

## Full-day in-home infant movement monitoring: Opportunities and challenges.

Beth Smith, USC

### Abstract:

Very early identification of impaired infant neuromotor control is needed to initiate and target intervention to promote development. Our goal is to use full-day movement monitoring with small inertial sensors on infants' legs to determine quantity, type and quality of movements and differentiate healthy and impaired neuromotor control. Full-day assessment is desirable due to high inherent variability in infant performance and temperament. We have collected a full day (8-13 hours) of leg movement activity from infants, ages 1 to 12 months. Infants were measured 3 times each, 2 months apart. Tri-axial accelerometer and gyroscope data were collected at 20 Hz from sensors attached to the front of ankles. Many different threshold-based algorithms have been used to detect and characterize adult leg movement using accelerometers and/or gyroscopes, however infant algorithms are lacking. To set a threshold to differentiate infant leg movements from extraneous background movement such as being carried around or riding in a stroller or car, we analyzed both acceleration and rotational rate data from gyroscopes. Although movement detection based on acceleration was sensitive to leg movement, some false positives were detected due to linear acceleration from extraneous background movement. Gyroscope data appeared more adept at differentiating infant leg movements from background movement. We filtered the gyroscope data with a 4 Hz low pass filter and defined a significant leg movement above a threshold of 30 degrees/s of total rotation sustained for more than 0.4 s. Unconstrained infant movements produced rates of rotation of 300-900 degrees/s, while constrained movements, such as those produced in a car seat, were represented by rates of rotation of 30-200 degrees/s. While it is feasible to collect full-day movement monitoring across the first year of life with sensors attached to infants' legs, further work is required to validate the sensor data, relate leg movement trajectories to developmental milestones, and differentiate typical and atypical development.