Exploring the Early Communication Key Skills for Intervention Decision-making With Infants and Toddlers

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Introduction

The Early Communication Indicator (ECI) is one of a growing class of general outcome measures emerging in early education and early childhood special education designed to identify infants and toddlers (6 to 36 mos) who are not making expected progress learning to communicate, promote levels of more intensive intervention to address children's delays, and monitor children's progress to ensure that they are benefiting from services received (Carta, Greenwood, Walker & Buzhardt, 2010). Benchmarks for intervention decision making with the ECI are currently based on the Total Communication Score, normed on children served in Early Head Start (Greenwood, et. al., 2006). However, the ECI Total Communication Score is comprised of four key skill elements of early communication, each with a dynamic pattern of growth and change over time. A line of research is exploring the benefit of basing screening and intervention decisions on the key skills rather than Total Communication. Results are consistent with widely accepted theories of language suggesting that simpler elements of communication precede more complex language (e.g., prelinguistic to linguistic) development. Findings support the hypothesis that ECI key skill elements may allow earlier and more sensitive decision making related to need for communication interventions. Reported are analyses conducted to extend prior findings by (a) estimating predictive relations within and between ECI key skill elements' growth trajectories and (b) establishing the divergent validity of the key skills based on children with and without communication risk (disability status).

Research Questions

1. What are the predictive relations within and between ECI key skill elements across time?

2. What is the divergent validity of the ECI key skills based on a breakdown by known risk groups (Individual Family Service Plan; IFSP vs. No IFSP)?

Methods

Sample

Participants were infants and toddlers recruited from Early Head Start (EHS) programs representing urban, suburban, and rural communities across Kansas and Missouri. Of 5111 infants and toddlers, 2299 enrolled in 13 Kansas EHS programs (n = 1430; 62.20%) and 13 Missouri EHS programs (n = 869; 37.80%) met the inclusion criterion; children having three or more repeated Early Communication Indicator (ECI) observations were included. 52.5% (n = 1208) of participants were male. English was the primary language spoken in the home for 89.8% (n = 2056) of participants. 9.13% (n = 210) of participants were eligible to receive IDEA Part C early intervention services (indicated by an IFSP).

Measure

The Early Communication Indicator (ECI) is a general outcome measure developed for use with infants and toddlers aged 6 to 42 months. The ECI was adopted as an accountability measure by Kansas and Missouri EHS in 2002. Infants and toddlers participating in EHS programs across Kansas and Missouri were screened quarterly using the ECI, which quantifies the occurrence of four key skill elements—gestures, vocalizations, single-words, and multiple-word utterances—in the context of observations of children's communicative proficiency during 6-minute play-based sessions with a familiar adult and standard toy set.

The frequencies of occurrence of the four ECI key skill elements were recorded and converted into rates per minute. ECI assessors (i.e., trained home visitors and early educators) became reliable in their scoring and administration of the ECI through online training and certification. Certification required practice assessment coding, administration of the ECI with a minimum of 85% fidelity, and coding of standard certification videos, achieving a minimum of 85% agreement with master codings. (See http://www.igdi.ku.edu for information about certification methods.) The psychometric properties of the ECI, including indices of reliability and criterion and predictive validity, have been reported as good (Greenwood et al., 2006). Literature supports the technical adequacy and feasibility of the ECI for continuous progress monitoring.

Analyses

The first research question was addressed using Structural Equation Modeling (SEM) to estimate latent longitudinal panel and growth curve models describing predictive relations within and between ECI key skill elements across time. Logistic regression analyses were conducted to determine predictive values of infant's and toddler's observed frequencies per minute of gestures, vocalizations, and single word utterances at 12, 18, 24, and 30 months to future success or failure in demonstrating 36 month multiple word fluency.

The second research question was addressed using Hierarchical Linear Modeling (HLM) to estimate growth parameters for children 6 to 42 months of age. Communication risk (IFSP vs. No IFSP status) was treated as a fixed effect.

Table 1. Squared Multiple Correlation Coefficients R^2 for Univariate Longitudinal Panel Models

	Gestures				Vocalizations				Single Words				Multiple Words			
	1st Order	2nd Order	3rd Order	4th Order	1st Order	2nd Order	3rd Order	4th Order	1st Order	2nd Order	3rd Order	4th Order	1st Order	2nd Order	3rd Order	4th Order
6 months	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9 months	.422	--	--	--	.167	--	--	--	.804	--	--	--	.607	--	--	--
12 months	.378	.453	--	--	.172	.190	--	--	.246	.261	--	--	.619	.620	--	--
15 months	.345	.430	.468	--	.233	.280	.318	--	.300	.322	.324	--	.597	.780	.815	--
18 months	.346	.410	.449	.489	.241	.310	.342	.386	.219	.244	.251	.256	.594	.601	.601	.602
21 months	.250	.355	.404	.437	.242	.302	.358	.385	.293	.326	.328	.333	.435	.499	.502	.503
24 months	.340	.420	.459	.501	.282	.366	.394	.423	.246	.275	.294	.295	.432	.478	.499	.499
27 months	.343	.425	.463	.495	.327	.378	.400	.412	.281	.326	.337	.341	.385	.392	.392	.392
30 months	.346	.433	.463	.522	.375	.460	.471	.488	.281	.331	.364	.370	.299	.373	.388	.393
33 months	.390	.448	.489	.508	.368	.419	.446	.491	.272	.333	.359	.375	.415	.437	.456	.457
36 months	.404	.456	.489	.523	.356	.431	.452	.469	.312	.368	.433	.453	.411	.453	.481	.482

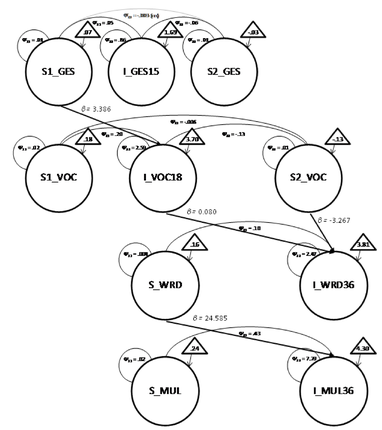
Note: The increment in R^2 for observations that are more that 4 measurement occasions removed is negligible. Autoregressive relationships not reported.

Results

What are the predictive relations within and between ECI key skill elements?

The squared multiple correlation coefficients estimated within each of the four key skill elements suggested that observations one year removed significantly predicted communication rates at subsequent measurement occasions. Latent growth modeling (Figure 1) confirmed that simpler elements of communication preceded more complex. Specifically, growth in gestures between 6 and 15 months significantly predicted the frequency of vocalizations at 18 months; children demonstrating rapid growth in gestures achieved higher vocalization rates at 18 months, which in turn predicted single-word utterance rate at 36 months. The observed negative slope of vocalizations after18 months predicted single word communication at 36 months such that children who were slower to use words and multiple words in their communication achieved lower single-word rates at age three. Finally, growth in single-words beginning at 12 months significantly predicts multiple-word fluency (rate per minute) at 36 months.

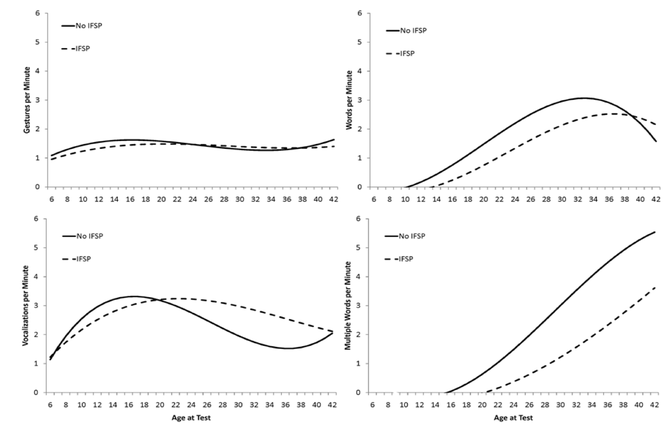
Fig 1. Predictive relations between ECI Key skill elements' status and growth trajectories



What is the divergent validity of the ECI key skills based on a breakdown by known risk groups?

Children in both groups with IFSPs were using gesturing for communication as early as 6 months of age and did not differ. The first indication of an IFSP difference was seen in vocalization growth in terms of significantly lower slope (t[5189] = 3.441, p = .0001, d = -0.43) and intercept (t[5189] = 7.626, p = .001, d = -0.99 (Fig 2 upper right panel). This slower growth pattern then extended to single word utterances in the IFSP group (d = -0.35 intercept, 0.27 slope, and 0.43 acceleration) and subsequently, multiple word utterances (d = - 0.76 intercept, -0.59 slope, and -0.39 acceleration) . As seen in Fig 2 (lower left panel), single word use began to rise above the record floor of zero on average two months earlier for children without IFSPs than children with IFSPs. With the onset of multiple word use (Fig 2, lower right panel), this extended to a 4 months earlier difference and greater acceleration favoring children without IFSPs.

Fig 2. Early communication key skill element curvilinear growth patterns by IFSP status.



Discussion

The predictive validity of the earlier key skills (gestures, vocalizations) to later single word and multiple words at 6 months was established using latent growth modeling, replicating and extending these relationships. Findings support the potential value of using the Key Skills for further research on predictive utility. The divergent validity of the Key Skills was established using HLM showing that children at risk due to their IFSP status and receipt of early intervention services compared to Early Head Start peers without this risk, generally started growth in individual key skills later, and grew slower in skills over time (with the exception of gestures). Together, these findings support continuing work developing the ECI for screening, intervention decision making, and progress monitoring. Future research on the sensitivity and specificity of the ECI key skills is in progress (e.g., Wilson & Lonigan, 2010). Planned are several analyses of the key skills' predictive utility in relationship to a communication outcome criterion variable for children 36 to 48 months of age (e.g., the Preschool Language Scale, Preschool Picture Naming IGDI; TOPEL).

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