

Hammersmith Infant Neurological Examination (HINE)



Holland Bloorview
Kids Rehabilitation Hospital





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Webinar Objectives:



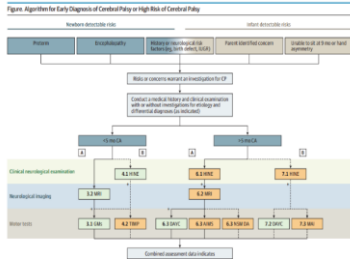
1. Provide an introduction to administering the Hammersmith Infant Neurologic Examination (HINE)
2. Provide an introduction to scoring the HINE

Background



Average age of cerebral palsy (CP) diagnosis is 18.9 ± 12.8 months in Canada

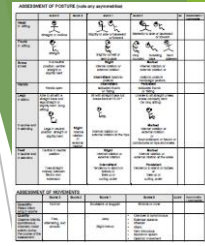
International clinical practice guidelines (CPG) exist to identify and detect CP at as early as 5 months in infants with etiologic risk factors for CP (e.g. children in Neonatal Follow-up clinics born preterm or with Neonatal Encephalopathy)



The Hammersmith Infant Neurological Exam is key tool for Early Identification !!!




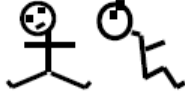
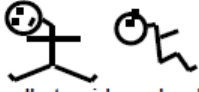



Early detection of high-probability of CP can prompt for early referrals to evidence-based interventions



Hammersmith Infant Neurological Exam (HINE)

- ▶ For infants between 3-24 months of age (corrected)
- ▶ 26 items - cranial nerves, posture, quality/quantity of mvt, tone, reflexes (not including Behavioural State and developmental milestone items)

ASSESSMENT OF POSTURE (note any asymmetries)

	score 3	score 2	score 1	score 0	sc	Asymmetry / comments
Head in sitting	 Straight; in midline		 Slightly to side or backward or forward	 Markedly to side or backward or forward		
Trunk in sitting	 Straight		 Slightly curved or bent to side	 Very rounded rocketing back bent sideways		

Hammersmith – Why it is GREAT!

- ▶ Easy to perform, scoreable, fast to administer, standardized infant neuro exam
- ▶ Accessible to all clinicians
- ▶ It will improve your neurological exam skills!
- ▶ Excellent inter-observer reliability -(even in less experienced staff)
- ▶ HINE optimality score provides prognostic information on motor outcomes
- ▶ Asymmetry scores - very sensitive for picking up Hemiplegia
- ▶ Sensitivity and specificity is high (>90%)
- ▶ Inexpensive - scoring sheets freely available
- ▶ Follow infant with sequential exams

When administering the HINE...

- ▶ Place infant in age-appropriate safe position
- ▶ Have infant in appropriate clothing so that all body parts can be seen
- ▶ Parents can assist
- ▶ Can proceed even if infant is crying
- ▶ Items can be administered in any sequence
- ▶ Look for age and gross motor appropriate responses
- ▶ Provide support as needed for young infants and infants have more physical challenges

Items you will need...

- ▶ Reflex hammer
- ▶ High contrast toy, black and white object works best
- ▶ Simple rattle
- ▶ Measuring tape
- ▶ Score sheet/ proforma (<http://hammersmith-neuro-exam.com/recording-scoring-proformas/>)



Assessment of Cranial Nerve Function

	score 3	2	score 1	score 0
Facial appearance (at rest and when crying or stimulated)	Smiles or reacts to stimuli by closing eyes and grimacing		Closes eyes but not tightly, poor facial expression	Expressionless, does not react to stimuli
Eye movements	Normal conjugate eye movements		Intermittent Deviation of eyes or abnormal movements	Continuous Deviation of eyes or abnormal movements
Visual response Test ability to follow a black/white target	Follows the target in a complete arc		Follows target in an incomplete or asymmetrical arc	Does not follow the target
Auditory response Test the response to a rattle	Reacts to stimuli from both sides		Doubtful reaction to stimuli or asymmetry of response	No response
Sucking/swallowing Watch infant suck on breast or bottle. If older, ask about feeding, assoc. cough, excessive dribbling	Good suck and swallowing		Poor suck and/or swallow	No sucking reflex, no swallowing

Facial Appearance: observe face watch for asymmetry with smile or grimace (no talking)

Eye Movements: observe eye movements with eye tracking

Assessment of Cranial Nerve Function

	score 3	2	score 1	score 0
Facial appearance (at rest and when crying or stimulated)	Smiles or reacts to stimuli by closing eyes and grimacing		Closes eyes but not tightly, poor facial expression	Expressionless, does not react to stimuli
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Sucking/swallowing Watch infant suck on breast or bottle. If older, ask about feeding, assoc. cough, excessive dribbling	Good suck and swallowing		Poor suck and/or swallow	No sucking reflex, no swallowing

Visual Response: using a **high contrast toy**, start at midline find the focal point then move toy slowly in a circular arc. Allow several attempts to follow, ensure **no noise** is involved

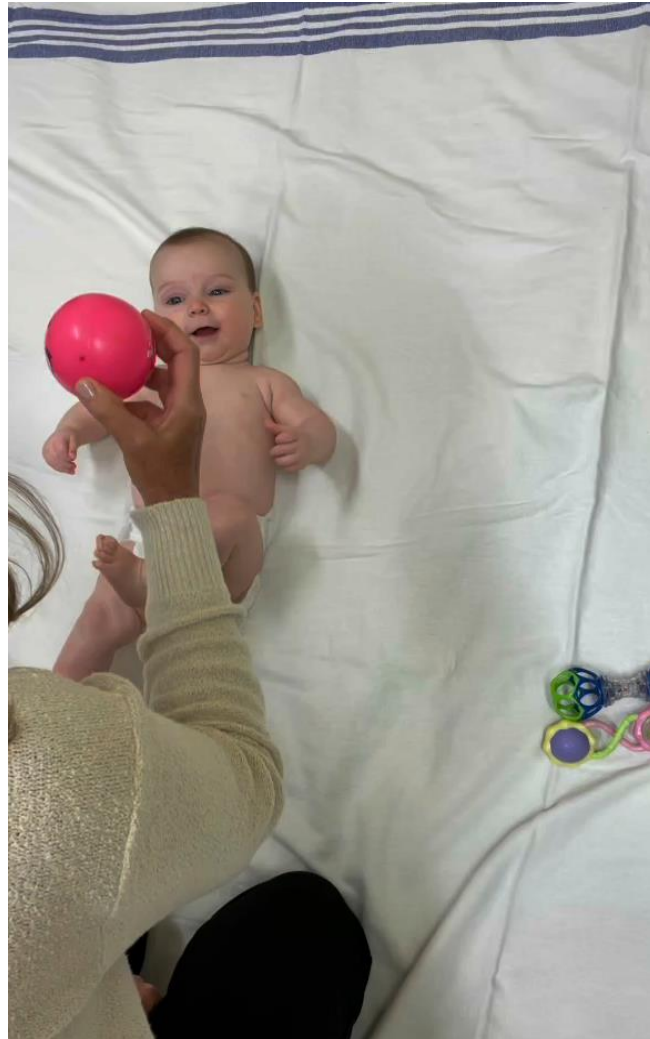
Assessment of Cranial Nerve Function

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Sucking/swallowing Watch infant suck on breast or bottle. If older, ask about feeding, assoc. cough, excessive dribbling	Good suck and swallowing		Poor suck and/or swallow	No sucking reflex, no swallowing

Auditory Response: clap hands or shake a rattle on either side of child but do not use harsh or sharp sounds, **ensure no visual contact with toy**

Sucking/Swallowing: by parent report or observe use of soother

Cranial Nerves












Cranial Nerves

	score 3	2	score 1	score 0	score	Asymmetry / Comments
Facial appearance (at rest and when crying or stimulated)	Smiles or reacts to stimuli by closing eyes and grimacing		Closes eyes but not tightly, poor facial expression	Expressionless, does not react to stimuli	3	
Eye movements	Normal conjugate eye movements		Intermittent Deviation of eyes or abnormal movements	Continuous Deviation of eyes or abnormal movements	3	
Visual response Test ability to follow a black/white target	Follows the target in a complete arc		Follows target in an incomplete or asymmetrical arc	Does not follow the target	3	
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Sucking/swallowing Watch infant suck on breast or bottle. If older, ask about feeding, assoc. cough, excessive dribbling	Good suck and swallowing		Poor suck and/or swallow	No sucking reflex, no swallowing	3	

Assessment of Posture


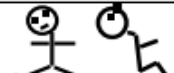
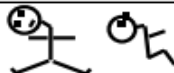






- ▶ For posture items : a “static” event therefore appropriate support is required to achieve an accurate assessment of posture
- ▶ Caregiver can provide external support as needed i.e. age appropriate or physically challenged
- ▶ True asymmetry vs asymmetry due to increased effort
- ▶ look at posture in multiple positions i.e. sitting, supine , supported standing .

ASSESSMENT OF POSTURE (note any asymmetries)



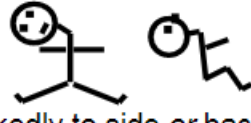
	score 3	score 2	score 1	score 0	sc	Asymmetry / comments
Head in sitting	 Straight in midline		 Slightly to side or backward or forward	 Markedly to side or backward or forward		
Trunk in sitting	 Straight		 Slightly curved or bent to side	 Very rounded back, rocketing back, bent sideways		
Arms at rest	In a neutral position, central straight or slightly bent		Slight Internal rotation or external rotation Intermittent dystonic posture	Marked Internal rotation or external rotation or dystonic posture hemiplegic posture		
Hands	Hands open		Intermittent adducted thumb or flexing	Persistent adducted thumb or flexing		
Legs in sitting	Able to sit with a straight back and legs straight or slightly bent (long sitting) 		Sit with straight back but knees bent at 15-20° 	Unable to sit straight unless knees markedly bent (no long sitting) 		
in supine and in standing	Legs in neutral position straight or slightly bent	Slight Internal rotation or external rotation	Internal rotation or external rotation at the hips	Marked Internal rotation or external rotation or fixed extension or flexion or contractures at hips and knees		
Feet in supine and in standing	Central in neutral position Toes straight midway between flexion and extension		Slight Internal rotation or external rotation Intermittent Tendency to stand on toes or toes up or curling under	Marked Internal rotation or external rotation at the ankle Persistent Tendency to stand on toes or toes up or curling under		

Assessment of Posture

ASSESSMENT OF POSTURE (note any asymmetries)




	score 3	score 2	score 1	score 0	sc	Asymmetry / comments
Head in sitting	 Straight; in midline		 Slightly to side or backward or forward	 Markedly to side or backward or forward		
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Feet in supine and in standing	Central in neutral position Toes straight midway between flexion and extension		Slight internal rotation or external rotation Intermittent Tendency to stand on tiptoes or toes up or curling under	Marked internal rotation or external rotation at the ankle Persistent Tendency to stand on tiptoes or toes up or curling under		

Assessment of Posture

	score 3	score 2	score 1	score 0	sc	Asymmetry / comments
Head in sitting	 Straight; in midline		 Slightly to side or backward or forward	 Markedly to side or backward or forward		

Head: Observe position of head in sitting (provide as much support to trunk as needed)

* Head – for 3-4 month old infants support at hips in sitting.

Trunk in sitting	 Straight		 Slightly curved or bent to side	 Very rounded rocketing back bent sideways		
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Trunk: Observe posture of trunk in sit (with or without support)

Arms at rest	In a neutral position, central straight or slightly bent		Slight internal rotation or external rotation Intermittent dystonic posture	Marked internal rotation or external rotation or dystonic posture hemiplegic posture		
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Arms: Observe position of arms in a relaxed position (supine or supported sit if needed)

*if externally rotated the chest will look square

Assessment of Posture

Hands	Hands open		Intermittent adducted thumb or fisting	Persistent adducted thumb or fisting		
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Hands: Observe posture of hands in a supported position (throughout the assessment)

Legs in sitting	Able to sit with a straight back and legs straight or slightly bent (long sitting) 		Sit with straight back but knees bent at 15-20 ° 	Unable to sit straight unless knees markedly bent (no long sitting) 		
in supine and in standing	Legs in neutral position straight or slightly bent	Slight internal rotation or external rotation	Internal rotation or external rotation at the hips	Marked internal rotation or external rotation or fixed extension or flexion or contractures at hips and knees		

Feet in supine and in standing	Central in neutral position Toes straight midway between flexion and extension		Slight internal rotation or external rotation Intermittent Tendency to stand on tiptoes or toes up or curling under	Marked internal rotation or external rotation at the ankle Persistent Tendency to stand on tiptoes or toes up or curling under		
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look at the feet in relation to the axis of the tibia

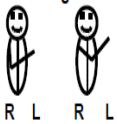






Assessment of Movements

	Score 3	Score 2	Score 1	Score 0
Quantity Watch infant lying in supine	Normal		Excessive or sluggish	Minimal or none
Quality Observe infant's spontaneous voluntary motor activity during the course of the assessment	Free, alternating, and smooth		Jerky Slight tremor	<ul style="list-style-type: none">• Cramped & synchronous• Extensor spasms• Athetoid• Ataxic• Very tremulous• Myoclonic spasm• Dystonic movement

Quantity: Place child in supine (may be age dependent). This is your overall impression of the amount (quantity) of independent movement

Quality: Throughout the assessment, this is your overall impression of the quality of the child's independent, spontaneous movements

Assessment of Tone

	Score 3	Score 2	Score 1	Score 0
Scarf sign Take the infant's hand and pull the arm across the chest until there is resistance. Note the position of the elbow in relation to the midline.	Range:  R L R L		 R L	 or  R L R L
Passive shoulder elevation Lift arm up alongside infant's head. Note resistance at shoulder and elbow.	Resistance overcomeable  R L	Resistance difficult to overcome R L	No resistance  R L	Resistance, not overcomeable  R L
Pronation/supination Steady the upper arm while pronating and supinating forearm, note resistance	Full pronation and supination, no resistance		Resistance to full pronation / supination overcomeable	Full pronation and supination not possible, marked resistance

Scarf Sign: With one hand, **stabilize trunk at pelvis** and with the other hand take the child's arm across the chest. **Ensure NO trunk rotation.** With the child in a stable position, look at the trunk as a block, note the position of the elbow to midline.

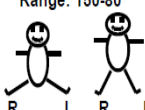







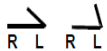

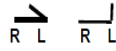

Passive Shoulder Elevation: **With child in a stable position,** grasp forearm, lift arm forward and up above head to bring elbow in line with the ear. May also slightly abduct and externally rotate shoulder to elevate. Do one arm at a time, then together to compare. **Watch for resistance above 90 degrees.**

Pronation/Supination: **Straighten the arm, support the arm with one hand just above the elbow** while supinating and pronating the forearm. Ensure the elbow is maintained in extension. Look for resistance at head of ulna and radius.

Assessment of Tone : Scarf Sign



Assessment of Tone

Hip adductors With both the infant's legs extended, abduct them as far as possible. The angle formed by the legs is noted.	Range: 150-80°  R L R L	150-160°  R L	>170°  R L	<80°  R L
Popliteal angle Keeping the infant's bottom on the bed, flex both hips onto the abdomen, then extend the knees until there is resistance. Note the angle between upper and lower leg.	Range: 150°-100°  R L R L	150-160°  R L	~90° or > 170°  R L R L	<80°  R L
Ankle dorsiflexion With knee extended, dorsiflex the ankle. Note the angle between foot and leg.	Range: 30°-85°  R L R L	20-30°  R L	<20° or 90°  R L R L	> 90°  R L

Hip Adductors: Best position is supine as **both hips and knees must be in extension**. Hold the legs at the ankles and abduct the legs gently, quickly and smoothly.

Popliteal Angle: Best position is in supine. **Flex knees and bring thighs up onto chest**. With hands around knees and thumbs on calves, straighten the knees and hold.

Ankle Dorsiflexion: **With knee in extension, place your flat hand on plantar surface of foot, push into maximal dorsiflexion**. Note the R2 angle.

Assessment of Tone: Popliteal Angle










1. Flat pelvis required on the surface
2. To determine if there is an **asymmetry**: Observe the angle of the feet – are the feet parallel?

Reflexes and Reactions: Arm Protection




With one hand supporting the trunk over the pelvis (centre of diaper area), with the other hand bring child to sit by rotating up through the side. Note the reaction of the arm on the weight bearing side.



REFLEXES AND REACTIONS						
	Score 3 	Score 2 	Score 1 	Score 0 	sc	Asym / Co
Arm protection Pull the infant by one arm from the supine position (steady the contralateral hip) and note the reaction of arm on opposite side.	 Arm & hand extend R L	Hand remains fistled	 Arm semi-flexed R L	 Arm fully flexed R L		

Reflexes and Reactions: Vertical Suspension

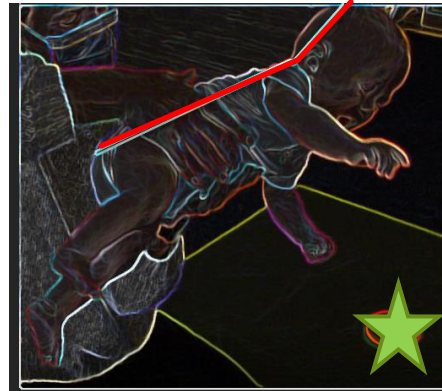
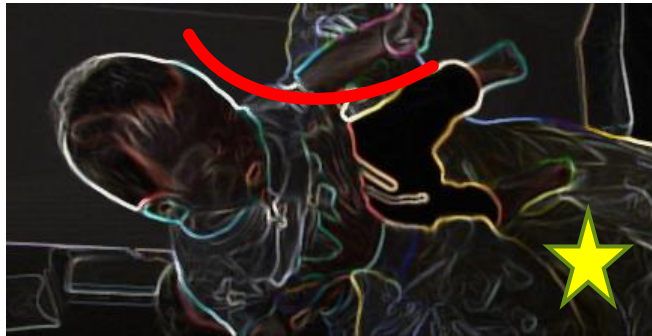
Hold the child with your hands under the axilla. Suspend the child upright with **no foot contact on any surface**. Someone may “tickle” feet to stimulate leg movement.

	Score 3	Score 2	Score 1	Score 0	sc	Asym / Co
Vertical suspension hold infant under axilla making sure legs do not touch any surface – you may “tickle” feet to stimulate kicking.	 Kicks symmetrically		 Kicks one leg more or poor kicking	 No kicking even if stimulated or scissoring		



Reactions and Reflexes: Lateral Tilt

Hold child vertically with support around the hips.
 Move quickly sideways towards horizontal. Avoid head going lower than hips. **Observe the response of upward side of the head, neck, trunk and limbs.**



	Score 3	Score 2	Score 1	Score 0	sc	Asym / Co
Lateral tilting (describe side up). Hold infant up vertically near to hips and tilt sideways towards the horizontal. Note response of trunk, spine, limbs and head.						

Reflexes and Reactions: Forward Parachute

In vertical suspension, move child forward quickly towards the ground. **Avoid contact of the feet on the surface.**



	Score 3	Score 2	Score 1	Score 0	sc	Asym / Co
Forward parachute Hold infant up vertically and quickly tilt forwards. Note reaction /symmetry of arm responses.	 (after 6 months)	 (after 6 months)	 (after 6 months)	<i>Under 5-6 months</i>		A L= 2 R= 1

Reflexes and Reactions: Tendon Reflexes

Using a reflex hammer, test the reflexes of the biceps (elbow), quadriceps (knee) and Tendo-achilles (ankle). Flex joint being tested, place your thumb over tendon and strike your thumb to test reaction of muscle tendon.

	Score 3	Score 2	Score 1	Score 0	sc	Asym / Co
Tendon Reflexes Have child relaxed, sitting or lying – use small hammer	Easily elicitable biceps knee ankle	Mildly brisk bicep knee ankle	Brisk biceps knee ankle	Clonus or absent biceps knee ankle		



Knee- quads tendon



Ankle- tendon-achilles



Elbow- biceps tendon


Scoring the HINE

The Basics

- ▶ 26 items
- ▶ Each item is scored 0-3
- ▶ Total score range from 0-78
- ▶ Use corrected age
- ▶ Subsection scores
- ▶ Asymmetry score

HAMMERSMITH INFANT NEUROLOGICAL EXAMINATION (v 08.02.19)

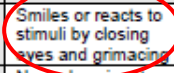

Name _____ Date of birth _____
 Gestational age _____ Date of examination _____
 Chronological age / **Corrected age** _____ Head circumference _____

SUMMARY OF EXAMINATION		
Global score (max 78)		
Number of asymmetries 		
Behavioural score (not part of the optimality score)		
Cranial nerve function	score	(max 15)
Posture	score	(max 18)
Movements	score	(max 6)
Tone	score	(max 24)
Reflexes and reactions	score	(max 15)
COMMENTS		

(Throughout the exam, if a response is not optimal but not poor enough to score 1, give a score of 2)






NEUROLOGICAL EXAMINATION

ASSESSMENT OF CRANIAL NERVE FUNCTION

	score 3	2	score 1	score 0	score	Asymmetry / Comments
Facial appearance (at rest and when crying or stimulated)	Smiles or reacts to stimuli by closing eyes and grimacing 		Closes eyes but not tightly, poor facial expression	Expressionless, does not react to stimuli	3	
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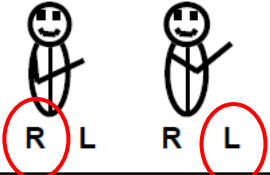



Scoring Asymmetries

ASSESSMENT OF TONE

	Score 3	Score 2	Score 1	Score 0	sc	Asym/Co
Scarf sign Take the infant's hand and pull the arm across the chest until there is resistance. Note the position of the elbow in relation to the midline.	Range:   R L R L		 R L	 or  R L R L	1.5	A [R]

Scoring Asymmetries

ASSESSMENT OF TONE

	Score 3	Score 2	Score 1	Score 0	sc	Asym/Co
Scarf sign Take the infant's hand and pull the arm across the chest until there is resistance. Note the position of the elbow in relation to the midline.	Range: 			 or 	3	A

Optimality Score

The JOURNAL
of PEDIATRICS

J Pediatr 1999;135:153-61.

Haataja L et al. Optimality score for the neurologic examination of the infant at 12 and 18 months of age

- ▶ **Optimality Scores** are scores above which babies are considered to show typical neurologic performance
- ▶ The **Optimality Scores** are 10th percentile scores for children born at term, without any risk factors for CP
- ▶ The Optimality Score at 12 months is 73 and at 18 months is 74

Application of a scorable neurologic examination in healthy term infants aged 3 to 8 months

Leena Haataja, MD • Frances Cowan, MD • Eugenio Mercuri, MD • Laura Bassi, MD • Andrea Guzzetta, MD
Lilly Dubowitz, MD

DOI: [https://doi.org/10.1067/S0022-3476\(03\)00393-7](https://doi.org/10.1067/S0022-3476(03)00393-7)

Age	Optimality Score
>9 months	≥ 73
6 months	≥ 70
3 months	≥ 67

- ▶ Median HINE scores of preterm infants are lower than term infants
- ▶ Very preterm (VP) (< 32 weeks) infants have median total scores that are lower than late preterm (LP) (33-36 weeks) infants
- ▶ If born preterm, the cut-off scores should be lowered at 3 months by 3.5 points, at 6 months by 3 points, at 9 months by 2.5 (VP) - 1.5 (LP) points and at 12 months by 2 (VP) - 1 (LP) point(s)

HINE Scores that predict Cerebral Palsy

Cut Off Scores for High Probability of CP

(sensitivity > 90%; specificity > 85%)

- ▶ 3 months < 56
- ▶ 6 months < 59
- ▶ 9 months < 62
- ▶ 12 months < 65

Romeo DM, et al. Neurological assessment in infants discharged from a neonatal intensive care unit. *Eur J Paediatr Neurol.* 2013 Mar;17(2):192-8. doi: 10.1016/j.ejpn.2012.09.006. PMID: 23062755.



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Original article

Neuromotor development in infants with cerebral palsy investigated by the Hammersmith Infant Neurological Examination during the first year of age

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^cDepartment of Internal and Specialist Medicine, Section of Infectious Diseases, University of Catania, Italy

^dNeonatal Intensive Care Unit, Department of Paediatrics, University of Catania, Italy

- ▶ At **3-6 months**, infants with quadriplegia, **GMFCS IV and V** and those with diplegia **GMFCS III** scored **below 40**, whereas diplegia **GMFCS I-II** and hemiplegia GMFCS I-II level mainly scored between **40-60**.
- ▶ 26% of infants with hemiplegia scored ≥ 67 at 12 months

> *Pediatr Neurol.* 2018 Oct;87:70-74. doi: 10.1016/j.pediatrneurol.2018.07.002. Epub 2018 Jul 25.

Hammersmith Infant Neurological Examination Asymmetry Score Distinguishes Hemiplegic Cerebral Palsy From Typical Development

Krystal Hay¹, MaryAnn Nelin¹, Helen Carey¹, Olena Chorna¹,
Melissa Moore-Clingenpeel Ma Mas², Nathalie Maitre³, NCH Early Developmental Group

Global score <63 and an **asymmetry score >5
is sensitive (91.8%) and specific (100%) to
distinguish hemiplegia from typical
development**

Name: _____
 MRN: _____
 Date of Birth: _____

Hammersmith Infant Neurological Examination (HINE): Score Interpretation Aid for Children Receiving Neonatal Follow-Up Care

Clinical history: _____

Brain imaging (if available): _____

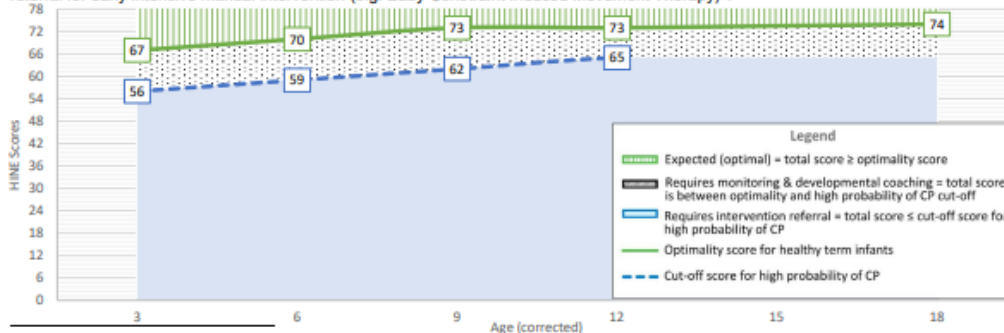
Visit	Child's Age (corrected)	Child's Total HINE Score	HINE Asymmetry Score	Corrected Age for GMA (if available)	GMA Category (if available)	Interpretation/Action	Discussed with family
1							<input type="checkbox"/>
2							<input type="checkbox"/>
3							<input type="checkbox"/>
4							<input type="checkbox"/>
5							<input type="checkbox"/>

HINE Scoring Aid Reference Information

Interpret total score by comparing to optimality score^{1,2} and high probability of CP cut-off scores³ for the child's corrected age. Optimality scores refer to HINE scores above which babies are considered to have typical neurological performance (90% of healthy, term babies score higher than this benchmark on the HINE). CP cut-off scores represent benchmarks below which babies with etiologic risk factors for CP (e.g. preterm, neonatal encephalopathy) have a high probability of developing CP. Interpret HINE score with clinical reasoning: clinical history, and if available, brain imaging and General Movements Assessment (GMA):

Child's Age (corrected)	OPTIMALITY Score (healthy term) ^{1,2}	Cut-Off Scores for High Probability of CP ³	Difference Between Lower MEDIAN Total Scores in Very Preterm (≤32 weeks) and Term Babies ⁴	Difference Between Lower MEDIAN Total Scores in Late Preterm (33-36 weeks) and Term Babies ⁴
3 months	≥ 67	≤ 56	3.5	3.5
6 months	≥ 70	≤ 59	3	3
9 months	≥ 73	≤ 62	2.5	1.5
12 months	≥ 73	≤ 65	2	1
18 months	≥ 74	A total score <40 is predictive of non-ambulant CP ⁵		The cut-off score should be lowered by the respective estimate above if the child is preterm. Note: this research presents median - 50 th percentile, rather than optimality - 10 th percentile scores.

The HINE also provides an asymmetry score. If an **asymmetry score > 5** = significant asymmetric neurologic performance – consider referral for early intensive manual intervention (e.g. Baby Constraint Induced Movement Therapy)⁶.



¹ Haataja L, et al. Optimality score for the neurologic examination of the infant at 12 and 18 months of age. *J Pediatr*. 1999 Aug;135(2 Pt 1):153-61. doi: 10.1016/s0022-3476(99)70016-8. PMID: 10431108.

² Haataja L, et al. Application of a scorable neurologic examination in healthy term infants aged 3 to 8 months. *J Pediatr*. 2003 Oct;143(4):546. doi: 10.1016/s0022-3476(03)00562-7. PMID: 14603891.

³ Romano DM, et al. Neurological assessment in infants discharged from a neonatal intensive care unit. *Eur J Paediatr Neurol*. 2013 Mar;17(2):192-6. doi: 10.1016/j.ejpn.2012.09.005. PMID: 23062755.

⁴ Romano DM, et al. Early psychomotor development of low-risk preterm infants: Influence of gestational age and gender. *Eur J Paediatr Neurol*. 2016 Jul;20(4):518-23. doi: 10.1016/j.ejpn.2016.04.011. Epub 2016 Apr 22. PMID: 27142253.

⁵ Romano DM, et al. Neurosensor development in infants with cerebral palsy investigated by the Hammersmith Infant Neurological Examination during the first year of age. *Eur J Paediatr Neurol*. 2008 Jan;12(1):24-31. doi: 10.1016/j.ejpn.2007.05.005. Epub 2007 Jul 2. PMID: 17804195.

⁶ Hay K, et al. Hammersmith Infant Neurological Examination Asymmetry Score Distinguishes Hemiplegic Cerebral Palsy From Typical Development. *Pediatr Neurol*. 2018 Oct;87:70-74. doi: 10.1016/j.pediatrneurol.2018.07.002. Epub 2018 Jul 25. PMID: 30190180; PMCID: PMC620094.

Scoring Aid

D Fehlings, A Makino, P. Church, R Banihani, K Thomas, M Luther, S Lam-Damji, S Kumar, L Switzer (Jun 28/23, Version 5)

Name: _____
MRN: _____
Date of Birth: _____

Hammersmith Infant Neurological Examination (HINE): Score Interpretation Aid for Children Receiving Neonatal Follow-Up Care

Clinical history: _____

Brain imaging (if available): _____

Scoring Aid

Visit	Child's Age (corrected)	Child's Total HINE Score	HINE Asymmetry Score	Corrected Age for GMA (if available)	GMA Category (if available)	Interpretation/Action	Discussed with family
1							<input type="checkbox"/>
2							<input type="checkbox"/>
3							<input type="checkbox"/>
4							<input type="checkbox"/>
5							<input type="checkbox"/>

Scoring Aid

HINE Scoring Aid Reference Information

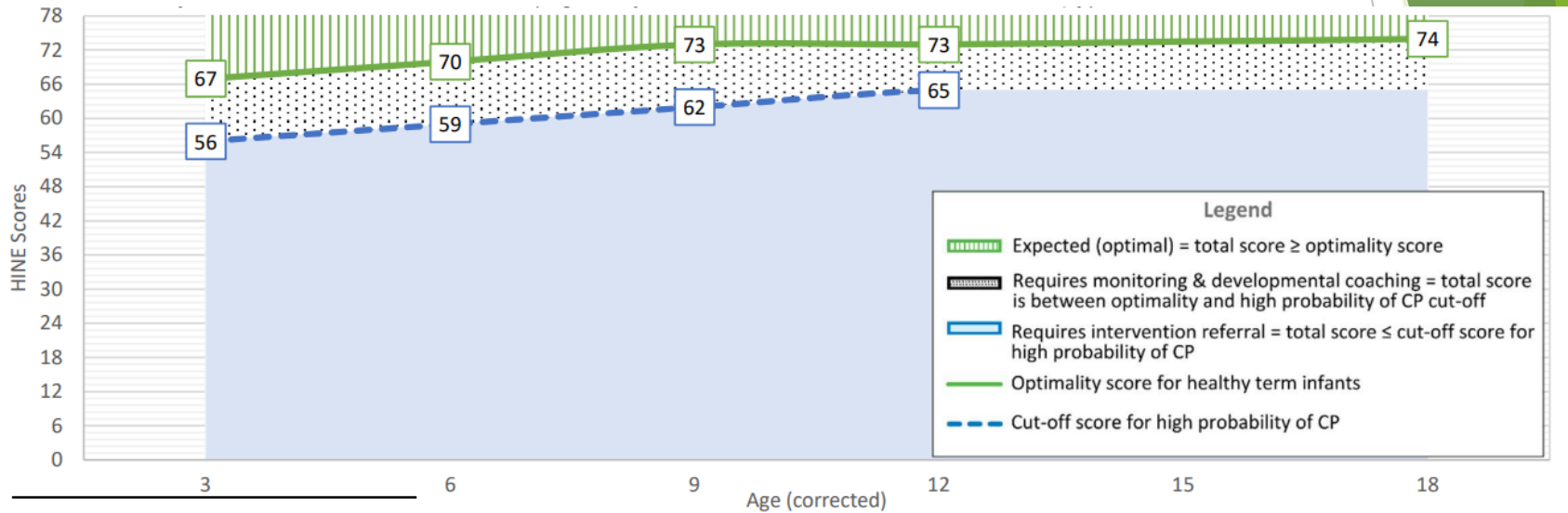
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18 months	≥ 74				

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The cut-off score should be lowered by the respective estimate above if the child is preterm. Note: this research presents median - 50th percentile, rather than optimality - 10th percentile scores.

Scoring Aid



Scoring Aid

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18 months	≥ 74	A total score <40 is predictive of non-ambulant CP ⁵	The cut-off score should be lowered by the respective estimate above if the child is preterm. Note: this research presents median - 50 th percentile, rather than optimality - 10 th percentile scores.
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The HINE also provides an asymmetry score. If an **asymmetry score > 5** = significant asymmetric neurologic performance – consider referral for early intensive manual intervention (e.g. Baby Constraint Induced Movement Therapy)⁶.

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 MRN: _____
 Date of Birth: _____

Hammersmith Infant Neurological Examination (HINE): Score Interpretation Aid for Children Receiving Neonatal Follow-Up Care

Clinical history: _____

Brain imaging (if available): _____

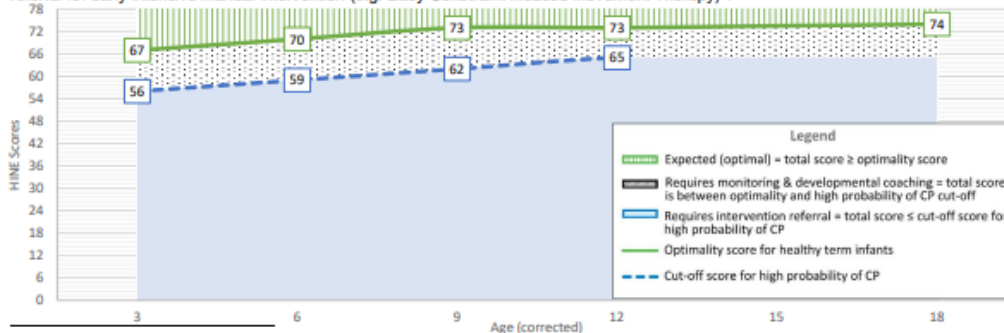
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1							<input type="checkbox"/>
2							<input type="checkbox"/>
3							<input type="checkbox"/>
4							<input type="checkbox"/>
5							<input type="checkbox"/>

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⁵ Romano DM, et al. Neurosensor development in infants with cerebral palsy investigated by the Hammersmith Infant Neurological Examination during the first year of age. *Eur J Paediatr Neurol*. 2008 Jan;12(1):24-31. doi: 10.1016/j.ejpn.2007.05.005. Epub 2007 Jul 2. PMID: 17804195.

⁶ Hay K, et al. Hammersmith Infant Neurological Examination Asymmetry Score Distinguishes Hemiplegic Cerebral Palsy From Typical Development. *Pediatr Neurol*. 2018 Oct;87:70-74. doi: 10.1016/j.pediatrneurol.2018.07.002. Epub 2018 Jul 25. PMID: 30190180; PMCID: PMC620094.

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Hammersmith Neonatal and Infant Neurological Examinations

What are the Hammersmith Neurological Examinations?

The Hammersmith Neonatal Neurological Examination (HNNE) is a quick, practical and easy to perform examination but requires some learning and experience to perform well. There are 34 items assessing tone, motor patterns, observation of spontaneous movements, reflexes, visual and auditory attention, and behaviour. It was initially developed by Dr Lilly Dubowitz and Professor Victor Dubowitz in 1981, and updated with Dr Eugenio Mercuri, in 1998. Many studies have been performed using it in different clinical groups of full term and preterm infants at different ages within the neonatal period.

The Hammersmith Infant Neurological Examination (HINE) has similar structure to the neonatal exam and consists of 26 items that assess different aspects of neurological function: cranial nerve function, movements, reflexes and protective reactions and behaviour, as well as some age-dependent items that reflect the development of gross and fine motor function. The HINE is aimed to be used for infants between 3 and 24 months of age.

Today, the HNNE and the HINE are used throughout the world in the clinic and for research. Both the HNNE and the HINE have been standardised in large cohorts of typically developing children. The examinations are easily recorded on standardised proformas, simplifying the documentation of findings and comparison between sequential examinations. The examinations can be scored to enable classification into optimal and sub-optimal neurological categories. The scores of the HINE can also be used to enable detection of high risk of cerebral palsy (CP) at an early age, and prediction of independent sitting and walking in high-risk infants.

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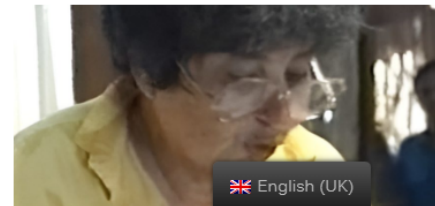
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HINE@hollandbloorview.ca

This HINE Introductory Webinar was developed with the help of Swetlana Kumar.