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Motor and language abilities from early to late toddlerhood: Using formalized assessments to capture continuity and discontinuity in development

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ABSTRACT

Developmental tests reflect the premise that decreases in skills over time should be a sign of atypical development. In contrast, from a psychological perspective, discontinuity may be viewed as a normal part of typical development. This study sought to describe the variability in patterns of continuity and discontinuity in developmental scores over time. Seventy-six toddlers (55% boys) from a larger screening study were evaluated at 13 and 30 months using the Mullen Scales of Early Development (MSEL) in five areas: gross motor, fine motor, visual perception, receptive language, and expressive language. Parents completed the First Year Inventory (FYI) at 12 months as well. At 30 months, 23.68% of the sample received a clinical diagnosis (e.g., developmental delay, autism spectrum disorder [ASD]). Toddlers were classified as stable, increasing, or decreasing by at least 1.5 standard deviations (*SD*) on their scores in each of the five MSEL areas from 13 to 30 months. Between 3.9% and 51.3% of the sample was classified as increasing and 0–23.7% as decreasing across areas. Decreases in motor areas were associated with increases in language areas. None of the toddlers showed decreases greater than 1.5 *SD* on their MSEL composite scores. There was no single pattern that characterized a certain diagnosis. Higher FYI sensory-regulatory risk was associated with decreases in gross motor. Lower FYI risk was linked with increases in receptive language. Developmental discontinuity in specific developmental areas was the rule rather than the exception. Interpretations of decreases in developmental levels must consider concurrent increases in skill during this emerging period.

1. Introduction

Autism spectrum disorder (ASD) affects 1 out of 88 children worldwide (Center for Disease Control, 2013). ASD is well known for impairing children's social abilities (American Psychiatric Association, 2013). However, ASD is more complex than researchers once thought (Kantzer, Fernell, Gillberg, & Miniscalco, 2013). For example, many children with ASD demonstrate difficulty executing complex motor tasks (Duffield et al., 2013) and using language to communicate with others (Horovitz & Matson, 2010). These deficits in motor and language skills significantly affect children's development and future outcomes

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(Kuhl et al., 2013). Risk for ASD has been linked with developmental outcomes (Turner-Brown, Baranek, Reznick, Watson, & Crais, 2012). Therefore, early screening and identification of impairments associated with ASD are critical. This is especially the case with toddlers because ASD is often undetected in this age group (Kleinman et al., 2008). Early verification of ASD risk often depends on developmental scores.

ASD may go undetected in toddlers due to the continuity and discontinuity inherent in development. The mixture of continuous and discontinuous trajectories observed during toddlerhood is substantial. Continuity reflects stability in development between time points. In contrast, discontinuity represents a decrease or increase in developmental level so that toddlers transition either from meeting, exceeding, or not meeting age norms from one time point to another. In clinical populations, health professionals interpret a decrease in skill as a potential indicator of a need for services. In contrast, in typical development, discontinuities can reflect periods of system reorganization (Thelen & Spencer, 1998). This system reorganization can be due to variability in strategies available for performance (Vereijken, 2010), concurrent improvements in other developmental domains (Berger, Adolph, & Kavookjian, 2010), or changes in environmental demands (Van Dijk & Van Geert, 2007). Differences in how discontinuity is interpreted have practical implications. For example, if parents express concerns about their toddlers' deterioration of motor or language abilities based on their observations, but clinicians do not observe changes in toddlers' skills based on traditional assessments, what does this imply? Should the number of areas in which discontinuity is observed or the magnitude of discontinuity matter? The current study aimed to address these questions by describing longitudinal patterns of domain-specific continuity and change at 13 and 30 months using a formalized assessment in a community sample.

The present study focused on one of the most widely used developmental tests for toddlers: the Mullen Scales of Early Learning (MSEL; Mullen, 1995). Both task hierarchy and scoring on this test assumes developmental continuity. However, a few studies show hints of discontinuity across areas (i.e., areas meant to be a measure of developmental domains) using the MSEL in typically developing toddlers. In a recent cross-sectional study of 47 36- to 60-month-old toddlers from South Africa, there were fluctuations in average scores within MSEL areas and across ages. However, continuity was not statistically tested (Bornman, Sevcik, Romski, & Pae, 2010). In a longitudinal study of Indian American toddlers followed from 6 to 36 months, the shape of change in MSEL scores differed across areas and was not linear throughout time. They had decreases in all areas with the exception of the gross motor area between 6 and 15 months. MSEL language scores remained stable between 15 and 36 months (Mitchell, Croy, Spicer, Frankel, & Emde, 2011). Both studies suggest the presence of inter- and intra-individual discontinuities in MSEL scores but do not classify toddlers based on their patterns of change.

In clinical populations, the MSEL has been used to profile patterns of developmental change (Chawarska, Klin, Paul, Macari, & Volkmar, 2009; Landa & Garrett-Mayer, 2006; Macari et al., 2012). Longitudinal research shows significant increases between 2 and 3 years of age in MSEL verbal scores in toddlers with ASD but not in non-verbal scores (Chawarska, Klin, Paul, & Volkmar, 2007). Others documented a decrease in MSEL motor, visual perception, and expressive language scores in half of those with ASD between 14 and 24 months (Landa & Garrett-Mayer, 2006). In a screening study, patterns of change in MSEL scores from 24 to 42 months were compared among toddlers with ASD, toddlers with intellectual disabilities, and typically developing toddlers. Although most toddlers were stable in their scores, increases were observed in about a third of those with ASD who were functioning within average or below average ranges. In contrast, only 14% of those with intellectual disabilities and 5% of the typically developing group had increases in scores (Dietz, Swinkels, Buitelaar, & Daalen, 2007). At the same time, other studies indicate relative stability in scores of toddlers with ASD (Begovac, Begovac, Majić, & Vidović, 2009; Yang, Jong, Hsu, & Lung, 2011) and with language disorders (Clegg, Hollis, Mawhood, & Rutter, 2005). These findings raise questions about interpreting discontinuity to be an indicator of developmental impairments.

The current study sought to answer three primary questions: (1) what is the rate of continuity (i.e., stability in skills) and discontinuity (i.e., increase or decrease in skills) between 13 and 30 months across developmental areas in a community sample? (2) Do patterns of continuity and discontinuity overlap across areas? (3) How are factors such as the risk of developmental disability and incidence of clinical referrals associated with increases, decreases, or stability between 13 and 30 months? We used the MSEL to measure patterns of change via periods of continuity or discontinuity across five areas that map onto domains important in toddler development: gross motor, fine motor, visual perception, expressive language, and receptive language skills. Unlike previous studies, we looked for evidence of discontinuity or continuity in each area between two time points rather than using one score collapsed across all areas. We hypothesized that toddlers who showed discontinuity in one area would demonstrate a corresponding discontinuity in a related area. We also believed that discontinuity would be associated with the risk of ASD in toddlers. In the current study, toddlers with and without clinical diagnoses were included to reflect how the MSEL is typically interpreted in practice: with a community sample of toddlers not yet diagnosed.

2. Method

2.1. Measures

2.1.1. The mullen scales of early learning (MSEL: Mullen, 1995)

The MSEL is an assessment of motor and language functioning from birth to 68 months. It takes about 30 min to administer to toddlers ages 12–36 months. The MSEL yields five scale scores (fine motor, gross motor, visual reception, expressive language, and receptive language) and an Early Learning Composite score (ELCS) or developmental quotient (DQ)