

Test of Infant Motor Performance (TIMP)

Indexing Metadata/Description

- › **Outcome measure/test:** Test of Infant Motor Performance (TIMP)
- › **Synonyms:** N/A
- › **Area(s) of specialty:** Pediatric Rehabilitation, Neurological Rehabilitation, Acute Care
- › **Description/use:** The Test of Infant Motor Performance (TIMP) is a predictive, discriminative, and evaluative norm-referenced assessment tool that examines postural and selective control of movement needed for functional gross motor performance in infants.^(2,19) The TIMP can be used by physical therapists (PTs), occupational therapists (OTs), and other healthcare specialists who work in early intervention to evaluate posture and movement of infants born at 34 weeks postconceptional age (PCA) through 4 months of gestational age (GA) or corrected age (CA). The TIMP is used to identify infants who might benefit from early intervention services⁽¹⁹⁾
 - The current TIMP version is 5.1 and has two sections: 13 observed items used to examine the infant's spontaneous movements and 29 elicited items that assess the infant's movement responses to various positions, sights, and sounds⁽¹⁹⁾
 - The TIMP assesses the following 4 categories:⁽¹⁹⁾
 - The ability to orient and stabilize the head in space and respond to auditory and visual stimulation in supine, prone, side-lying, and upright positions and during transitions from one position to another
 - Body alignment when the head is manipulated
 - Distal selective control of the fingers, wrists, hands, and ankles
 - Antigravity control of arm and leg movements
- › **CPT codes**
 - 96110 developmental testing; limited (e.g., Developmental Screening Test II, Early Language Milestone Screen), with interpretation and report
 - 96111 developmental testing; extended (includes assessment of motor, language, social, adaptive and/or cognitive functioning by standardized developmental instruments) with interpretation and report
- › **Indications:** The TIMP is indicated for infants with known or suspected motor development difficulties and/or delays
 - The TIMP can be used to
 - identify delayed motor development or atypical motor performance in an infant born at 34 weeks PCA through 4 months GA or CA^(1,19)
 - A cross-sectional study in Brazil found that prematurity is associated with impaired motor development using the TIMP⁽¹⁴⁾
 - Preterm infants with a GA of 28–33 weeks were compared to a group of full-term newborns
 - Forty-six subjects were in each group and were assessed up to 48 hours after birth at one hospital
 - In the preterm group, 73.9% were classified as typical for motor development compared to 100% of the full-term group, with a significant difference in average raw TIMP scores between groups
 - measure change in a typically developing infant over 2-week periods⁽¹⁾

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- develop goals for physical and/or occupational therapy intervention for an infant with delayed or atypical motor development⁽¹⁾
- measure improvement in motor development as a result of physical and/or occupational therapy interventions⁽¹⁾
- educate parents about typical and atypical infant motor development⁽²⁾
- predict how a child will perform motor skills at 1 year of age and early school age^(1,2)

› **Population:** The TIMP can be used for the following infants

- Premature infants born at 34 weeks PCA through 4 months GA or CA as indicated⁽¹⁹⁾
- Full-term infants through 17 weeks post term⁽⁴⁾
- Infants of both sexes as well as all races and ethnicities
 - Norms for the TIMP were developed based on a sample of 990 infants in the United States of all races/ethnicities⁽²⁾
- Infants at risk for developmental disability, including those with
 - Cerebral palsy (CP) and spinal muscle atrophy (SMA) (Recommended by the National Institutes of Health in clinical trials for research in CP and SMA)⁽²⁶⁾
 - Neonatal seizures⁽⁵⁾
 - Intraventricular hemorrhage⁽⁵⁾
 - Authors of a South Korean study assessed factors that affected performance on the TIMP among 80 preterm infants at a PCA of 40 weeks. Intraventricular hemorrhage (IVH) was the most important factor affecting the TIMP scores of these infants⁽¹⁵⁾
 - Other clinical factors (in descending order) that statistically affected TIMP scores were caesarean section delivery, neonatal seizures, low birth weight, and multiple births
- The TIMP is intended to be used in neonatal intensive care units (NICUs), developmental follow-up clinics, and early intervention programs⁽¹⁹⁾

› **ICD-10 codes**

- Z13.9 Screening for
 - Developmental handicap Z13.4
 - In Early Childhood Z13.4
 - Disability Intellectual Z13.4
 - Disease or disorder Z13.9
 - (ICD codes are provided for the reader's reference, not for billing purposes)
 - Similar tests:** Alberta Infant Motor Scale (AIMS),⁽³⁾ Harris Infant Neuromotor Test (HINT),⁽²⁾ Bayley Scale of Infant and Toddler Development–Version III (BayleyIII),^(2,3) Toddler and Infant Motor Examination (TIME),⁽³⁾ Peabody Developmental Motor Scales, Second Edition (PDMS-2)⁽³⁾
 - The TIMP Screening Items (TIMPSI) is a shortened version of the TIMP (designed to take half the time of the TIMP) and was developed for infants who are too medically fragile to complete the TIMP⁽⁶⁾
 - Test-retest reliability for TIMPSI in infants at risk for impaired functional motor performance has been found to be excellent (intra-classcorrelation coefficient = 0.99)⁽²¹⁾

–**Reimbursement:** Reimbursement for developmental assessments will depend on insurance contract coverage; no specific special agencies are applicable for this assessment. No specific issues or information regarding reimbursement has been identified

–**Test author(s):** Campbell SK, Girolami GL, Kolobe THA, Osten ET, and Lenke MC

–**Contraindications/Precautions to test**

- Avoid using this test in infants who cannot tolerate the positioning

–**Psychometric properties**

- **Reliability**

- Test-retest reliability over a 3-day period is reported at $r = 0.89$ ⁽⁸⁾
- High intra-rater reliability (intraclass correlation coefficient [ICC] = 0.98 to 0.99) and interrater reliability (ICC = 0.95)⁽²⁰⁾

- Researchers of a study conducted in South Korea found a moderate but statistically significant correlation with the physical index ($p = 0.001$) and mental index ($p = 0.017$) on the Bayley III⁽¹⁶⁾
 - Seventy-six preterm and term infants were recruited from a NICU and were tested with the TIMP at their initial visit and at 6 months after the original test date
- Authors of a study ($N = 655$ infants from Brazil between 34 weeks postmenstrual age and 17 weeks CA) who investigated the reliability and construct, content, and criterion validity of the TIMP for infants from Brazil found strong inter-rater (α from 0.65 to 0.99) and intra-rater (α from 0.97 to 0.99) reliability. Test-retest reliability was high ($r = 1.00$; $ICC = 1.00$)⁽²⁵⁾
- **Validity**
 - Construct and content validity
 - Researchers of a study conducted in the United States found that the TIMP and the Bayley III motor composite have a correlation of 0.546; however, the correlation between the TIMP and the Bayley cognitive composite and Bayley language composite was lower (0.310 and 0.281)⁽¹⁸⁾
 - One hundred forty-five infants born at 29 to 34 weeks GA with socioenvironmental risk factors were included in this study
 - Despite the correlation of the Bayley III with the TIMP, no child in this moderate-risk group was identified as delayed by the Bayley III scale at 6 weeks CA
 - Researchers recommended that for assessment of motor performance and determination of the need for intervention at very early ages in infants at risk, the TIMP, not the Bayley III, should be the preferred test
 - Researchers of a study conducted in the United States found that abnormal white matter as measured by MRI was correlated to abnormal scores on the TIMP in infants as young as 3 months post-term⁽²²⁾
 - Abnormal white matter was characterized by volume loss, thinning, cysts, or ventricular dilation
 - Abnormal white matter also correlated with abnormal general movements as measured by the General Movement Assessment test
 - Authors of a study ($N = 655$ infants from Brazil) investigated the psychometric properties of the Portuguese version of the TIMP for use in infants in Brazil. They found the test had high test-item construct validity⁽²³⁾
 - Authors of a study ($N = 655$ infants from Brazil between 34 weeks postmenstrual age and 17 weeks CA) who investigated the reliability and construct, content, and criterion validity of the TIMP for infants from Brazil found high content validity ($ICC 0.74$ to 0.100)⁽²⁵⁾
- Concurrent validity
 - Researchers in the Netherlands conducted a study to compare the TIMP to the AIMS in the ability to predict gross motor development and independent walking in infants born very preterm (< 30 weeks GA)⁽¹⁷⁾
 - A correlation was made between TIMP and AIMS raw scores of 0.82 and between TIMP and AIMS z-scores of 0.71
 - Neither TIMP nor AIMS scores at 3 months CA were associated with gross motor outcome at 15 months CA
 - AIMS scores at 6 months CA predicted the AIMS scores at 15 months CA with an explained variance of 19%
 - Researchers concluded that neither the TIMP nor the AIMS was able to predict gross motor development at 15 months CA and independent walking prior to 6 months CA
 - Authors of a study ($N = 655$ infants from Brazil between 34 weeks postmenstrual age and 17 weeks CA) who investigated the reliability and construct, content, and criterion validity of the TIMP for infants from Brazil found the concurrent validity to be low in the first months and weak to moderate at 3–4 months when compared with the AIMS⁽²⁵⁾
- Evaluative validity/responsiveness
 - Authors of a systematic review of neonatal assessments for preterm infants up to 4 months CA found that the TIMP had the best evaluative validity of the 8 neonatal assessments that met the inclusion criteria for the review. The 8 neonatal assessments that met the criteria were the Assessment of Preterm Infants' Behavior (APIB), Neonatal Intensive Care Unit Network Neurobehavioral Scale (NNNS), TIMP, Prechtl's Assessment of General Movements (GMs), Neurobehavioral Assessment of the Preterm Infant (NAPI), Dubowitz Neurological Assessment of the Preterm and Full-Term Infant, Neuromotor Behavioral Assessment (NMBA), and the Brazelton Neonatal Behavioral Assessment Scale (NBAS)⁽¹⁰⁾

- Discriminative validity
 - Researchers of a retrospective study conducted in the United States examined the discriminative validity of the TIMP and found that it was more sensitive at 8 weeks CA than at 13 weeks; however, the authors noted that this result contradicted the results of previous research studies, which found the opposite⁽¹¹⁾
 - Authors of a study (N = 655 infants from Brazil between 34 weeks postmenstrual age and 17 weeks CA) who investigated the reliability and construct, content, and criterion validity of the TIMP for infants from Brazil found that the TIMP discriminated typical and non-typical motor behaviors in infants from Brazil⁽²⁵⁾
- Predictive validity
 - United States researchers evaluated the ability of the TIMP to predict infant scores on the AIMS at 6, 9, and 12 months of age; researchers found that an infant's TIMP score at 3 months of age had the greatest predictive value for future performance when tested with the AIMS at 12 months of age⁽⁹⁾
 - Ninety-six infants born from 32 weeks PCA to 4 months post-term were included in the study
 - Infants were tested at 7, 30, 60, and 90 days after term age
 - Researchers of a follow-up research study conducted in the United States examined infants' TIMP scores at 7, 30, 60, and 90 days post-term to assess the ability of the TIMP to predict PDMS-2 total motor scores at 4 and 5 years of age; researchers found that the 90-day TIMP score was the most sensitive for predicting future performance on the PDMS-2⁽¹²⁾
 - Sixty-one children from an original cohort of 90 infants participated in this follow-up study
 - Authors of a study (N = 106 infants born earlier than 31 weeks GA) investigated the relationship between the TIMP at 3 months and cognitive, language, and motor outcomes on the Bayley III at 2 years of age in high-risk infants born preterm⁽²⁴⁾
 - The TIMP z-scores at 10–15 weeks of age were significantly associated with all three subscales on the Bayley III at 2 years of age ($p < 0.001$). Using a TIMP z-score cutoff of -0.5 , specificity was relatively high for cognitive (87%), language (88%), and motor (89%) outcomes, but sensitivity was low (cognitive 41%, language 49%, motor 57%)
 - While the TIMP is a measure of motor integrity, it is also predictive of cognitive and language outcomes
 - Authors of a study (N = 655 infants from Brazil between 34 weeks postmenstrual age and 17 weeks CA) investigated the reliability and construct, content, and criterion validity of the TIMP for infants from Brazil found that infants assessed with motor difficulties in the first days of life had the same challenges after 20 and 40 days, and therefore were in need of intervention. The TIMP can predict developmental delays within small intervals⁽²⁵⁾
- **Sensitivity:** Sensitivity of 92%⁽⁹⁾
 - In a 2011 study conducted in South Korea, researchers evaluated the sensitivity and specificity of the TIMP as an assessment tool for infant development
 - Receiver operator characteristics (ROC) curve analysis was performed to evaluate the TIMP for screening infant motor development. ROC analysis showed areas under the curve of 0.825 in the physical index and 0.992 in the mental index on the Bayley III, indicating that the TIMP is an excellent tool for screening infant motor development
 - Seventy-six preterm and term infants were recruited from a NICU and tested with the TIMP at their initial visit and at 6 months after the original test date
 - Researchers recommended that the TIMP be used as a reliable screening tool for neonates and infants < 4 months of age in South Korea instead of the more commonly used tools, the Denver Developmental Screening Test and Bayley III
- **Internal consistency:** Internal consistency coefficient of 0.98⁽¹⁾
 - Authors of a study (N = 655 infants from Brazil) investigated psychometric properties of the Portuguese version of the TIMP for use on infants in Brazil. They found the TIMP had high internal consistency⁽²³⁾
- **Ceiling/floor Effects:**
 - Authors of a study (N = 655 infants from Brazil) investigated psychometric properties of the Portuguese version of the TIMP for use on infants in Brazil. They found the TIMP had no ceiling or floor effects⁽²³⁾
- **Time to complete test:** The TIMP takes 25–40 minutes to administer depending on the child's abilities, behavioral state, physiological stability, and level of cooperation;⁽¹⁹⁾ average time to complete is 33 minutes⁽¹⁾
 - The TIMPSI was developed as a screening tool to determine which infants should take the TIMP, as the TIMP can be demanding on the youngest and most fragile infants⁽²¹⁾

- **Potential complications/side effects:** Researchers of one research study conducted in the United States found that some test items can cause infant irritability due to overall muscle weakness in infants with SMA type 1⁽⁷⁾
 - **Test preparation/materials required**
 - Test authors recommend that PTs and OTs receive specific training in administration of the TIMP prior to administering it⁽²⁾
 - Infant Motor Performance Scales, LLC offers an online learning program for the TIMP. The program has 9 learning modules featuring lectures by the designers of the TIMP and other workshop instructors, videos of the TIMP in action, and opportunities for the learner to assess their comprehension of the material and score test-item video clips⁽¹³⁾
 - Infant Motor Performance Scales, LLC offers TIMP approved in-person workshops in the United States and China. The 2-day workshops are taught by certified instructors⁽¹³⁾
 - Examiners administering the TIMP should be fully trained and qualified to handle, examine, and care for infants⁽²⁾
 - Materials required to complete the TIMP
 - A rattle with a soft (not sharp or harsh) sound (e.g., maraca toys, plastic eggs or boxes filled with popcorn or rice)⁽²⁾
 - Any item used during the TIMP should not be used as a toy for the infant; these items should only be used for testing purposes⁽²⁾
 - A squeaky object with a soft (but not whispery or harsh) sound (many 4–5” dog toys can be used; however, latex toys should be avoided due to potential allergies)⁽²⁾
 - A shiny red ball approximately 55 mm, or 2 inches, in diameter⁽²⁾
 - An age calculation wheel that allows for automatic calculation of CA or chronologic age up to 18 weeks post-term to accurately compare performance against age expectations from the TIMP and TIMPSI normative studies⁽²⁾
 - **Test procedure**
 - Instructions for administration are included with the TIMP test kit⁽¹⁾
 - The clinician administering the TIMP first observes the infant’s behaviors, then elicits specific behaviors according to standardized procedures outlined by the test administration manual⁽³⁾
 - Items on the test include postural change, antigravity movement, adaptation to handling, visual reaction, auditory reaction, interaction with caregiver, and head and body control⁽¹⁵⁾
 - **Test scoring/interpretation**
 - The 13 observed items are scored “yes” or “no”⁽¹⁾
 - A yes answer is equal to 1 point; a no answer is worth 0 points⁽¹⁾
 - The 29 elicited items involve having the administering clinician handle the infant, place the infant in various positions, and document the infant’s response to visual or auditory stimuli⁽¹⁾
 - The instructions for the elicited items have pictures with a text description of the infant position, test procedure, and scoring criteria⁽¹⁾
 - The elicited items have scoring options from 0 to 3, 0 to 4, 0 to 5, or 0 to 6; certain items are scored for both the left and right⁽¹⁾
 - A total raw score ranges from 0 to 142.⁽¹⁹⁾ The total raw score is calculated from the subtotal for the observed items and a subtotal for the elicited items; the clinician can use the chart in the manual to convert the raw score to the final TIMP score for the corresponding age group⁽¹⁾
 - Score sheets allow for plotting the infant’s scores against percentile ranks, which provide an age-equivalent score⁽¹⁹⁾
 - Higher total score indicates better motor development and can be an early indication of motor developmental delay or atypical motor function in infants
 - The authors of the TIMP suggest a –0.5 standard deviation below the mean for identifying infants who may require close monitoring and/or referral for early intervention services⁽¹⁹⁾
 - **Test follow-up:** Developmental assessments such as the TIMP should be repeated frequently to document both age-related and intervention-related changes, document progression toward goals, and assist with more accurately predicting future motor skills/need for continued intervention⁽⁹⁾
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