

New analysis of premature infants' heartbeats, breathing could be cues for leaving NICU

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Late gestation is a busy time for babies getting ready for life outside the womb, particularly for functions critical to life such as breathing and maintaining an adequate heartbeat. These two functions are connected in mature infants and healthy people throughout life, so measuring their level of connectedness can give doctors a cue about whether an infant is ready to head home or needs to remain in the care of the neonatal intensive care unit (NICU). Current methods to analyze this connection are not yet fully developed, leaving doctors and nurses without an optimal way to deal with periodically missing data or natural variations in breathing or heartbeat. Now, however, researchers in Virginia have found a way around this problem by using a new analytical method that looks for so-called cardiorespiratory interaction using individual breaths and heartbeats and relating the two in time. The findings shed light on which infants may be mature enough to leave the NICU, showing that postnatal age seems to be an indicator of maturity, but birth weight or gestational age at birth are not.

The article is entitled "Breath-By-Breath Analysis of Cardiorespiratory Interaction for Quantifying Developmental Maturity in Premature Infants." It appears in the current edition of the [Journal of Applied Physiology](#), published by the [American Physiological Society](#).

The researchers collected data from the bedside monitors of 1,202 infants cared for in the University of Virginia NICU from January 2009 to June 2011. This data included both [electrocardiogram](#) waveforms (an indicator of heartbeats) and chest impedance signals (an indicator of breaths) from both infants considered to have very low birth weights and those with normal birth weights. The researchers paired these two measures in sliding four minute windows, using software to determine

whether patterns in breathing correlated with patterns in heartbeats. They also collected other data on these patients, including [gestational age](#) at birth (a measure of prematurity), postnatal age (length of time after birth), and age at discharge from the hospital.

The researchers were able to gather 34,600 breathing and heartbeat records for the 1,202 patients, corresponding to an average of 13 days of data for each infant. Their results showed that their analytical method was useful for identifying the link between breathing and heartbeat in this population. Findings revealed that cardiorespiratory interaction steadily increased with each infant's postnatal age. Surprisingly, researchers found no correlation between cardiorespiratory interaction and either [birth weight](#) or gestational age at birth, two factors often used to gauge infant maturity. The degree of cardiorespiratory interaction increased over time before the attending physician's decision to discharge each baby from the hospital without respiratory support or cardiorespiratory monitoring, suggesting that each infant's brainstem—a critical structure that controls many functions vital to life—was maturing over time.

These findings suggest that by coupling individual breaths to heartbeats, the researchers were able to avoid the pitfalls of earlier methods. The analytical method used by this research team could be useful for monitoring whether [premature infants](#) have developed enough to head home from the hospital without complications.

"Since coupling of organs is correlated with good health, continuously measuring cardiorespiratory interaction may provide early detection of subacute, potentially catastrophic illness. Future studies should test the hypothesis that falling cardiorespiratory interaction precedes clinically

evident deterioration," the authors say.

Provided by American Physiological Society

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