Purpose of the Bayley-4

Conduct developmental assessment to identify infants and toddlers who have a developmental delay so that we can provide early intervention services.

Early Intervention: Federal Mandate


Early Intervention Program for Infants and Toddlers with Disabilities

IDEA Part C and Bayley-4

Early Intervention services are designed to identify and meet a child’s needs in five developmental areas:

• physical development (including vision and hearing),
• cognitive development,
• communication,
• social or emotional development, and
• adaptive development.

Bayley-4 assesses development in these five domains.

Overview of Bayley-4

Format
Core battery of five domains:
- Cognitive
- Language
- Motor
- Social-Emotional
- Adaptive Behavior

Administration
- Individual
- Paper/Pencil and Online (Q-Global)
- Administration Time: 30-70 minutes (depending on age of child)

Scores
- Scaled Scores
- Composite Scores
- Percentile Ranks
- Confidence Intervals
- Developmental Age Equivalents
- Growth Scale Values

Qualification Level: B
Ages: 16 days to 42 months
Scoring Options: Q-Global (Web-based); Manual

Incorporate Three Interrelated Elements in Assessing Developmental Delay

Administration of structured test items
Direct observation of behaviors and milestones
Active participation of parent or caregiver in the evaluation process

Cognitive, Language, and Motor Scales
Maintain Basic Qualities of Bayley-III


Assess level of performance of infants and toddlers by observing the child’s interaction with stimuli designed to engage him or her.


Maintain Basic Format of Bayley-III

Bayley-4

... an individually administered instrument that assesses the developmental functioning of infants and young children ages 16 days to 42 months.

Five Developmental Domains

Structure of Bayley-4

SCALE SUBTEST

Cognitive (COG) Cognitive (CG)

Receptive Communication (RC) Expressive Communication (EC)

Motor (MOT) Fine Motor (FM) Gross Motor (GM)

Structure of Bayley-4

SCALE DOMAIN SUBDOMAIN

Social Emotional (Sel)

Social Emotional (Sel)

Communication (Comm)

Receptive (REC)

Expressive (EXP)

Adaptive Behavior (AB)

Daily Living Skills (DLS)

Personal (PER)

Socialization (SOC)

Interpersonal Relationships (IRR)

Play and Leisure (PLA)

Bayley-4: Polytomous Scoring

Scoring for Items on Cognitive, Language, and Motor Scales

<table>
<thead>
<tr>
<th>Bayley-III</th>
<th>Bayley-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichotomous Scoring</td>
<td>Polytomous Scoring</td>
</tr>
<tr>
<td>1: the child demonstrates the behavior assessed by the item.</td>
<td>2: the response or behavior indicates Mastery.</td>
</tr>
<tr>
<td>0: the child’s behavior does not meet the criteria specified for an item.</td>
<td>1: the response or behavior indicates the skill or behavior is Emerging.</td>
</tr>
<tr>
<td>0: the response or behavior indicates the skill or behavior is Not Present.</td>
<td></td>
</tr>
</tbody>
</table>

Include Caregivers in Evaluation/Scoring

Bayley-4 includes:

• Structured test items with associated caregiver questions.
• Caregiver questions to provide additional information.
• Items scored entirely based on information provided by caregiver.

Caregiver questions are not utilized for items that involve performance on test-specific tasks.
Simplify Administration and Reduce Administration Time

- Developed Bayley-4 on Q-global
- Combined items
- Eliminated redundant items
- Incorporated caregiver questions

Improve Content Coverage

Included items to assess

- neurodevelopment, and
- precursors to executive functioning.

Improve Clinical Utility

Special Group Studies

| Conditions that place children at developmental risk (e.g., extremely preterm and very preterm infants). | Children with clinical diagnoses (e.g., Autism Spectrum Disorder, Down syndrome, language impairment, motor impairment). |

Evidence Based on Special Group Studies

Developmental Delay Compared to Matched Control

<table>
<thead>
<tr>
<th>Score</th>
<th>DD Mean</th>
<th>Matched Control Mean</th>
<th>Diff.</th>
<th>p value</th>
<th>Std. Dff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG</td>
<td>6.5</td>
<td>9.4</td>
<td>2.88</td>
<td>&lt;.01</td>
<td>1.03</td>
</tr>
<tr>
<td>RC</td>
<td>6.5</td>
<td>9.3</td>
<td>2.77</td>
<td>&lt;.01</td>
<td>0.91</td>
</tr>
<tr>
<td>EC</td>
<td>6.1</td>
<td>9.5</td>
<td>3.39</td>
<td>&lt;.01</td>
<td>1.23</td>
</tr>
<tr>
<td>FM</td>
<td>7.0</td>
<td>9.3</td>
<td>2.37</td>
<td>&lt;.01</td>
<td>0.84</td>
</tr>
<tr>
<td>GM</td>
<td>6.7</td>
<td>9.5</td>
<td>2.81</td>
<td>&lt;.01</td>
<td>1.02</td>
</tr>
<tr>
<td>LANG</td>
<td>78.8</td>
<td>96.5</td>
<td>17.74</td>
<td>&lt;.01</td>
<td>1.15</td>
</tr>
<tr>
<td>MOT</td>
<td>81.5</td>
<td>96.7</td>
<td>15.21</td>
<td>&lt;.01</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Update Normative Data: Standardization Sample

<table>
<thead>
<tr>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive, Language, and Motor Scale Normative Sample</td>
<td>Social-Emotional Scale Normative Sample</td>
<td>Adaptive Behavior Scale Normative Sample</td>
</tr>
</tbody>
</table>

Reliability of Normative Sample

<table>
<thead>
<tr>
<th>Score</th>
<th>Average $r_{xx}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive</td>
<td>.95</td>
</tr>
<tr>
<td>Receptive Communication</td>
<td>.93</td>
</tr>
<tr>
<td>Expressive Communication</td>
<td>.93</td>
</tr>
<tr>
<td>Fine Motor</td>
<td>.93</td>
</tr>
<tr>
<td>Gross Motor</td>
<td>.94</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>.96</td>
</tr>
<tr>
<td>MOTOR</td>
<td>.95</td>
</tr>
</tbody>
</table>
Increase Sensitivity

- Excluded from normative sample children identified as at-risk.
- Introduced polytomous scoring approach.
- Included some additional easier items.

Correlations with Bayley-III

<table>
<thead>
<tr>
<th></th>
<th>Bayley-4 Mean</th>
<th>Bayley-III Mean</th>
<th>Standard difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG</td>
<td>10.4</td>
<td>10.5</td>
<td>-0.04</td>
</tr>
<tr>
<td>RC</td>
<td>10.3</td>
<td>10.4</td>
<td>-0.04</td>
</tr>
<tr>
<td>EC</td>
<td>10.3</td>
<td>10.5</td>
<td>-0.08</td>
</tr>
<tr>
<td>FM</td>
<td>10.1</td>
<td>10.0</td>
<td>0.04</td>
</tr>
<tr>
<td>GM</td>
<td>10.3</td>
<td>10.8</td>
<td>-0.19</td>
</tr>
<tr>
<td>LANG</td>
<td>101.0</td>
<td>102.3</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

Cognitive Scale (COG)

- Retained most items from Bayley-III.
- Added new items.
- Deleted items.
- Combined several items to reduce administration time.

Cognitive Subtest (CG) 81 items
Bayley-III 91 items

Language Scale (LANG)

- Added new items to reflect traditional language milestones and related speech processes.
- Combined several items.
- Dropped items that were determined to be redundant based on construct overlap.

Receptive Communication (RC) 42 items
Bayley-III 49 items
Expressive Communication (EC) 37 items
Bayley-III 48 items

Motor Scale (MOT)

- Added new items to expand age and content coverage, and to measure neurodevelopmental functions.
- Combined items.
- Dropped items that were determined to be redundant.

Fine Motor (FM) 46 items
Bayley-III 66 items
Gross Motor (GM) 58 items
Bayley-III 72 items

Social-Emotional Scale (SOEM)

- Adaptation of Greenspan Social-Emotional Growth Chart: A Screening Questionnaire for Infants and Young Children.
- Items unmodified from Bayley-III.
- Items assess child’s mastery of functional emotional skills.
Adaptive Behavior Scale (ADBE)

Composed of select items and skill areas derived from the Comprehensive Parent/Caregiver Form of the Vineland-3.

- Communication
- Daily Living Skills
- Socialization
- Adaptive Behavior


Administration and Scoring Options

Digital Administration

- Items on Cognitive, Language, and Motor scales can be administered and scored using an internet-based mobile device, laptop, or PC.
- The digital administration is optimized for screen size of tablet (iPad) or larger.

Paper Administration: Bayley-4 Kit

- Administration Manual
- Technical Manual
- Cognitive, Language, and Motor Record Forms
- Motor Response Booklets
- Social-Emotional and Adaptive Behavior Questionnaires
- Caregiver Reports
- Stimulus Book
- Observation Checklist
- Manipulative Set

Digital Administration

- Administration Rules

<table>
<thead>
<tr>
<th>Start Point</th>
<th>Basal</th>
<th>Reverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal</td>
<td>3 consecutive scores of 2</td>
<td></td>
</tr>
<tr>
<td>Reverse</td>
<td>Previous Start Point</td>
<td></td>
</tr>
<tr>
<td>Discontinue</td>
<td>5 consecutive scores of 0</td>
<td></td>
</tr>
</tbody>
</table>

Features of the Digital Administration

- Combines information from the Record Form and Administration Manual in one place for easy accessibility during testing.
- Is designed to support non-linear administration of items on Cognitive, Language, and Motor scales.
Series Items

Series items are items that have the same administration directions but require varying levels of performance to meet the scoring criteria.

<table>
<thead>
<tr>
<th>Paper Administration</th>
<th>Digital Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 40 20 24 48 S 21 20 26 45 S</td>
<td>The Bayley–4 on Q-global configures series items to allow for a single administration, to record a single response, and to automatically score all the items in the series.</td>
</tr>
</tbody>
</table>

Related Items

- Many items have different administration directions but require the use of the same test materials, or that the child participate in similar activities.
- When possible, it is beneficial to administer and score these items in succession even when they do not appear consecutively in the subtest.

Caregiver Question Item Scoring (CG, RC, EC, FM, GM)

<table>
<thead>
<tr>
<th>Skill level</th>
<th>Caregiver Response*</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery</td>
<td>Almost Every Time or Often</td>
<td>2 points</td>
</tr>
<tr>
<td>Emerging</td>
<td>Some of the Time or Not Often</td>
<td>1 point</td>
</tr>
<tr>
<td>Not Present</td>
<td>None of the Time or Not at All</td>
<td>0 points</td>
</tr>
</tbody>
</table>

*For items with Caregiver Question

Incidental Observation

- During testing, the examiner may observe that the child exhibits behaviors that satisfy the scoring criteria for certain items.
- If the behavior is not observed spontaneously, follow the directions to elicit the behavior.
- Items that can be scored through incidental observation are scored at any time during testing.

Questionnaire: Paper

Questionnaire: Digital

Remote On-Screen Administration
Bayley Scales of Infant and Toddler Development, Fourth Edition (Bayley-4)
Anise Flowers, Ph.D.
HouMet 2019

Social-Emotional and Adaptive Behavior

Social-Emotional

Adaptive Behavior

Behavior Frequency

Social-Emotional Behavior Frequency

Adaptive Behavior Frequency

• Start with Item 1.
• Stop when you reach stop point based on child's age.

Bayley-4 Scores

Bayley-4 Scores

(See p. 6 Bayley-4 Administration Manual)

Standard Scores

Scaled Scores

Diagnosing Developmental Delay

Several different criteria used:

Percent (%) Delay

Standard Deviation

Performing a certain number of months below chronological age

Bayley-4 Indicators of Developmental Problems

Indicators of motor and movement abnormalities

• Movement and muscle tone indicators
• Eye movement and coordination
• Hand movements

Indicators of Attention/Executive Function Deficit

Indicators of Autism Spectrum Disorder
Autism Spectrum Disorder Indicator Items

### Cognitive

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Recognizes Caregiver Note: Also included in Receptive Communication Item 4.</td>
</tr>
<tr>
<td>6.</td>
<td>Reaction to Caregiver Note: Also included in Receptive Communication Item 6.</td>
</tr>
<tr>
<td>7.</td>
<td>Reacts to Departure of Caregiver</td>
</tr>
<tr>
<td>16.</td>
<td>Interacts With Image</td>
</tr>
<tr>
<td>20.</td>
<td>Pats Table</td>
</tr>
<tr>
<td>29.</td>
<td>Stirs Spoon</td>
</tr>
<tr>
<td>36.</td>
<td>Squeezes Object</td>
</tr>
<tr>
<td>57.</td>
<td>Imitates 2-Step Action</td>
</tr>
<tr>
<td>59.</td>
<td>Imaginary Play</td>
</tr>
</tbody>
</table>

### Receptive Communication

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Calms When Spoken To</td>
</tr>
<tr>
<td>12.</td>
<td>Responds to Name</td>
</tr>
<tr>
<td>15.</td>
<td>Attends to Play Routine</td>
</tr>
<tr>
<td>29.</td>
<td>Understands Pronouns (Her, Me, You, My, Your)</td>
</tr>
<tr>
<td>35.</td>
<td>Understands Pronouns (They, She, Me)</td>
</tr>
</tbody>
</table>

### Expressive Communication

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Social Smile</td>
</tr>
<tr>
<td>4.</td>
<td>Social Vocalizing/Laughing</td>
</tr>
<tr>
<td>6.</td>
<td>Solicits Attention/Interaction</td>
</tr>
<tr>
<td>9.</td>
<td>Uses Gestures</td>
</tr>
<tr>
<td>10.</td>
<td>Jabbers Expressively</td>
</tr>
<tr>
<td>12.</td>
<td>Directs Attention of Adult to Object</td>
</tr>
<tr>
<td>13.</td>
<td>Imitates Word</td>
</tr>
<tr>
<td>14.</td>
<td>Initiates Play</td>
</tr>
<tr>
<td>19.</td>
<td>Combines Gesture and Words</td>
</tr>
<tr>
<td>26.</td>
<td>Uses Pronouns</td>
</tr>
<tr>
<td>28.</td>
<td>Poses Questions</td>
</tr>
<tr>
<td>32.</td>
<td>Answers Questions</td>
</tr>
</tbody>
</table>

### Sharing Results with Families

- Describe Bayley-4 and what the subtests and subdomains measure
- Present child's test results
- List activities parents/caregivers can use with their child.

### Key Features of Bayley-4

- **Administration and Scoring**
  - Flexible administration
  - Series items
  - Related items
- **Content Updates**
  - Retains five domains
  - Adaptive Behavior from Vineland-3
- **Administration Format**
  - Manual Admin and Scoring
  - Manual Admin and Digital Scoring
- **Item Scoring (CG, LANG, MOT)**
  - 2 = Mastery
  - 1 = Emerging
  - 0 = Not Present