fetal cranial growth measures from <14 weeks’ gestation, five fetal trajectories were identified, subsequently associated with specific neurodevelopmental, behavioural, visual, postnatal morbidity and anthropometric measures at birth and at age 2 years (n=3598). Trajectories reflecting early faltering or accelerating fetal head circumference growth changed within a 20–25 week gestational age window and were associated with developmental scores at 2 years in a mirror (positive/negative) pattern, mostly focused on maturation of cognitive, language and visual skills. Additionally, analysis of the 1381 preterm infants born within this cohort identified eight aetiology-based preterm phenotypes, which were associated with markedly different neonatal morbidity, child growth and developmental profiles at age 2.

These findings confirm that in early life: (1) within-population variability for skeletal growth and neurodevelopment is far greater than that among populations when health and nutritional needs are met, and (2) epidemiological patterns between un-selected populations are largely environment-driven, expressed by phenotypes and exposotypes with differential risk profiles. The Project has also constructed, for the first time, a set of international standards to monitor human growth and development from early pregnancy to age 2, to facilitate unified clinical care and research (https://intergrowth21.tghn.org/standards-tools/).

REFERENCES

IV. Rescuing child development: from science to interventions

THE NEUROBIOLOGY OF EARLY PARENTING: FROM BASIC SCIENCE TO INTERVENTIONS

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Parents’ early interactions with their infants have been shown to shape long-term child development. When interacting with an infant, adults intuitively enact a range of behaviours that support infant development, such as altering speech, establishing eye contact and mirroring infant expressions. Sensitive, contingent responsiveness from parent to infant involves the parental capacity to detect, monitor and respond to infant social signals.

Our work has studied parental responses to infant signals using a range of methods, from magnetoencephalography and local field potential recordings, to observational studies of motor behavior and mother-infant interactions in depression. This work has provided converging evidence that infant communicative cues have a privileged status, and elicit highly selective responses in the human adult brain. We have demonstrated rapid differentiation of infant vocalisations from other sounds in both subcortical regions, such as the periaqueductal gray (PAG), and cortical regions, including the orbitofrontal (OFC), anterior cingulate and motor cortices. Before 100ms, we found a significant difference in activity recorded from the PAG in response to infant vocalizations compared with constructed control sounds and adult and animal affective vocalizations. We propose that this rapid activity in response to infant vocalizations may reflect the initiation of a state of heightened alertness to support parent-infant interactions.

Among cortical brain regions, we have reported several findings showing that the OFC rapidly responds to different infant communicative cues, such as faces and voices, which may support their efficient processing. OFC activity may thereby facilitate rapid orienting to infant cues, fundamental to intuitive parenting behaviour. These neuroimaging findings of rapid processing of infant cues are further supported by experimental evidence showing that adults can move more rapidly, and with greater accuracy and effort after hearing infant cries, compared to other environmental sounds.

We have also shown that adults are highly attuned to subtle parameters communicating distress in infant cues, and that attunement can be enhanced via training. In adults with major depression, and no musical training, we found disrupted interpretation of infant vocal distress, but not in adults with music training. This suggests that prior acoustic training might reduce depression-related disruptions in sensitivity to infant cues. Furthermore, we found that interpretation of infant vocal distress could be enhanced through short-term, perceptual acoustic discrimination training. Overall, our work suggests that adults can rapidly detect and preferentially orient to infant cues, processes supported by both subcortical and cortical brain responses. Interventions that can enhance parents’ attention to infant cues, and the capacity to ‘read’, or interpret infant cues appropriately, may be useful in support of early caregiving. Such interventions may be of particular value in conditions where caregiving is disrupted, in for instance depression, where there are well-recognised biases in social and emotional processing.

REFERENCES