time reasons
☐ Baby refused the breast
☐ Mother finds bottle feeding better/more convenient
☐ Mother wants to go back to work
☐ Due to advise from a midwife
☐ Baby drank poorly
☐ Baby lost weight
☐ Health problems of the baby
☐ Health problems of the mother
☐ Medication intake of the mother
☐ Lack of knowledge/guidance on breastfeeding
☐ Due to advise from a pediatrician/gynecologist
☐ Other reasons: _____

_____

_____

**2. Have there been any breastfeeding problems in the last 6 weeks?** ☐ Yes *(please specify)* ☐ No

☐ Soar nipples
☐ Breast engorgement
☐ Mastitis
☐ Baby refused the breast
☐ Baby had problems drinking/sucking
☐ Baby was too tired to drink
☐ Not enough breast milk
☐ Other breastfeeding problems

Other breastfeeding problems: _____

_____



Hoermann H, *et al. BMJ Open* 2022; 12:e063009. doi: 10.1136/bmjopen-2022-063009

**If breastfeeding problems were experienced, do you see them as being related to supplemental feeding/management of postnatal hypoglycaemia?**

☐ Yes ☐ No

_____

**3. Have you ever pumped breast milk since your baby was born?**

☐ Yes, only at the beginning/occasionally ☐ Yes, regularly ☐ No

If yes, please give reasons?

_____

_____

_____

_____

**4. Were you supported by a midwife after discharge from the hospital?** ☐ Yes ☐ No

**If yes, how often and over what time period did the midwife visit you?**

*(e.g., 3x/week over 4 weeks)*_____

**5. How satisfied were you with the assistance/guidance on breastfeeding provided by the nurses and midwives of the University Hospital Düsseldorf?**

☐ Very satisfied ☐ Rather satisfied ☐ Neither satisfied nor unsatisfied

☐ Rather unsatisfied ☐ Very unsatisfied

What could be improved? Further comments:

_____

_____

# Survey Breastfeeding/Nutritional intake – ProBrain-D Study

## Age 6 months:

**Pseudonymization number:**_____ **Date of phone call:** _____

**Current weight of the baby (kg):**_____ **Current length of the baby (cm):** _____

**1. How is the baby currently nourished?**

☐ **Exclusively breastfed*** *(**without** formula, water, tea and **without** complementary food like mashed vegetables, fruits etc.)*

☐ **Partially breastfed*** *(**with** formula, complementary food and water/tea)*

☐ **Exclusively breastfed*** *(**without** formula and complementary food but **with** water/tea)*

☐ **Not breastfed*** *(**only** formula, complementary food and water/tea)*

* breastfeeding = feeding with breast milk, this also includes pumped breast milk given by bottle

**2. Until which month of life was your baby exclusively breastfed?**

Month of life: _____

☐ The baby was never exclusively breastfed

**If breastfeeding was only partially done or not done at all, give reasons for this.** *(Multiple answers possible)*

☐ Mother doesn't want or is not able to breastfeed
☐ Baby did not get enough breastmilk
☐ For time reasons
☐ Baby refused the breast
☐ Mother finds bottle feeding better/more convenient
☐ Mother wants to go back to work
☐ Regular introduction of complementary feeding
☐ Baby drank poorly
☐ Baby lost weight
☐ Health problems of the baby
☐ Health problems of the mother
☐ Medication intake of the mother
☐ Lack of knowledge/guidance on breastfeeding
☐ Other reasons: _____

**3. Have there been any breastfeeding problems in the last 6 months?** ☐ Yes *(please specify)* ☐ No

☐ Soar nipples
☐ Breast engorgement
☐ Mastitis
☐ Baby refused the breast
☐ Baby had problems drinking/sucking
☐ Baby was too tired to drink
☐ Not enough breast milk
☐ Other breastfeeding problems

Other breastfeeding problems: _____

_____

_____

**If breastfeeding problems were experienced, do you see them as being related to supplemental feeding/management of postnatal hypoglycaemia?**

☐ Yes ☐ No

_____

**4. When did the baby first receive the following foods?**

| | Months of life: | Not received |
|---|---|---|
| ☐ **Fluids** *(water, tea, juice)* | ( ) | ☐ |
| ☐ **Cow's milk** | ( ) | ☐ |
| ☐ **Formula** | ( ) | ☐ |
| ☐ **Complementary food** *(mashed vegetables, fruits, bread, cookie etc. )* | ( ) | ☐ |
| ☐ **Foods containing gluten** *(cereals, bread, cookies etc.)* | ( ) | ☐ |

*ProBrain-D* **Pseudonym:** _____

# Survey Developmental Milestones – ProBrain-D Study

## Age 6 Months

Date of phone call: _____ Age of the patient in months: _____

| | **Task fulfilled** | |
|---|---|---|
| | yes | no |
| **Gross motor skills** | | |
| *Lifts head and chest, at least 90°, supported on straightened arms.* | | |
| **Fine motor skills** | | |
| *Passes objects (e.g., toys) from one hand to the other.* | | |
| **Perception/cognition** | | |
| *Objects, toys are grasped with both hands, put into the mouth, gnawed, but not looked at very intensively (explored orally and manually). Activities in the immediate environment are followed attentively.* | | |
| **Language** | | |
| *Formation of rhythmic syllable chains (e.g. ge-ge-ge, mem-mem-mem, die-die-die).* | | |
| **Social and emotional skills** | | |
| *Laughs vocally when being teased. Behaves differently with familiar people and with strangers. Is happy when another child appears.* | | |
| ***Mood/affect*** | | |
| *The child appears content and balanced in the presence of the primary caregiver. When the primary caregiver speaks to the child or communicates with him/her non-verbally, the child remains in a positive, balanced and open mood. In reunification situations (after brief turning away/short separation), the child appears relaxed, pleased and immediately seeks eye contact with the primary caregiver.* | | |
| ***Contact/communication*** | | |
| *The child responds to address or nonverbal communication by the primary caregiver with a smile, turning of the head or spontaneous physical contact. The child spontaneously sends clear signals to the primary caregiver and seeks contact through gaze, facial expressions, gestures and sounds. In unfamiliar situations, the child makes physical or eye contact to reassure the primary caregiver.* | | |
| ***Regulation/stimulation*** | | |
| *The child allows itself to be soothed by a primary caregiver within a short period of time by being rocked, sung to or spoken to. The child engages in interplay with the primary caregiver (e.g., with fingers or with building blocks). The child can usually self-regulate his or her feelings and tolerate mild disappointment. The child responds appropriately to loud noises, bright lights and physical stimuli.* | | |

**Have there been any abnormalities in development or have any illnesses been diagnosed?**
☐ **No** ☐ **Yes**

**If yes, please specify:** _____

_____

_____

*ProBrain-D* **Pseudonym: _____**

## Age 12 Months

Date of phone call: _____ Age of the patient in months: _____

| | **Task fulfilled** | |
|---|---|---|
| | yes | no |
| **Gross motor skills** | | |
| *Sits freely with a straight back and secure balance control. Pulls him-/herself up to a standing position and remains standing for a few seconds. Turns independently and fluidly from supine to prone position. Crawls safely and in a coordinated manner (including stairs).* | | |
| **Fine motor skills** | | |
| *Picks up small objects between thumb and pointer finger. Taps 2 blocks against each other. Points to objects with index finger. Passes objects from hand to hand. Holds pen in fist and scribbles dots and dashes.* | | |
| **Perception/cognition** | | |
| *Hands an object to mother/father when asked. Follows the index finger in the direction shown. Takes interest in individual objects/things in picture books. Maintains regular eye contact with caregivers.* | | |
| **Language** | | |
| *Spontaneous production of longer syllable chains. Produces double syllables (wauwau, dada). Imitates sounds (meow, mah). Can say mama, dada.* | | |
| **Emotional development/ego development** | | |
| *The child can distinguish between strangers and familiar people (begins to be shy with strangers). Is happy to see other children. Caresses doll or stuffed animal. Actively returns tenderness. May refuse a request by protesting. Is interested in his/her mirror image, touches it and looks into his/her eyes.* | | |
| **Social development/independence** | | |
| *Follows request 'Come here!' or 'Give me!'. Imitates domestic activities, e.g., wiping, cleaning, and imitates gestures, e.g., waving or clapping hands. Rolls ball to a play partner and shows enjoyment of other children. Holds cup to drink and wants to eat by him-/herself. Helps to take off clothes and shoes, can do it partially alone.* | | |
| **Learning and playing behavior** | | |
| *Touches and examines things with mouth, hands, and eyes. Finds an object that was hidden under a pillow while watching (object permanence). Makes purposeful actions: e.g., puts lid on can, reaches into cup, puts something down. Begins with functional play, objects are used according to their function: e.g., plays 'eating', 'combing', 'sleeping'. Begins with representational play, actions are performed on dolls.* | | |

**Have there been any abnormalities in development or have any illnesses been diagnosed?**
☐ **No** ☐ **Yes**

**If yes, please specify: _____**

_____

_____

_____

*ProBrain-D* **Pseudonym: _____**

## Age 18 Months

Date of phone call: _____ Age of the patient in months: _____

| | Task fulfilled | |
|---|---|---|
| | yes | no |
| **Gross motor skills** | | |
| *Free walking with secure balance control. Can walk up stairs with holding on.* | | |
| **Fine motor skills** | | |
| *Builds a tower of 2-4 blocks (showing allowed). Turns several book pages at once. Objects held by the child are handed over on demand, put into a container or taken out.* | | |
| **Language** | | |
| *Speaks approximately 10 words. Symbolic language (wau-wau), non-comprehensible child and one-word language are used for communication.* | | |
| **Perception/cognition** | | |
| *Draws a line. Pulls toys behind him/her. Drinks and eats independently. Likes to look at age-appropriate picture books, points to familiar things, does role-playing with him-/herself.* | | |
| **Social development** | | |
| *Simple rules and prohibitions are understood and followed to a greater or lesser extent.* | | |

**Have there been any abnormalities in development or have any illnesses been diagnosed?**
☐ **No** ☐ **Yes**

**If yes, please specify:**

_____

_____

_____

*ProBrain-D* **Pseudonym:** _____

## Age 24 Months:

Date of phone call: _____ Age of the patient in months: _____

| | Task fulfilled | |
|---|---|---|
| | yes | no |
| **Gross motor skills** | | |
| *Child runs safely, avoiding obstacles. Walks down 3 steps at a child's pace, holding on with one hand. Squats and picks up objects. Climbs on playground equipment. Kicks ball away forcefully with foot. Can walk on tiptoes. Throws balls or toys while standing and hops (legs closed) forward without falling.* | | |
| **Fine motor skills** | | |
| *Paints flat spiral. Holds pencil for painting in fist grip. Can unwrap wrapped candy or other small objects. Turns book pages one by one. Loves to play with blocks and cups (build towers, transfer things, etc.). Can unscrew a lid.* | | |
| **Language** | | |
| *One-word, two-word language (at least 50 correct words). Understands and follows simple requests. Expresses through gestures or speech (shaking head or saying no) that he/she dislikes something or has his/her own ideas. Points or looks at 3 named body parts. Understands characteristics such as 'large', 'heavy', or 'cold'.* | | |
| **Perception/cognition** | | |
| *Stacks 3 cubes, builds a tower of 4-6 blocks. Points to familiar objects in the picture book. Puts three cups of different sizes inside each other.* | | |
| **Emotional development/ego development** | | |
| *Stays and plays alone for about 15 minutes, even if mom/dad is not in the room but nearby. Has interest in other children. Learns that he/she has a mind of his/her own, says 'no', gets angry. Defends his/her possessions. Calls him/herself by his/her own name. Seeks comfort when sad. Likes to play with other children, it is still more of a side by side game than with each other. Smiles after a successful action.* | | |
| **Social development/independence** | | |
| *Likes to play chase with peers. Helps with small domestic jobs (setting and clearing the table etc.). Imitates domestic chores (cleaning, ironing, mowing lawn, etc.). Takes off an open jacket and t-shirt, puts on a sweater independently. Can eat with a spoon, eats plate empty with little spills, and dries hands cursorily. Tries to pull parents somewhere.* | | |
| **Learning and playing behavior** | | |
| *Spontaneously cares for doll or stuffed animal (begins simple role play). Interested in story in picture book and points out details. Does not give up immediately when playing: Tries to put shapes in a shape box, tries out what fits where and how (cups, blocks, etc.).* | | |

**Have there been any abnormalities in development or have any illnesses been diagnosed?**
☐ **No** ☐ **Yes**

**If yes, please specify:**

_____

_____

## Survey on the 'Diagnosis and Treatment Standard for Neonatal Hypoglycaemia (≥ 35+0 weeks of gestation)' - Midwives/Nurses

Dear midwives and nurses of the Department for Obstetrics and Gynaecology and the Department of General Paediatrics, Neonatology and Paediatric Cardiology of the University Hospital Düsseldorf,

Thank you for taking the time to complete this questionnaire regarding the new diagnosis and treatment standard for neonatal hypoglycaemia. The survey is anonymous, so it is not possible to identify you. Please answer the questions truthfully. This is the only way we can adequately evaluate the standard and subsequently optimise it.

Personal information: I have ____ years of work experience

I work as a: ☐ midwife ☐ nurse

☐ Department of Obstetrics and Gynaecology ☐ Department of Paediatrics

Please indicate to what extent the statements apply to you.

**Example:**

| Statement | strongly disagree ☐ 0 | disagree ☐ 1 | slightly disagree ☐ 2 | slightly agree ☐ 3 | agree ☐ 4 | strongly agree ☐ 5 |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. I use the standard in every baby with neonatal hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 2. The diagnosis and treatment standard is clearly and logically structured. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 3. The diagnosis and treatment standard is complete. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 4. The standard gives me confidence in the management and treatment of at-risk neonates and neonates with hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 5. I am following the diagnosis and treatment measures of the step-by-step flowchart of the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 6. The diagnosis and treatment standard better monitors at-risk neonates. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 7. I follow the measures for prevention of hypoglycaemia stated in the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 8. The measures for prevention of hypoglycaemia mentioned in the standard are followed by my colleagues. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 9. The measures for prevention of hypoglycaemia are reasonable. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 10. I make sure to check after birth/admission if the neonate has a risk factor for hypoglycaemia and therefore an indication for blood glucose screening and preventive measures. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 11. I regularly use the SGA/LGA weight chart in the standard to determine if the baby has a risk factor for neonatal hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 12. For neonates who have been seen/examined by a paediatrician after birth but stay in the obstetrics wards, I independently re-evaluate whether there is a risk factor for hypoglycaemia and a blood glucose screening should be performed. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 13. Since the implementation of the treatment standard, I have been paying more attention to clinical signs consistent with hypoglycaemia in the neonates. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 14. When I notice clinical signs consistent with hypoglycaemia in a neonate, I perform a blood glucose measurement. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 15. Since the implementation of the standard, I have taken more measures to prevent hypothermia in the neonate. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 16. Neonatal hypoglycaemia is a physiological phenomenon and should be tolerated without prevention and treatment. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 17. Supplemental feeding is useful to prevent hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 18. The volumes of formula that are fed supplementary are too high. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 19. Supplemental feeding often leads to breastfeeding problems. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 20. I have enough time to make the supplementary feeding 'breastfeeding friendly (cup, spoon)' and to avoid bottle feeding. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 21. I think 'breastfeeding-friendly' supplemental feeding (cup, spoon) is important. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 22. Collecting colostrum even before admission for delivery would be a useful addition. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 23. I regularly give dextrose gel to prevent hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 24. The application of dextrose gel is simple and safe. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 25. I regularly give dextrose gel for hypoglycaemia ≤ 45 mg/dl. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 26. For hypoglycaemia in the 46-54 mg/dl range, I regularly give dextrose gel after feeding if the child has not drunk enough. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 27. For the administration of dextrose gel, I use the dosing table of the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

If 0-2: How do you dose the dextrose gel?

_____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 28. The regular blood glucose measurements are a burden on my daily work. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 29. Due to the regular blood glucose measurements, I neglect other tasks. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 30. Timing of blood glucose measurements depending on blood glucose results is reasonable. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 31. The time requirement of 12 hours for the duration of blood glucose screening in babies of diabetic mothers and LGA is justified. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 32. The time requirement of 36 hours for the duration of blood glucose screening in SGA and preterm infants is justified. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 33. Too many blood glucose measurements are performed. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 34. The many blood glucose measurements that the standard demands are more likely to harm the neonate than to protect it. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 35. Parents understand that preventive measures and blood glucose measurements are performed on at-risk neonates. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 36. The blood glucose measurements cause worries in parents. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 37. I have enough knowledge about neonatal hypoglycaemia to educate and advice parents. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 38. In case of hypoglycaemia < 30 mg/dl or 3x ≤ 45mg/dl, I immediately inform a paediatrician. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 39. There is often a time delay between a blood glucose measurement and the following intervention. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 40. Since the implementation of the standard, more neonates are being transferred to the neonatal unit due to hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 41. Since the implementation of the standard, overtreatment of neonates with hypoglycaemia has occurred. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 42. I believe that the standard is sufficient to protect neonates from even mild hypoglycaemic brain damage. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 43. I am glad that the standard was introduced. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 44. There was enough opportunity to participate in the development of the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 45. I had the opportunity to attend training sessions for the new standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

I have the following important modification requests:

Do you have any other remarks/comments on the 'Diagnosis and Treatment Standard for Neonatal Hypoglycaemia (≥ 35+0 weeks of gestation'?

**Thank you for your participation!**

## Survey on the 'Diagnosis and Treatment Standard for Neonatal Hypoglycaemia (≥ 35+0 weeks of gestation)' - Physicians

Dear physicians of the Department for General Paediatrics, Neonatology and Paediatric Cardiology,

Thank you for taking the time to complete this questionnaire regarding the new diagnosis and treatment standard for neonatal hypoglycaemia. The survey is anonymous, so it is not possible to identify you. Please answer the questions truthfully. This is the only way we can adequately evaluate the standard and subsequently optimize it.

Occupation:

- Resident physician
- Attending physician
- Senior physician
- Fellow in neonatology

Please indicate to what extent the statements apply to you.

**Example:**

| Statement | strongly disagree ☐ 0 | disagree ☐ 1 | slightly disagree ☐ 2 | slightly agree ☐ 3 | agree ☐ 4 | strongly agree ☐ 5 |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. I use the standard in every child with neonatal hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 2. The diagnosis and treatment standard is clearly and logically structured. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 3. The standard covers all aspects of neonatal hypoglycaemia management. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 4. The standard gives me confidence in handling blood glucose screening and hypoglycaemia management. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 5. I am always following the diagnosis and treatment procedures of the step-by-step flowchart of the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 6. The treatment steps in the standard are reasonable. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 7. The intervals for blood glucose measurements specified in the standard are reasonable. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 8. The standard leads to an unnecessary high number of blood glucose measurements. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 9. Since the implementation of the standard, overtreatment of neonates with hypoglycaemia has occurred. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 10. With the standard, hypoglycaemia in at-risk newborns is more reliably detected and treated. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 11. The standard makes it easier for me to write orders to treat hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 12. Since the implementation of standard, there have been fewer queries from nurses/midwives about the treatment and procedures for neonatal hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 13. The midwives/nurses independently follow the steps outlined in the standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 14. The standard is accepted and implemented by all professional groups (midwives, nurses, physicians). | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

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| 15. Since the implementation of the standard, I have been paying more attention to ordering blood glucose measurements in at-risk neonates. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 16. Since the implementation of the standard, I am paying more attention to ordering a blood glucose measurement in a neonate with clinical signs consistent with hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 17. Since the implementation of the standard, more neonates are transferred to the neonatal unit due to hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 18. The supplemental feeding foreseen in the standard has a negative impact on successful breastfeeding. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 19. The designated measures are well accepted by parents. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 20. Parents understand that their baby may need to be transferred to the neonatal unit for profound or recurrent hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 21. Since the implementation of the standard, I regularly use dextrose gel to treat hypoglycaemia. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 22. For neonates who have been treated with intravenous glucose for > 48 h, I perform a fasting test before discharge. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 23. In clinical practice, I notice that my colleagues are using the new standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 24. The new standard has become well established in everyday clinical practice. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |
| 25 I had the opportunity to attend training sessions for the new standard. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 |

Do you have modification requests? yes ☐ no ☐

Suggestions:

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Further remarks/comments on the 'Diagnosis and Treatment Standard for Neonatal Hypoglycaemia (≥ 35+0 weeks of gestation':

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**Thank you for your participation!**