The PREMTiME Study

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Evidence Review

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Summary

The Women’s and Children’s service at the Sunshine Coast University Hospital (SCUH) has transformed a low value, high volume blanket follow-up pathway into a streamlined prioritised model of care focused on providing early detection of adverse neurodevelopmental outcomes and excellence in service delivery for families impacted by preterm birth.
Our team researched clinical assessment tools that would allow clinicians to make early prediction

about motor and cognitive outcomes. After national benchmarking, literature search and training, SCUH was the first hospital in Queensland to implement the General Movement Assessment (GMA) in the Neonatal Unit and Paediatric outpatient setting. The GMA had proven predictive accuracy for early detection of cerebral palsy and we were excited about additional early research findings suggesting that GMA may have strong negative predictive value and potential to predict milder developmental delays.
The result was the PREMTiME study: a multidisciplinary research initiative incorporating neonatal and paediatric medical and allied health teams. Study methods were in two parts. Firstly, a systematic review of all clinical tools, used at six months corrected age (CA) or younger, to predict motor and cognitive delay (not cerebral palsy) at 24 months CA in infants born very preterm or very low birth weight. Secondly, a prospective longitudinal cohort of study of very preterm and very low birth weight infants on the Sunshine Coast, Australia. All infants were assessed between 34-35 weeks and 16 weeks corrected age using the Premie-Neuro Examination, the General Movement Assessment, the Alberta Infant Motor Scale, and the Infant Sensory Profile 2. At 24 months corrected age delays were identified using the Bayley III and Neurosensory Motor Developmental Assessment (NSMDA).

Key dates

Apr 2021

Implementation sites

Sunshine Coast University Hospital

Partnerships

Faculty of Medicine, University of Queensland; Stella Maris Institute in Italy; Queensland Cerebral Palsy and Rehabilitation Research Centre

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Aim

The PREMTiME study aimed to identify early clinical biomarkers from birth to 16 weeks corrected age to predict typical outcome and mild motor and cognitive delays at 24 months corrected age in very preterm and very low birth weight (VLBW) infants. As early delays are difficult to differentiate from typical development, impacted infants often miss out on crucial intervention during the critical period of brain neuroplasticity experienced in the first days and months following birth. As risk for adverse neurodevelopmental outcome is higher in the very preterm and VLBW population, clinicians require robust biomarkers they can rely on to prioritise follow up services, prevent overservicing and inform referral pathways to early intervention.

Benefits

Benefits for families:
By six months corrected age we can now provide parents with an estimate of their child’s risk for adverse outcome. Our findings demonstrated that GMA trajectories can predict and differentiate between very low, low, moderate and high risk for motor or cognitive delay. As a result, we are reassuring families where risk is low and facilitating early intervention and transition to NDIS funded therapies for high-risk infants.
Benefits for services:
Earlier prediction of developmental delay has translated into a cost effective, customised follow up pathway for very preterm and very low birth weight infants. Improved prioritisation is allowing redirection of essential resources towards very early intervention for infants with high risk for cerebral palsy.

Background

In the late 2000s we were engaged in traditional follow up practices. All infants born less than 1500g or less than 32 weeks were attending developmental screening at multiple timepoints between birth and two years corrected age. Without prognostic indicators we were unable to prioritise or streamline

the pathway or provide reassurance to families until children were two years of age or older. The model was unsustainable. With our growing population and limited resources, we could see that we needed to change and improve our practice.

Solutions Implemented

Results of the PREMTiME study are being translated into practice within a revised model of care facilitated by a seamless pathway from the Neonatal Unit to the Neonatal Neurodevelopmental Clinic (NNC). During the inpatient stay, infants commence early prognostic GMA that continues in the outpatient setting. Outpatient NNC appointments are scheduled at three set time points during the first four months CA to time with GMA and to provide early feeding, growth and developmental intervention where indicated.

- Upon completion of standard care pathways in the NNC, the multidisciplinary team facilitates ongoing co-ordinated care, including additional assessments and discharge planning.
- Infants identified as very low risk for adverse neurodevelopmental outcome are linked with health care providers in the community and discharged from the NNC.
- Low risk infants are encouraged to link with universal services but remain engaged with the NNC and will have scheduled developmental screening at two years CA.
- Moderate risk infants will qualify for ongoing developmental surveillance in the NNC until two years CA. If there is clinical evidence of delay in two or more domains the team will facilitate referral to NDIS via the ECEI scheme.
- Infants with high risk for adverse neurodevelopmental outcomes, including cerebral palsy, will be referred to NDIS and supported to transition to early intervention services. Early intervention is provided within the NNC while families await uptake with community providers.

Evaluation and Results

Findings from the systematic review were published in the journal of Developmental Medicine and Child Neurology (DMCN) in 2021 and outcomes of the cohort study in DMCN in March 2023.
The new and important information added by the systematic review showed that the General Movement Assessment (GMA) has predictive validity for both motor and cognitive dysfunction in infants born very preterm.
Of the 104 infants recruited to the cohort study, 79 completed outcome assessments (43 females, 36 males; gestational age 30 weeks [SD one week 6 days], mean birthweight 1346 g [SD 323]). The incidence of developmental delay (motor or cognitive) was n=5, 6.3%. Suboptimal quality of fidgety general movements (temporal organization and quality of movement) at 16 weeks corrected age demonstrated the best predictive accuracy for motor and cognitive delay. GMA trajectories with abnormal writhing at four to five weeks CA and suboptimal quality of fidgety movement at 16 weeks CA (intermittent, sporadic, abnormal, absent) were strongly predictive of developmental delay,

superior to all other clinical tools and perinatal/demographic variables investigated.
Overall, we found that when assessment of GMA trajectories commences at 34-35 weeks gestational age and includes assessment at the specific timepoints of four to five and 16 weeks CA, there is sufficient predictive validity to identify both typical outcome and developmental delay and differentiate risk for motor and cognitive outcomes at 24 months corrected age.

Lessons Learnt

As our team was inexperienced with research methods, collaboration with expert partners was an essential part of initiating and progressing the PREMTiME study. A committed multidisciplinary team, robust change management processes and our partnerships with management and funders has provided the framework that has supported the initiative across more than a decade of research.

References

Caesar R, Boyd RN, Colditz P, Cioni G, Ware RS, Salthouse K, et al. Early prediction of typical outcome and mild developmental delay for prioritisation of service delivery for very preterm and very low birthweight infants: a study protocol. BMJ Open. 2016;6(7).
Caesar R, Colditz PB, Cioni G, Boyd RN. Clinical tools used in young infants born very preterm to predict motor and cognitive delay (not cerebral palsy): a systematic review. Dev Med Child Neurol. 2021;63(4):387-95.
Caesar, RA, Boyd, RN, Cioni, G, Ware, RS, Doherty, J, Jackson, MP, et al. Early detection of developmental delay in infants born very preterm or with very low birthweight. Dev Med Child Neurol. 2023; 65(3): 346–357. https://doi.org/10.1111/dmcn.15381

Further Reading

https://espace.library.uq.edu.au/view/UQ:b9d81c0