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Examining the Feasibility of Using Non-Nutritive Suck as a Non-Invasive Biomarker of Brain Development in a Puerto Rican Cohort

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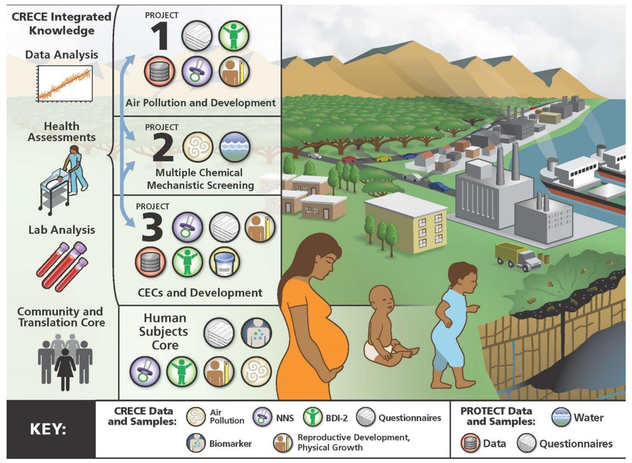
Opportunity

Why Non-Nutritive Suck (NNS)?

- There is a large gap in early, quantitative measures of neurodevelopment that can be administered in the first year of life. As a result, researchers are restricted to standardized tests, like the Bayley-III scales, that require significant training to administer, often underestimate delays, and are poor at predicting future neurodevelopment across preterm and full-term cohorts (Anderson & Burnett, 2017; Anderson et al., 2010; Spencer-Smith, Spittle, Lee, Doyle, & Anderson, 2015).
- Sensitive tests of early neurofunction are essential as infancy is a critical period of brain growth laying the foundation for all areas of neurodevelopment: communication, motor, socio-emotional, cognitive, and behavioral.
- Therefore, early neuro-assessment tools that make use of automated data collection and processing, provide quantitative measures of the outcomes, and require very little expertise or training to administer, are critical to move the field forward. A new and innovative technology that could address this gap in early neurodevelopmental measures is non-nutritive sucking (NNS).

Purpose

The goal of this study was to assess the feasibility of collecting and analyzing NNS from infants enrolled in a study at the Center for Research on Early Childhood Exposure and Development in Puerto Rico (CRECE).

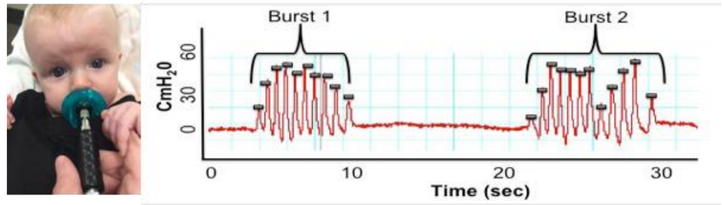


What is CRECE?

CRECE is an environmental health science research center that evaluates child development and monitors environmental exposures. Puerto Rico contains a complex mixture of environmental contaminants and the population has higher than average exposures to a number of contaminants. Because the effects of these exposures are not entirely known in children and children are more at risk when exposed at critical points in development, the center utilizes many methods for tracking developmental outcomes including NNS, eye tracking, a variety of questionnaires, assessments, and physical exams.

Approach

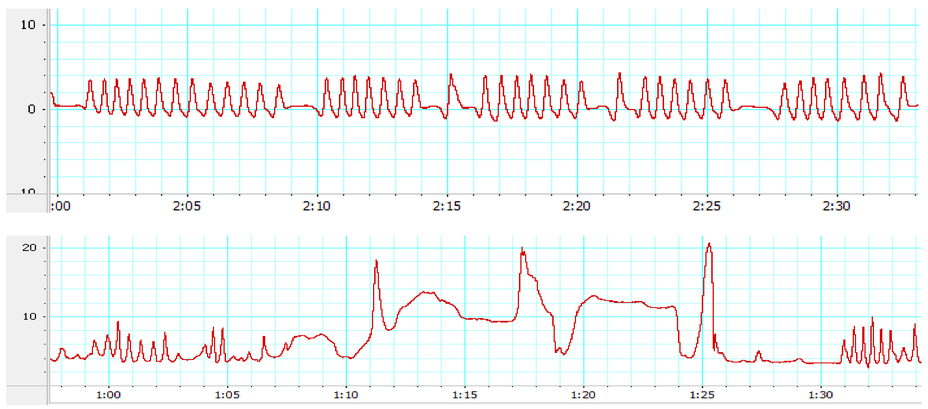
- NNS samples were attained using a research pacifier measuring pressure changes as the infant sucks during their 2-8 week follow-up visit at CRECE.
- Infants' NNS signal data was analyzed for average duration, average amplitude, average frequency, average number of sucking bursts, average cycles per burst, and average cycles per two minutes.
- Thus far, samples have been analyzed for ten infants enrolled in CRECE's study.
- The best two minutes of each sample collected was utilized for this analysis.
- Initial steps towards standardizing these analyses included creating a NNS data dictionary and a seamless method of exporting the NNS data consistently form Puerto Rico to the Speech and Neurodevelopment Lab (SNL) in Boston, MA.



LEFT: Infant sucking on research pacifier during NNS collection; RIGHT: Example of NNS sample analysis. Burst 1 containing 10 cycles or sucks and Burst 2 containing 12 cycles or sucks.

Data

Alex Newman, mechanical engineer delivering the NNS cart to Puerto Rico and training Dr. Huerta-Montanez and Abigail Figueroa Navedo on NNS calibration and collection.



TOP: Optimal NNS sample with clear bursts/pause periods. BOTTOM: Disorganized NNS pattern characterized by non-NNS events, like biting. Vertical axis cmH20 and horizontal axis time in minutes/seconds.

Impact

- We will continue to attain and analyze NNS data for CRECE (current n=45).
- The NNS data will then be analyzed in relation to environmental exposure levels already collected as part of CRECE, such as to various phthalates and BPA.
- NNS data will then be compared to subsequent neurodevelopmental milestones from birth to age four.
- Taken together, we can better understand environmental exposures and predict neurodevelopmental outcomes. This would immensely alter current clinical and research practices.
- The NNS collection was also recently expanded to another child environmental health center at the University of Illinois.
- Expanding to other cohorts will increase our sample size and provide a more diverse data sample.

LEFT: Participant from University of Illinois during NNS training and RIGHT: image of the traveling NNS cart delivered to the University of Illinois..

Acknowledgements

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