

# Development and Standardization

## Development of the DECA-I/T Items

**A**s with the original Devereux Early Childhood Assessment (DECA) (LeBuffe & Naglieri, 1999) multiple approaches were used to develop the initial set of items for the Devereux Early Childhood Assessment for Infants and Toddlers (DECA-I/T).


First, we reviewed the literature on resilience and noted behavioral descriptions of resilient children (Egeland, 1997; Gordon-Rouse, 1996; Masten and Coatsworth, 1998; Werner and Smith, 1982, 1992, and 2001; Werner, 1990 and 2000). During this process we reviewed existing measures of infant and toddler social and emotional health.

We also conducted focus groups with parents and teachers of infants and toddlers, early care and education professionals, and mental health professionals. In the focus group sessions, parents and professionals were asked to describe the behaviors of children that “were likely to do well” or indicated that the child was “doing well” in regards to social and emotional health. Conversely, parents and early care and education professionals were also asked to describe behaviors that indicated that the child was “likely to have problems.” Behavioral descriptions were used to generate rating scale items.

The items were written as directly observable behaviors requiring little or no inference on the part of the observer. Careful attention was also paid to potential psychometric qualities such as reliability and validity as well as ease of use of the scales. Finally, throughout all phases of item development, the reading level of the items and Rater directions were carefully considered so that the overall readability of the text would be as easy as possible.

The item development phase resulted in a pool of 112 items, which served as the starting point in the development of the DECA-I/T. By conducting a pilot study in the spring of 2005 with 251 participants at 12 sites nationally, it was possible to examine the usefulness of the initial set of items and

---



---

their inter-relationships. Children with identified special needs (behavioral, social, emotional) scored statistically significantly lower on protective factors than those children who were not identified as having social emotional concerns. There was also a statistically significant difference between infant and toddler scores.

The results of the pilot study were used to prepare a form consisting of 68 items to be used in the national standardization study described below.

## National Standardization

---

The DECA-I/T was standardized in a way to ensure the sample would closely represent the United States population on important demographic characteristics. The data collection procedures also ensured that a wide variety of children were included for the generation of norms. We collected data from a variety of settings across the United States. Infant and toddler early care and education professionals from childcare settings provided the teacher ratings and will be referred to in all tables as Teacher Raters. Parent (and/or other family member) ratings were obtained not only from these same settings, but also in response to recruitment efforts. To ensure the confidentiality of their responses, parents who chose to participate were able to: 1) place their completed rating form in a sealed envelope to be sent to Devereux for processing or 2) anonymously fill out the standardization form online. The online form was identical to the handwritten copy.

## Representativeness of the DECA-I/T Standardization Sample

---

The DECA-I/T standardization sample consisted of 2,183 infants and toddlers between 4 weeks and 3 years of age (45% infants and 55% toddlers). For this sample an infant was defined as being from 4 weeks up to 18 months and a toddler as being from 18 months up to 3 years of age. Early care and education professionals provided ratings on 52% of these children; parents provided ratings on the remaining 48% of the children. As shown in Table 1.1, the DECA-I/T standardization sample closely approximated the population of the United States with respect to gender. The desired characteristics of the standardization sample were based on the *Statistical Abstract of the United States 2006* 125th edition: *The National Data Book* by the U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census. In the tables that follow, the total numbers of children included may not sum to 2,183 due to missing data.

Table 1.1

## DECA-I/T Standardization Sample Characteristics: Age and Gender

Age	Males		Females		Unknown		Total	
	n	%	n	%	n	%	n	%
<b>Infants (1-18 Months)</b>	484	49.0%	483	48.9%	20	2.0%	987	45.2%
<b>Toddlers (18-36 Months)</b>	591	49.4%	595	49.7%	10	0.8%	1196	54.8%
<b>Total Sample</b>	1075	49.2%	1078	49.4%	30	1.4%	2183	
<b>U.S. %</b>		51.0%		49.0%				

Note. The U. S. population data are based on "Resident Population, by Sex and Age: 2006 Table No. 16," *Statistical Abstract of the United States 2006* 125th edition: *The National Data Book* by the U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 2006. Washington, DC: Author.

### Age and Gender

Table 1.1 presents the numbers and percentages of infants and toddlers by gender. The number of infants was 987 and the number of toddlers was 1,196. These results show that each age was sufficiently sampled. The data also show that the percentages of males and females in the standardization sample as a whole, as well as at each age, very closely approximated the proportions of the U.S. population.

### Geographic Region

We collected data from 99 sites in 29 states in the four geographic regions: Northeast, Midwest, West, and South. Table 1.2 shows the numbers and percentages of children for each age and the total sample for each of the four geographic regions. On average, the regional distribution of the DECA-I/T standardization sample was within 6% of the U.S. population for children 4 weeks to 3 years old. These data show that the DECA-I/T standardization sample closely approximated the regional distribution of the U.S. population.

Table 1.2

DECA-I/T Standardization Sample Characteristics:  
Geographic Region and Age

Age	Northeast		Midwest		West		South		Unknown		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
<b>Infants (1-18 Months)</b>	165	16.7%	283	28.7%	230	23.3%	302	30.6%	7	0.7%	987	45.2%
<b>Toddlers (18-36 Months)</b>	243	20.3%	301	25.2%	275	23.0%	366	30.6%	11	0.9%	1196	54.8%
<b>Total Sample</b>	408	18.7%	584	26.8%	505	23.1%	668	30.6%	18	0.8%	2183	
<b>U.S. %</b>		18.0%		21.8%		26.2%		33.9%				

Note. The U. S. population data are based on "Resident Population, by Sex and Age: 2006 Table No. 34," *Statistical Abstract of the United States 2006* 125th edition: *The National Data Book* by the U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 2006. Washington, DC: Author.

### Race

Table 1.3 provides the DECA-I/T standardization sample composition by geographic region and race. Based on information provided on the rating forms, the children were classified according to the five major race categories used by the U.S. Bureau of the Census: Native American, Asian/Pacific Islander, African American, Hispanic, and Caucasian. The DECA-I/T rating forms also allowed the Rater to describe the race of the child as "Mixed Race" or "Other."

The data in Table 1.3 indicate that the racial composition of the total DECA-I/T standardization sample closely approximated that of the U.S. population (total exceeds 100% due to some respondents making multiple selections). Additionally, sample percentages within each region were also similar to the actual population percentages found in each geographic region.

Table 1.3

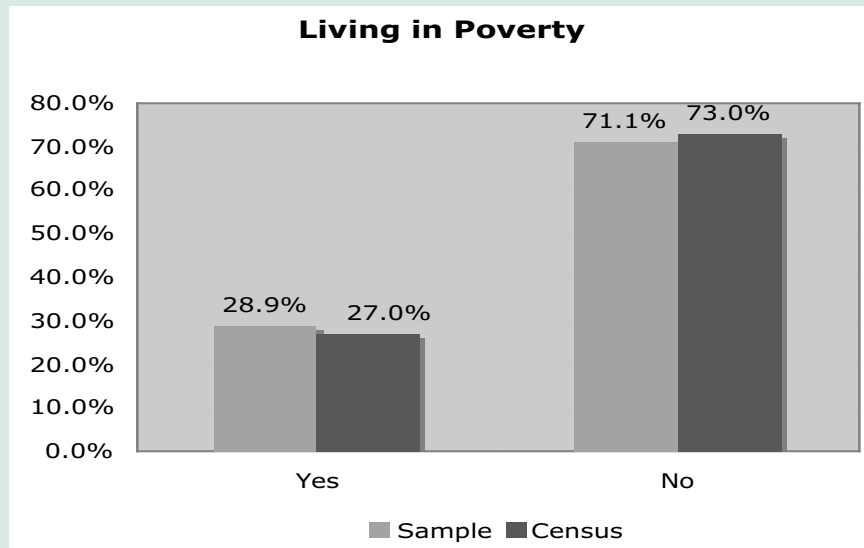
### DECA-I/T Standardization Sample Characteristics: Geographic Region and Race

	Native American		Asian Pacific Islander		African American		Hispanic		Caucasian		Other		Mixed Race		Not Reported		Total Sample			
	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	U.S. %	
<b>Northeast</b>	2	0.5%	7	1.7%	55	13.5%	7	1.7%	307	75.2%	4	1.0%	23	5.6%	3	0.7%	408	18.7%	18.1%	
<b>Midwest</b>	12	2.1%	1	0.2%	52	8.9%	24	4.1%	406	69.5%	11	1.9%	68	11.6%	10	1.7%	584	26.8%	21.8%	
<b>West</b>	26	5.1%	8	1.6%	3	0.6%	116	23.0%	264	52.3%	9	1.8%	71	14.1%	8	1.6%	505	23.1%	26.2%	
<b>South</b>	21	3.1%	8	1.2%	84	12.6%	180	26.9%	328	49.1%	9	1.3%	31	4.6%	7	1.0%	668	30.6%	33.9%	
<b>Not Reported</b>	1	5.6%	0	0.0%	2	11.1%	3	16.7%	11	61.1%	0	0.0%	1	5.6%	0	0.0%	18	0.8%		
<b>Total</b>	62	2.8%	24	1.1%	196	9.0%	330	15.1%	1316	61.7%	33	1.5%	194	8.9%	28	1.3%	2183			
<b>Adjusted Sample (w/o "Other", "Mixed Race", and "Not Reported")</b>																				
<b>Total</b>	62	3.2%	24	1.2%	196	10.2%	330	17.1%	1316	68.3%										1928
<b>U.S. %</b>		2.2%		3.4%		16.2%		12.2%		71.3%										

Note. The U. S. population data are based on "Resident Population, by Sex and Age: 2006 Table No. 22," *Statistical Abstract of the United States 2006 125th edition: The National Data Book* by the U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 2006. Washington, DC: Author.

Figure 1.1

## Poverty Level DECA-I/T Sample




### Socioeconomic Status

Determining the number of children receiving either subsidized childcare or enrolled in TANF assessed the socioeconomic status of the DECA-I/T standardization sample. Of the entire sample of over 2,183 children, 29% were either receiving subsidized childcare or public assistance. This very closely approximates the 27% of infants and toddlers living in poverty (Children’s Defense Fund, 2005). Figure 1.1 depicts the breakdown of the DECA-I/T sample compared to Census Data (2006).

## Organization of Items into Scales

Utilizing the standardization data set, we attempted to organize the DECA-I/T items into statistically and logically derived scales. The Protective Factor Scales were identified through the use of exploratory item factor analysis. We applied this method to the entire set of protective factor items. Careful examination of the factorial results suggested that no single solution would work across the developmental age span and there needed to be two forms (infant and toddler), which became the Devereux Early Childhood Assessment for Infants (DECA-I) and the Devereux Early Childhood Assessment for Toddlers (DECA-T).

---



---

Next, we conducted a series of analyses to determine which items should be deleted to obtain the best configuration of scales, for infants and toddlers separately. We based the decisions to delete items on the following goals: 1) to identify the best factor solution from psychometric and interpretability perspectives, 2) to shorten the two forms of the DECA-I/T as much as possible without compromising breadth of coverage, and 3) to ensure that the constructs are measured reliably by the scales. Although this left anchor items common to both scales, it also permitted differing items that were developmentally appropriate either for the infant or the toddler scale. The final results of these analyses are provided in Table 1.4 for the infant form and Table 1.5 for the toddler form.

The DECA-I/T Infant form (DECA-I) ended up with 33 items and the Toddler form (DECA-T) with 36 items reflecting positive behaviors (strengths) typically seen in resilient children. Factor analysis elicited a strong two factor solution for the infants and a strong three factor solution for the toddlers. The infant and the toddler factor solutions, with the individual item descriptions were sent to the National Advisory Team and the DECI Research Advisory Board (see Devereux Early Childhood Assessment for Infants and Toddlers: User's Guide, Appendix D) to advise on naming the protective factor scales. Additionally our literature review provided further guidance in selecting these scale titles. There was strong agreement with both expert opinion and literature which resulted in the titles and their descriptions for the Infant Form as listed below:

*Initiative* (18 items) assesses the infant's ability to use independent thought and actions to meet her or his needs.

*Attachment/Relationships* (15 items) assesses the mutual, strong, long lasting relationship between the infant and significant adults such as family members, and teachers.

*A Total Protective Factors scale*, which is a composite of the above two scales, provides an overall indication of the strength of the infant's protective factors.

The DECA-I/T Toddler Form (DECA-T) is comprised of the following scales:

*Attachment/Relationships* (18 items) assesses the mutual, strong, long lasting relationship between the toddler and significant adults such as family members, and teachers.

*Initiative* (11 items) assesses the toddler's ability to use independent thought and actions to meet her or his needs.

*Self-Regulation* (7 items) assesses the toddler's ability to gain control of and manage emotions, and sustain focus and attention.

*A Total Protective Factors scale*, which is a composite of the above three scales, provides an overall indication of the strength of the toddler's protective factors.

Table 1.4

## Rotated Factor Analysis Results for DECA-I Scales

Item #	Item	Factors	
		In	A/R
1	try to do new things	.73	
3	imitate actions of others	.72	
5	keep trying when unsuccessful	.72	
7	show interest in what others were doing	.70	
9	notice changes in surroundings	.70	
11	adjust her/his energy level to the type of play	.69	
13	act happy when praised	.67	
15	explore surroundings	.65	
17	express her/his dislikes	.65	
19	reach for a familiar adult	.61	
20	respond to her/his name	.60	
22	react to another child's cry	.60	
21	keep trying to obtain a toy	.59	
26	act in a way that make others smile or show interest	.59	
27	easily go from one activity to another	.58	
28	seek attention when a familiar adult was with another child	.58	
30	enjoy being around other children	.57	
29	look to familiar adult when exploring her/his surroundings	.52	
32	act happy with familiar adults		.76
31	show pleasure when interacting with adults		.73
33	accept comfort from a familiar adult		.72
23	smile at familiar adults		.71
25	act happy		.69
24	respond positively to adult attention		.68
18	smile back at a familiar adult		.67
16	calm down with help from a familiar adult		.66
14	make eye contact with others		.64
12	act in a good mood		.63
10	seek comfort from familiar adults		.61
8	show affection for a familiar adult		.60
6	enjoy being cuddled		.59
4	enjoy interacting with others		.52
2	respond when spoken to		.50

Note: Only Loadings of .50 or above are reported.  
(In = Initiative, A/R = Attachment/Relationships)



Table 1.5

## Rotated Factor Analysis Results for DECA-T Scales

Item #	Item	Factors		
		A/R	In	SR
2	show affection for a familiar adult	.76		
21	easily go from one activity to another	.75		
6	act happy with familiar adults	.74		
22	show pleasure when interacting with adults	.73		
15	smile back at a familiar adult	.71		
4	seek comfort from familiar adults	.69		
36	express a variety of emotions (e.g., happy, sad, mad)	.66		
17	reach for a familiar adult	.66		
5	makes needs known to a familiar adult	.66		
25	accept comfort from a familiar adult	.66		
11	act happy when praised	.65		
13	make eye contact with others	.65		
24	makes others aware of her/his needs	.62		
7	show interest in her/his surroundings	.60		
18	respond to her/his name	.59		
8	respond when spoken to	.58		
14	enjoy being cuddled	.58		
1	enjoy interacting with others	.52		
9	show concern for other children		.76	
10	try to comfort others		.75	
26	play make-believe		.67	
29	try to clean up after herself/himself		.67	
28	show preference for a particular playmate		.66	
19	react to another child's cry		.64	
16	ask to do new things		.64	
31	play with other children		.60	
12	participate in group activities		.56	
32	try to do things for herself/himself		.55	
27	follow simple directions		.55	
23	handle frustration well			.72
34	accept another choice when the first choice was not available			.68
3	adjust to changes in routine			.67
33	calm herself/himself			.61
30	easily follow a daily routine			.58
35	have regular sleeping pattern			.56
21	easily go from one activity to another			.56

Note: Only Loadings of .50 or above are reported.

(A/R = Attachment/Relationships, In = Initiative, SR = Self-Regulation)

---

---

The individual DECA-I/T protective item factor loadings were obtained using principal components extraction with varimax rotation. The Kaiser (1960) rule (i.e., eigenvalues greater than 1.0) and scree plots were initially used to assist in determining the existence of a factor. Subsequently, an iterative procedure was used, based on absolute value of standardized factor loadings of .4, until potential subscales were completely resolved with unique factor loadings. These factor analytic results showed that each of the subscale factors is comprised of items with substantial loadings on the subscale on which they are placed, and which did not have substantial loadings on the subscales on which they were not placed.

## Norming Procedures

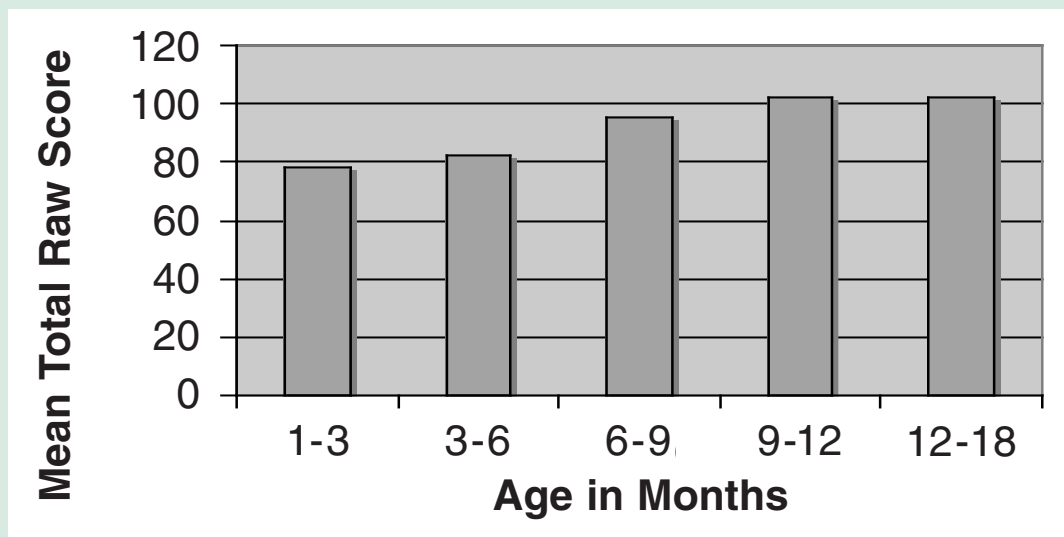
---

The first step in preparing the norms was to determine if any trends existed in the data. We examined the children's Total Protective Factors Scale Raw Score means and standard deviations for age, Rater, and gender differences. Figure 1.2 suggests age trends in the total raw score for the infant (1 to 18 months). There were no age trends for the toddlers. Separate norms tables (see Appendix A and B of the DECA-I/T User's Guide) were developed for 1 up to 3 months, 3 up to 6 months, 6 up to 9 months, and 9 up to 18 months (there were no differences for the 9 up to 12, 12 up to 15, and 15 up to 18 months scores) for the infant form and 18 up to 36 months for the toddler form.

Figure 1.2


### Infant Mean Total Raw Scores by Age

---



---

---



We also found the need to construct norms by Rater (parents/family members and early care and education professionals) because initial analyses showed significant differences in the scores. These differences were most likely due to the different environments in which these different Raters see the children. After determining that Rater norms would be constructed, we examined the distributions of raw scores for normality. The cumulative frequency distributions for the derived scales (see Tables 1.4 and 1.5 on pages 8 and 9) all approached normality but were slightly positively skewed. For this reason we decided to compute the separate norms tables using classical normalization procedures.

To accomplish this, we fit the obtained frequency distribution for each scale to normal probability standard scores using Blom's (Blom, 1958) algorithm of

$$\frac{r - \frac{3}{8}}{w + \frac{1}{4}}$$

where  $r$  is the rank of the score and  $w$  is the sum of weight. These procedures were followed for all of the protective factor scales.

## T Scores

---

We computed standard scores separately for each of the scales based on their individual raw score distributions. We determined the standard scores corresponding to the percentiles for which they are theoretically associated based on the normal curve. T scores for each scale were set at a mean of 50 and a standard deviation of 10. We selected this metric because of its familiarity to professionals, its previous use with the DECA, and because it facilitates interpretation of the results and comparison with T scores from other similar scales.

In order to maintain this metric for Total Protective Factors scores, and in order to equalize the weights due to the different numbers of items per subscale, a second normalization was required. That is, we added together the T scores for the subscales (two for the Infant form and three for the Toddler form). This sum was then normalized using Blom's algorithm (Blom, 1958), and transformed with the T score formula of  $(10 \times Z) + 50$ .