

# Greenspan Social-Emotional Growth Chart

A validated, norm-referenced screening  
of key social-emotional milestones  
in infants and young children from birth to 42 months of age

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# AGENDA

1. SEGC: screening and/or surveillance?
2. Conceptual framework and domains
3. Psychometric properties
4. How to score and interpret results
  - Cut Points, sensitivity & specificity for ASD
  - Special groups
5. Advantages and Limitations
6. Discussion on possible uses

# Algorithm for Developmental Surveillance and Screening

American Academy of Pediatrics, 2006, 2007

## 1. Surveillance: at every well-child preventive care visit

- Eliciting and attending to the parent's concerns
- Documenting and maintaining a developmental history
- Making accurate observations of the child
- Identifying risk and protective factors
- Maintaining accurate record of documenting the process and findings



# Algorithm continued

## 2. Screening:

- 9 months
  - **18 months**
  - **(24 months)**
  - 30 months
- Identifying Children with Autism Early?  
V.B.Gupta, S. Hyman, C.P. Johnson, J. Bryant,  
B. Byers, R. Kallen, S.E. Levy, S.M. Myers  
A.I. Rosenblatt, M Yeargin-Allsopp  
*Pediatrics* 2007; 119; 152-153

# A long list of screenings.....

## *Directly Administered Tools*

Bayley Infant Neurodevelopmental Screen (BINS)	3-24 m	11-13 items	<u>10 min????</u>	SS: 0.75-0.86 SP: 0.75-0.86
Batelle Developmental Inventory Screening (BDI-ST)	0-95m	<b>100 items</b>	<u>10-15 min???</u> ( $< 3$ y)	SS: 0.72-0.93 SP: 0.79-0.88
Brigance Screens - II	0-90 m	8-10 items	10-15 min	SS: 0.70-0.80 SP: 0.70-0.80
Denver II	0-6 y	<b>125 items</b>	<u>10-20 min???</u>	SS: 0.56-0.80 SP: 0.43-0.80
CAT/CLAMS	3-36 m	<b>100 items</b>	<u>15-20 min??</u>	SS: 0.21-0.67 SP: 0.95-1.00
Screening Tool for Autism in Two-Year Olds (STATS)	<u>24-35 m</u>	12 items	20 min	SS: 0.83-0.92 SP: 0.85-0.86

# A long list of screenings.....

## *Parent Questionnaires*

Child Dev. Inventory (CDI)	18m-6y	300 items	30-50 min	SS: 0.80-1.00 SP: 0.94-0.96
Child-Development Review Parent Questionnaire (CDR- PQ)	18m-5y	6 open Q 26 items (99 items)	10-20 min	SS: 0.68 SP: 0.88
Infant Development Inventory	0-18 m	4 open Q 87 items	5-10 min??	SS: 0.85 SP: 0.77
<b>Ages &amp; Stages Q</b>	4-60 m	<u>30 items</u>	10-15 min??	SS: 0.70-0.90 SP: 0.76-0.91
Parent's Evaluation of Developmental Status ( <b>PEDS</b> )	0-8 y	<u>10 items</u>	<b>2-10 min</b>	SS: 0.74-0.79 SP: 0.70-0.80
Communication & Symbolic Behavior Scales ( <b>CSBS-DP</b> )	6-24 m	<u>24 items</u>	<b>5-10 min</b>	SS: 0.76-0.88 SP: 0.82-0.87
Modified Checklist for Autism in Toddlers ( <b>M-CHAT</b> )	16-48 m	<u>23 items</u>	<b>5-10 min</b>	SS: 0.85-0.87 SP: 0.93-0.99

# Social-Emotional Growth Chart (SEGC)

- Short 35-item Questionnaire designed to be completed by parents or caregivers in less than 10 minutes
- Easy to administer and score by any professional involved in clinical or educational work with children and their families



# Conceptual Framework, Domains &

## Number of Items

Functional Emotional Milestones		Age in months	# of questions
Stage 1	Self-regulation & interest in the world	0-3	11
Stage 2	Engages in relationships	4-5	13
Stage 3	Uses emotions in interactive purposeful manner	6-9	15
Stage 4a	Uses series of interactive emotional signals or gestures to communicate	10-14	17
Stage 4b	<b>Uses series of interactive emotional signals or gestures to solve problems</b>	15-18	<b>21</b>
Stage 5a	<b>Uses symbols or ideas to convey intentions or feelings</b>	19-24	<b>24</b>
Stage 5b	Uses symbols or ideas to express more than basic needs	25-30	28
Stage 6	Creates logical bridges between emotions and ideas	31-42	35

# The Social-Emotional Growth Chart

Developmental Stages

Logical bridges

Ideas beyond basic needs

Ideas (words/symbols)

4b. Complex problem-solving

4a. Simple problem-solving

3. Purposeful interaction

2. Engagement

1. Attention/focus

Age in Months

0-3

4-5

6-9

10-14

15-18

19-24

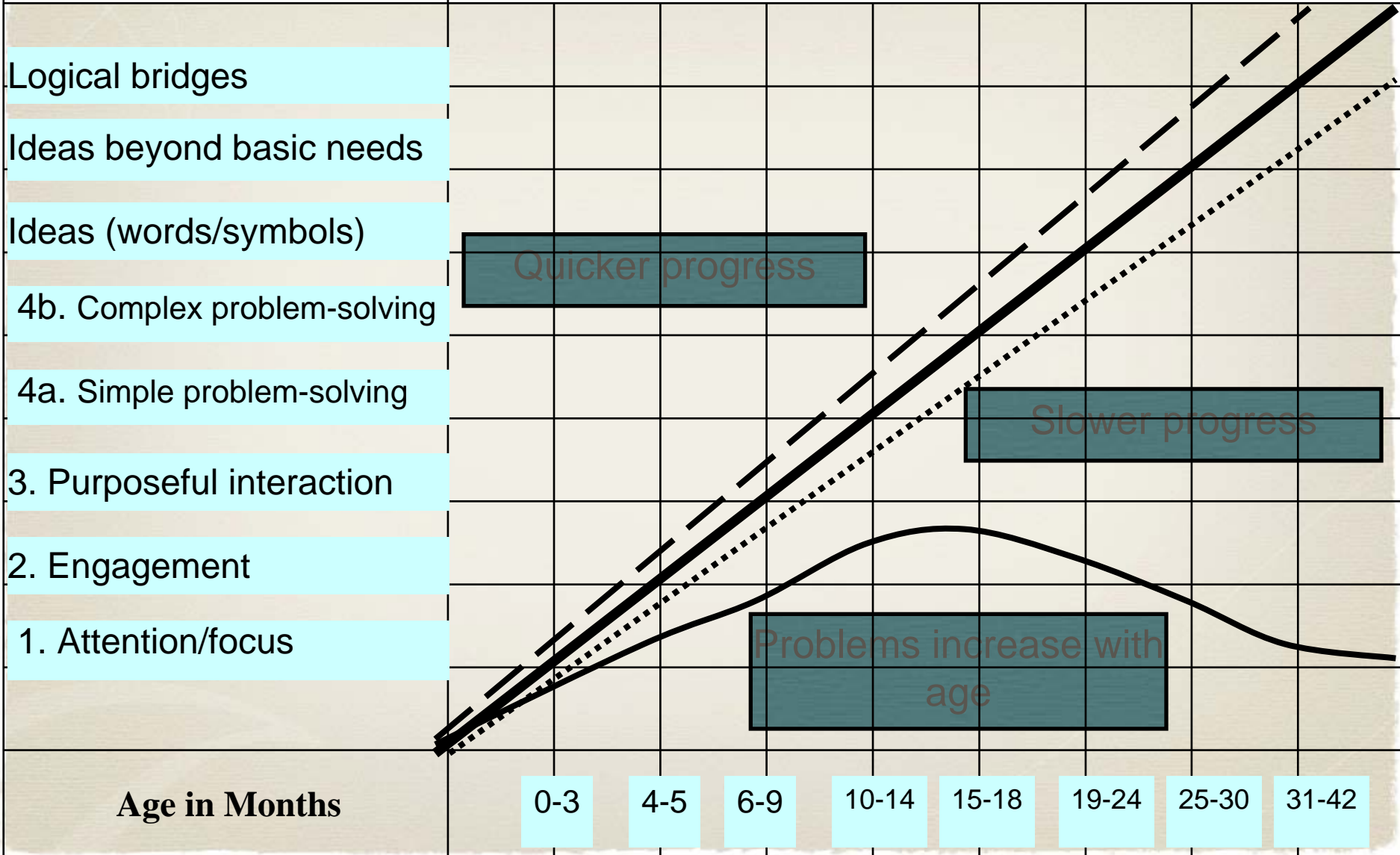
25-30

31-42

Quicker progress

Slower progress

Problems increase with age



# The Social-Emotional Growth Chart

## Developmental Stages

6. Logical bridges

5b. Ideas beyond basic needs

5a. Ideas (words/symbols)

4b. Complex problem-solving

4a. Simple problem-solving

3. Purposeful interaction

2. Engagement

1. Attention/focus

Age in Months

0-3

4-5

6-9

10-14

15-18

19-24

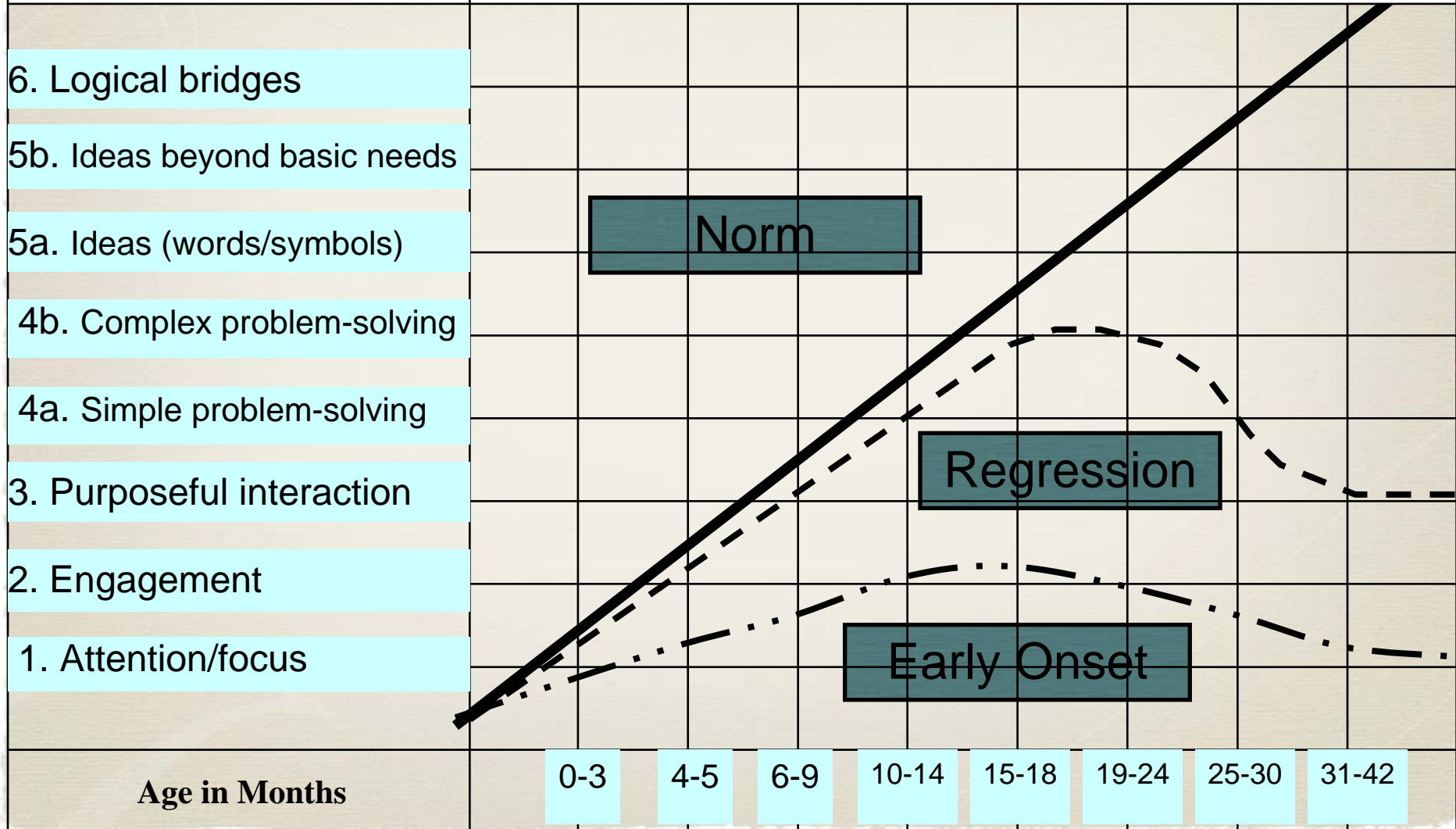
25-30

31-42

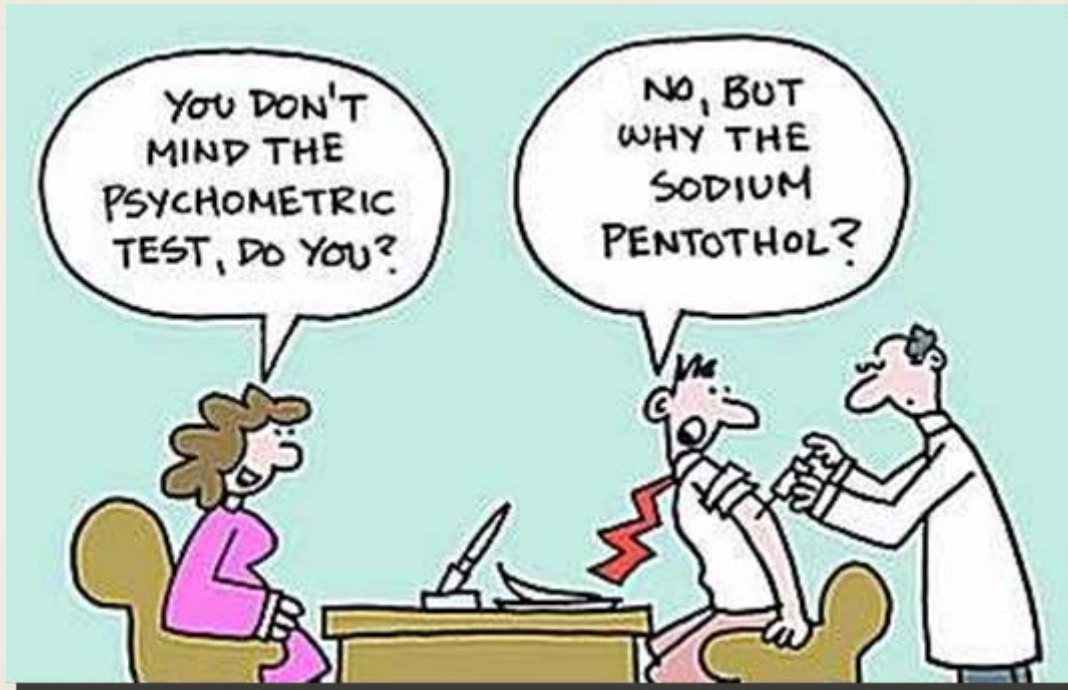
Norm

Regression

Early Onset



# Psychometric Properties



# Internal Consistency/Reliability

- \* Internal consistency estimated using a measure of the average correlation among items on the SEGC
  - \* average of .90 for social-emotional questions
  - \* average of .83 for sensory processing items
- \* Standard Error of Measurement
  - \* reflects the amount of error in the scores
  - \* used to calculate confidence interval
  - \* 1.0 (standard score) on average
- \* No test-retest data available

# External Validity

<b>Inter-correlations with Bayley-III</b>						
<b>Fine Motor</b>	<b>Gross Motor</b>	<b>Motor Composite</b>	<b>Cognitive</b>	<b>Receptive Communication</b>	<b>Expressive Communication</b>	<b>Language</b>
0.18	0.18	0.21	0.23	0.25	0.21	0.25

<b>Bayley-II</b>		
<b>Mental</b>	<b>Motor</b>	<b>Behavior Rating Scale</b>
0.25	0.24	0.38



<b>WPPSI-III</b>		
<b>VIQ</b>	<b>PIQ</b>	<b>FSIQ</b>
0.53	0.27	0.43

<b>Preschool Language Scales-4</b>		
<b>Auditory comprehension</b>	<b>Expressive Communication</b>	<b>Total Language</b>
0.22	0.20	0.23

# Peabody Developmental Motor Scales-2 (PDMS-2)

<b>Reflex</b>	<b>Stationary</b>	<b>Locomotion</b>	<b>Manipulation</b>	<b>Grasping</b>
0.06	0.1	0.33	-0.17	0.17

<b>Visual-Motor</b>	<b>Gross Motor</b>	<b>Fine Motor</b>	<b>Total Motor</b>
0.3	0.14	0.28	0.25



## Special needs groups as compared with demographically matched control group

	Special Needs		Matched Control		Comparison				
	Mean	SD	Mean	SD	N	Difference	<i>t</i>	<i>p</i>	Standard Diff.
<b>PDD</b>	<b>3.8</b>	<b>1.9</b>	<b>11.2</b>	<b>3.4</b>	<b>61</b>	<b>7.43</b>	<b>14.63</b>	<b>&lt;0.01</b>	<b>2.71</b>
<b>Down Syndrome</b>	<b>6.4</b>	<b>2.3</b>	<b>10.4</b>	<b>2.9</b>	<b>85</b>	<b>3.98</b>	<b>10.81</b>	<b>&lt;0.01</b>	<b>1.53</b>
<b>Cerebral Palsy</b>	<b>6.9</b>	<b>3.1</b>	<b>11.1</b>	<b>3.5</b>	<b>61</b>	<b>4.21</b>	<b>7.38</b>	<b>&lt;0.01</b>	<b>1.28</b>
<b>Language Impaired</b>	<b>7.4</b>	<b>2.4</b>	<b>10.3</b>	<b>2.9</b>	<b>81</b>	<b>2.94</b>	<b>6.83</b>	<b>&lt;0.01</b>	<b>1.1</b>
<b>FAS</b>	<b>7.8</b>	<b>2.9</b>	<b>10.3</b>	<b>3.3</b>	<b>43</b>	<b>2.51</b>	<b>3.69</b>	<b>&lt;0.01</b>	<b>0.8</b>
<b>Asphyxia</b>	<b>8.7</b>	<b>3.8</b>	<b>10.8</b>	<b>3.2</b>	<b>39</b>	<b>2.1</b>	<b>2.38</b>	<b>&lt;0.05</b>	<b>0.59</b>
<b>At Risk</b>	<b>8.8</b>	<b>4</b>	<b>10.4</b>	<b>3.3</b>	<b>72</b>	<b>1.61</b>	<b>2.46</b>	<b>&lt;0.05</b>	<b>0.44</b>
<b>Small for Gest. Age</b>	<b>9.8</b>	<b>3.3</b>	<b>11.2</b>	<b>3.6</b>	<b>43</b>	<b>1.35</b>	<b>1.82</b>	<b>&gt;0.05</b>	<b>0.39</b>
<b>Premature</b>	<b>9.7</b>	<b>3.4</b>	<b>10.3</b>	<b>2.9</b>	<b>81</b>	<b>0.63</b>	<b>1.26</b>	<b>&gt;0.05</b>	<b>0.2</b>

# Scoring of SEGC

<b>Response alternatives</b>	<b>Value</b>
Can't tell	0
None of the time	1
Some of the time	2
Half of the time	3
Most of the time	4
All of the time	5

	<b>Scaled scores &lt;= to 4</b>		
	<b>Clinical</b>	<b>Matched</b>	<b>N</b>
<b>Asphyxia</b>	<b>71.95</b>	<b>2.56</b>	<b>39</b>
<b>PDD</b>	<b>67.21</b>	<b>0</b>	<b>31</b>
<b>Cerebral Palsy</b>	<b>21.31</b>	<b>1.5</b>	<b>61</b>
<b>Down Syndrome</b>	<b>20</b>	<b>0</b>	<b>85</b>
<b>At Risk</b>	<b>13.89</b>	<b>0</b>	<b>72</b>
<b>Language Impaired</b>	<b>9.88</b>	<b>1.1</b>	<b>81</b>
<b>FAS</b>	<b>9.3</b>	<b>0</b>	<b>43</b>
<b>Small for Gest. Age</b>	<b>4.65</b>	<b>2.33</b>	<b>43</b>
<b>Premature</b>	<b>3.7</b>	<b>1.23</b>	<b>81</b>
<b>Total Sample</b>		<b>2.2</b>	

# Growth Chart Index Scores

<b>Age Bands</b>	<b>Significant Challenges</b>	<b>Emerging Challenges</b>	<b>Full Mastery</b>
0-3 Months	0-14	15-33	34-55
4-5 months	0-33	34-50	51-65
6-9 Months	0-44	45-61	62-75
10-14 Months	0-52	53-66	67-85
15-18 Months	0-60	61-84	85-105
19-24 Months	0-68	69-84	94-120
25-30 Months	0-84	85-119	120-140
31-42 Months	0-96	97-141	142-175

# Cut-off

- \* 4 or less = “Possible Challenges”
- \* theoretically based
- \* corresponds to an average score of 2.5
  - \* between “Some of the time” and “Half of the time”
- \* statistically, however, this is probably not the best place to set the cut-off

	Scaled score <= 4				Scaled score <= 5*				Scaled score <= 6*	
	Clinical	Matched	N		Clinical	Matched		Clinical	Matched	
<b>PDD</b>	<b>67.21</b>	<b>0</b>	<b>67</b>		<b>77.6</b>	<b>0</b>		<b>86.6</b>	<b>3.1</b>	
<b>Down Syndrome</b>	<b>20</b>	<b>0</b>	<b>85</b>		<b>34</b>	<b>1.1</b>		<b>55</b>	<b>4.5</b>	
<b>Cerebral Palsy</b>	<b>21.31</b>	<b>1.5</b>	<b>61</b>		<b>32.4</b>	<b>1.5</b>		<b>51.5</b>	<b>4.5</b>	
<b>FAS</b>	<b>9.3</b>	<b>0</b>	<b>43</b>		<b>24.4</b>	<b>0</b>		<b>51.1</b>	<b>8.7</b>	
<b>Language Impaired</b>	<b>9.88</b>	<b>1.1</b>	<b>81</b>		<b>20.7</b>	<b>1.1</b>		<b>38</b>	<b>3.4</b>	
<b>Asphyxia</b>	<b>71.95</b>	<b>2.56</b>	<b>39</b>		<b>22</b>	<b>2.6</b>		<b>31.7</b>	<b>7.5</b>	
<b>At Risk</b>	<b>13.89</b>	<b>0</b>	<b>72</b>		<b>18</b>	<b>0</b>		<b>26</b>	<b>8.2</b>	
<b>Premature</b>	<b>3.7</b>	<b>1.23</b>	<b>81</b>		<b>7</b>	<b>1</b>		<b>15.3</b>	<b>7.4</b>	
<b>Small for Gest Age</b>	<b>4.65</b>	<b>2.33</b>	<b>43</b>		<b>4.65</b>	<b>2.3</b>		<b>14</b>	<b>4.5</b>	
<b>Total Sample (N=1500 TD)*</b>		<b>2.01</b>				<b>4.3</b>			<b>9.68</b>	

\*Numbers calculated from data provided by PsychCorp.

# Specificity by Age Band (Typical Children Only)

Age in months	SS<= 4	SS<=5	SS<=6	SS<=7	SS<=8
0-1	7.2%	16.5%	29.9%	41.2	51.5
1-2	3	8.1	11.1	16.2	34.3
2-3	1	1	2.1	7.2	10.3
3-4	0	2.2	4.4	12.4	23.6
4-5	0	1	4.2	15.8	32.6
5-6	1.1	3.2	9.5	28.7	35.1
6-8	1.1	2.1	7.4	28.7	34.0
9-10	3.4	5.7	12.5	33.7	38.4
11-13	1.2	3.7	12.2	19.5	30.5
13-16	2.2	4.5	10.1	21.3	33.7
16-19	2.3	4.6	10.3	25.3	36.1
19-22	1.3	1.3	10.1	17.9	24.4
22-25	3.5	4.7	8.1	20.2	29.8
25-28	4.3	5.3	7.4	28.0	35.5
28-32	2.5	6.3	11.4	30.8	34.6
33-38	0	0	3.7	16.0	26.7
39-42	0	2.9	10.1	17.9	19.4
Mean	2.2% (97.8)	4.5% (95.5)	9.8% (90.2)	22.5% (77.5)	31.5% (68.5)

**Sensitivity and Specificity expressed as a percentage.  
 Calculated from the sample of 67 children diagnosed with PDD  
 and the matched controls.**

		SS<=4		SS<=5		SS<=6		SS<=7		SS<=8	
Age	N	Spec	Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec	Sens
16-19	4	100	75	100	75	100	75	75	75	75	75
19-22	5	100	80	100	100	100	100	100	100	60	100
22-25	3	100	100	100	100	100	100	100	100	100	100
25-28	0										
28-32	18	100	72	100	77.78	94.4	88.89	72.2	94.4	72.2	100
33-38	23	100	69.57	100	82.61	96.24	86.96	90.5	100	76.2	100
39-42	14	100	42.86	100	57.14	100	78.57	100	92.9	100	100

# SEGC Sensitivity & Specificity as a screening tool for ASD


	Total Growth Chart Score	
	Significant Challenges	Mild Emerging Challenges
Cut-off score	< 4	<8
<b>SENSITIVITY</b>	<b>67.2%</b>	<b>98.5%</b>
<b>SPECIFICITY</b>	<b>97.8%</b>	<b>68.5%</b>

- Low sensitivity, identifies only 67.2 % of ASD children
- Very specific, identifies correctly 97.8% of typically developing children

- Very sensitive, identifies 98.5% of ASD children
- Low specificity, 31.5% of typically developing children can fall in this category

# SEGC Sensitivity & Specificity as a screening tool for ASD

	Total Growth Chart Score
	Moderate Emerging Challenges
Scaled Scores	6 or less
<b>SENSITIVITY</b>	86.6%
<b>SPECIFICITY</b>	90.2%

- 
- Good sensitivity, correctly identifies about 87% of ASD children
  - Good specificity, correctly identifies about 90% of typically developing children but 10% can falsely fall in this category

	<b>Sensitivity</b>	<b>Specificity</b>
<b>SEGC</b>	<b>0.87</b>	<b>0.90</b>
<b>ADI</b>	<b>0.79</b>	<b>0.71</b>
<b>ADOS</b>	<b>0.92</b>	<b>0.81</b>
<b>Ages Stages</b>	<b>.70-.90</b>	<b>.76-.91</b>
<b>Batelle</b>	<b>.72-.93</b>	<b>.79-.88</b>
<b>CHAT</b>	<b>.38-.65</b>	<b>.98-1.00</b>
<b>CDI</b>	<b>.80-1.00</b>	<b>.94-.96</b>
<b>SCQ</b>	<b>0.85</b>	<b>0.75</b>

# Current Growth Chart Index Scores

<b>Age Bands</b>	<b>Possible Challenges</b>	<b>Emerging Mastery</b>	<b>Full Mastery</b>
0-3 Months	0-14	15-33	34-55
4-5 months	0-33	34-50	51-65
6-9 Months	0-44	45-61	62-75
10-14 Months	0-52	53-66	67-85
15-18 Months	0-60	61-84	85-105
19-24 Months	0-68	69-84	94-120
25-30 Months	0-84	85-119	120-140
31-42 Months	0-96	97-141	142-175
<b>Scaled Scores</b>	<b>Possible Challenges</b>	<b>Emerging Mastery</b>	<b>Full Mastery</b>
	<b>1-3</b>	<b>4-7</b>	<b>8-18</b>

# NEW Growth Chart Index Scores

Age Bands	Possible Challenges: Refer for further assessment		Emerging Mastery: Surveillance	Typical Functioning	
	Significant	Mild			
0-3 Months	0	19	28	29-33	34-55
4-5 months	0	39	46	47-50	51-65
6-9 Months	0	50	57	58-61	62-75
10-14 Months	0	57	63	64-66	67-85
15-18 Months	0	66	76	77-83	84-105
19-24 Months	0	73	86	87-93	94-120
25-30 Months	0	90	106	107-116	117-140
31-42 Months	0	99	124	125-136	137-175
Scaled Scores	Possible Challenges: Refer for further assessment		Emerging Mastery	Typical Functioning	
	Significant	Mild			
	<b>1</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>8-19</b>

# Scoring

- Review questions
- Video vignettes



# Advantages & Limitations

## Advantages

- Developmentally, Individual Differences, Relationship (DIR®)
- Short
- Easy to score
- Good enough sensitivity & specificity for ASD
- Guidance for intervention (Floortime™)

## Limitations

- Standardization sample excluded, among others:
- children who did not speak and understand English
- children with a developmental risk factor based on social, socioeconomic status, or parent education factors
- Limited to social-emotional, communication and cognitive domains (no fine and gross motor, praxis)

# Discussion on possible uses

- Primary care / pediatric offices
- Daycares
- Research

