Cerebral Palsy

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Neurosciences Module
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Sequence

- Definition and classifications
- History and examination
- Diagnosis
- Management

Definition and classifications

CEREBRAL PALSY (CP)

"CP describes a **group of permanent** disorders of the **development of**

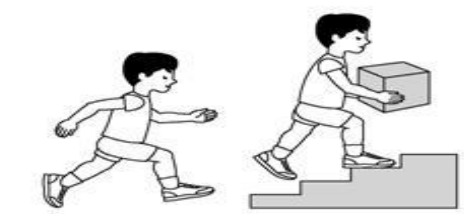
movement and posture causing **activity limitation** that are attributed to **non-progressive** disturbances that occurred in the **developing fetal or infant brain.**

The motor disorders of cerebral palsy are **often accompanied by**

disturbances of sensation, perception, cognition, communication and behavior, by epilepsy, and by secondary musculoskeletal disorders"

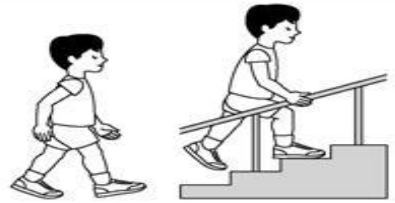
Rosenbaum P et al: Dev Med Child Neurol (Suppl.)2007;109:8-14

Gross motor function classification system



GMFCS Level I

Children walk indoors and outdoors and climb stairs without limitation. Children perform gross motor skills including running and jumping, but speed, balance and co-ordination are impaired.



GMFCS Level II

Children walk indoors and outdoors and climb stairs holding onto a railing but experience limitations walking on uneven surfaces an
or confined spaces.

GMFCS Level III

Children walk indoors
an assistive mobility de
holding onto a railing.
manually or are transp
distances or outdoors on uneven terrain.

GMFCS Level IV

Children may continue to walk for short distances on a walker or rely more on wheeled mobility at home and school and in the community.

GMFCS Level V

Physical impairment restricts voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. Children have no means of independent mobility and are transported.

- A common language
- Based on ability

Palisano, Rosenbaum, Bartlett & Livingston, 2007

BMC Musculoskeletal Disorders 2007, **8**:50

Classification according to tone

- Spastic: hemiplegic, diplegic, quadriplegic, triplegic
- Dyskinetic: Dystonic, choreo athetoid
- Ataxic
- Mixed
- (Hypotonic)

Definitions

•Hypertonia: abnormally increased resistance to passive stretch

•Spasticity: resistance to externally imposed movement increases with increasing speed of stretch and/or threshold speed or angle'

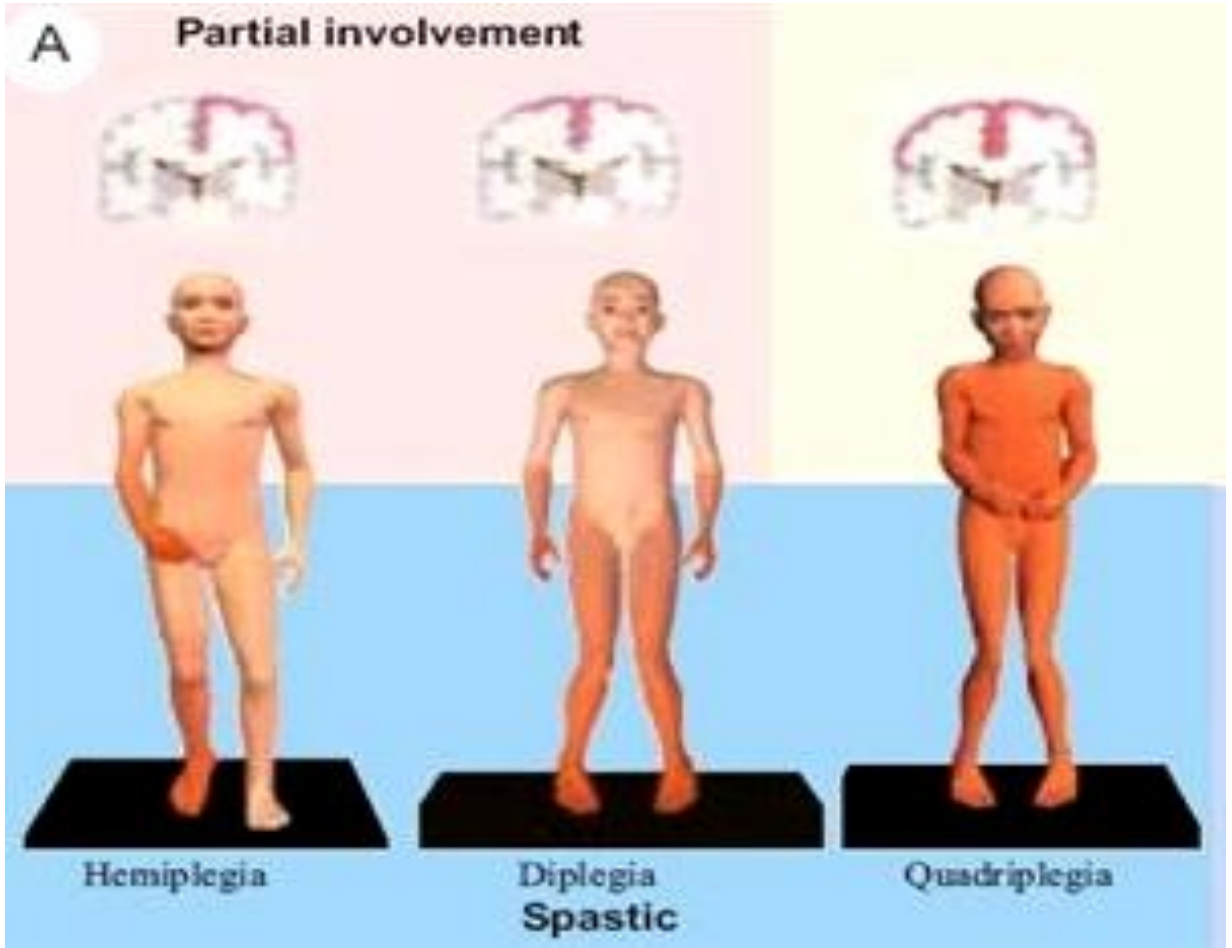
Spastic: topography

Spastic CP is the most common type (70-80) %

Hemiplegia (20%),

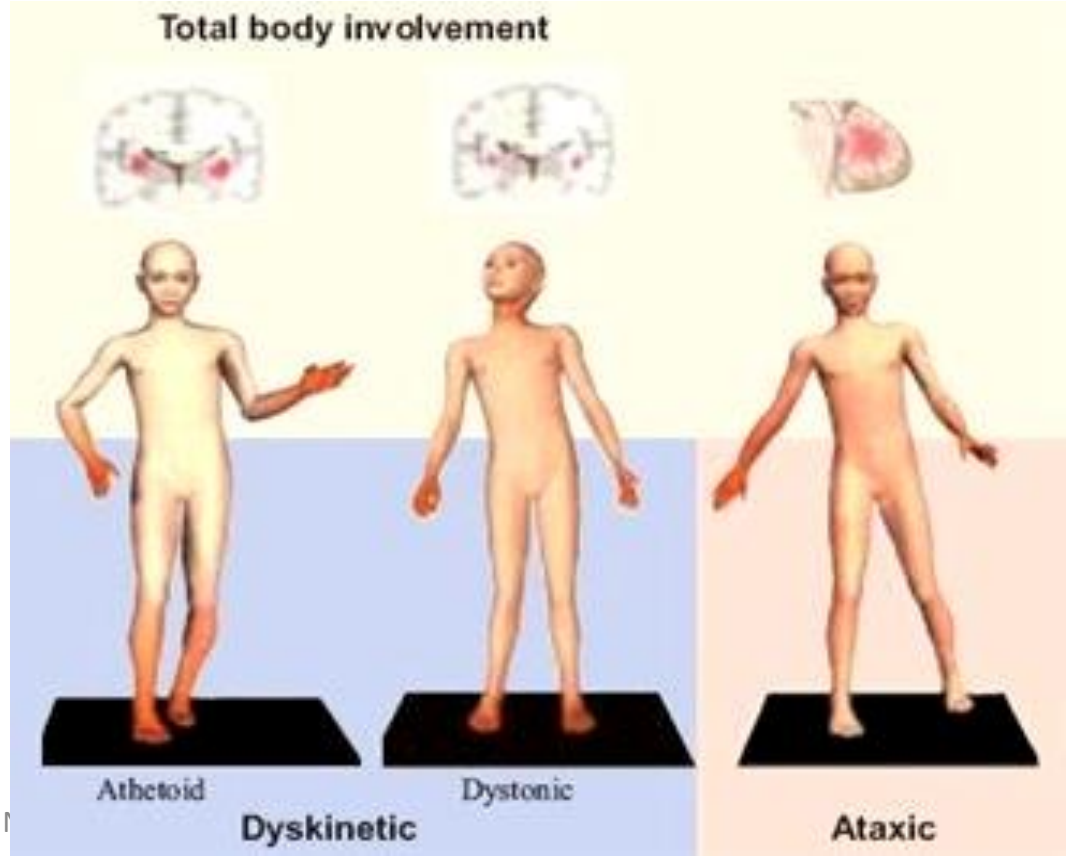
Diplegia (20%),

Quadriplegia (30%)



Dyskinetic CP accounts for 10 – 15 % of all CP cases

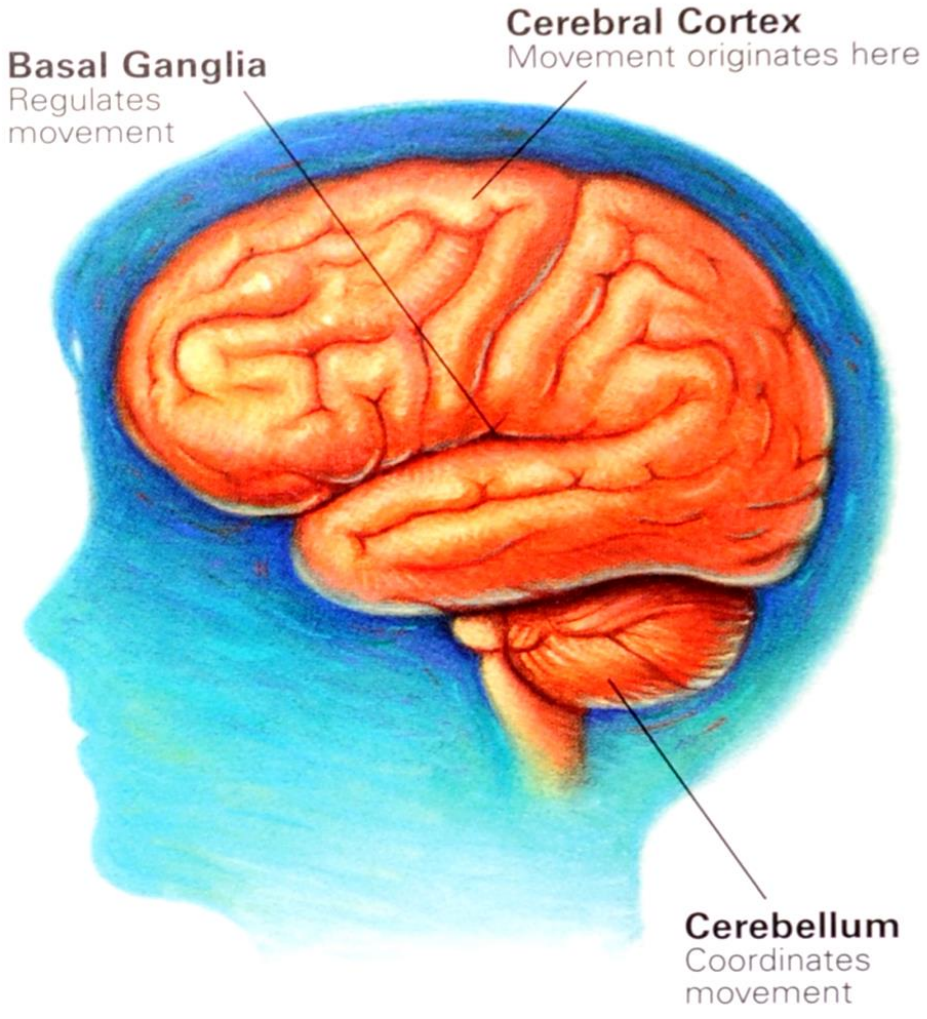
Ataxic CP is associated with cerebellar lesions



Significance of typing

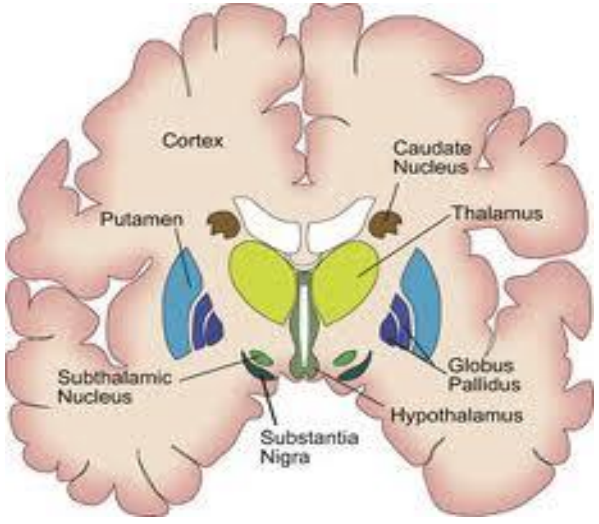
- Correlate with aetiology
- Look for associated conditions
- **Treatment and therapy**
- **Prognosticate**

Mapping the signs



Neurology 2016

Basal ganglia



History and examination

Common presentations

- Delayed motor milestones
- Handedness
- Tip toe walking
- Abnormal movements

- Incidental finding during routine screening

History

- Positive family history
  - Consanguinity
  - F/ H of CNS diseases

Prenatal risk factors

- Maternal illnesses: GDM, PIH
- Maternal drugs/ medications
- Exposure to radiation
- TORCH infections
- Premature birth
- SGA

Perinatal risk factors

Perinatal hypoxia
Infections
injuries

Postnatal risk factors

CNS infections
Seizures
Hypoglycaemia
Kernicterus
Hypocalcaemia and other metabolic derangements
Intra cranial bleeding: IVH, ICH

Early childhood risk factors

CNS Infections
Traumatic brain injuries

High degree of suspicion

Examination

- General
  - OFC and growth
  - Dysmorphism
  - Features of other illnesses
  - Scars of surgeries/ trauma

- Specific
  - Abnormal movements, gait and gross motor skills
  - Tone
  - Power
  - Reflexes
  - Development assessment
  - Feeding assessment
  - Learning assessment

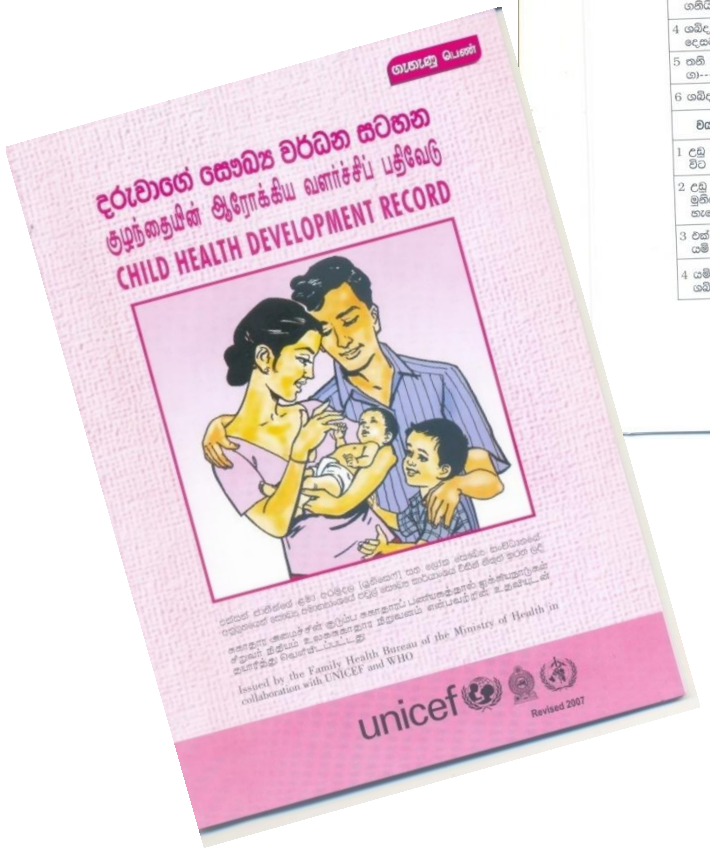
Common findings

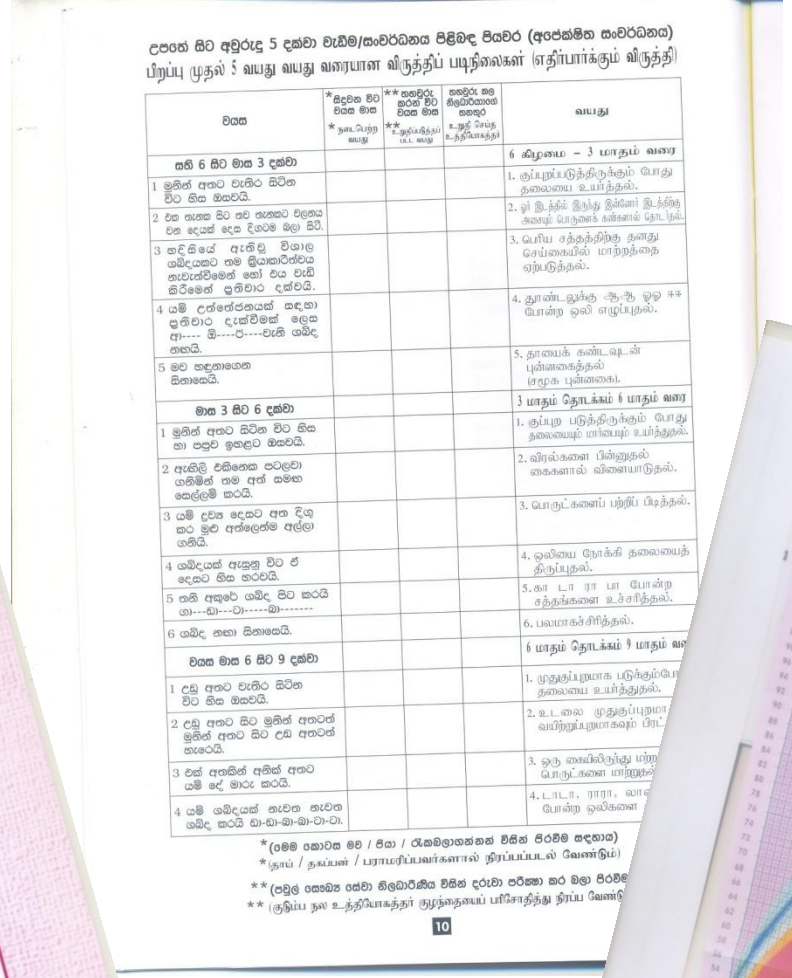
- Microcephaly
- Hypotonia:
  - ventral suspension: rag doll appearance
  - Supine lie: frog position
- Hypertonia: scissoring, hyperextension on ventral suspension/ prone lie
- Persistent asymmetric tonic neck reflex
- Exaggerated tendon reflexes, up going plantar, clonus

High risk children

- Low threshold to suspect
- Close and adequate follow up of at risk babies
  - Monthly for the first 1 year
  - Follow up till 4 years

Cerebral palsy can be identified as early as 20 weeks of age by careful observation of ovement patterns in babies





උපතේ සිට අවුරුදු 5 දක්වා වැඩීම/සංවර්ධනය පිළිබඳ පියවර (අපේක්ෂිත සංවර්ධනය)
பிறப்பு முதல் 5 வயது வயது வரையான விருத்திப் படிநிலைகள் (எதிர்பார்க்கும் விருத்தி)

වයස	*සිදුවිය හිට වයස මාස * நடைபெற்ற வயது	**තහවුරු කරන විට වයස මාස ** உறுதிசெய்தல் ப.ட. வயது	තහවුරු කළ නිලධාරියාගේ තනතුර உறுதி செய்த உத்தியோகத்தர்	වයස
සති 6 සිට මාස 3 දක්වා				**6 கிழமை – 3 மாதம் வரை**
1 මුහුණ අතට හැරිව සිටින විට හිස ඔසවයි.				1. குப்புறப்படுத்திருக்கும் போது தலையை உயர்த்தல்.
2 එක තැනක සිට තව තැනකට වලනය වන දෙයක් දෙස දිගටම බලා සිටී.				2. ஓர் இடத்தில் இருந்து இன்னோர் இடத்திற்கு அசையும் பொருளைக் கண்ணால் தொடர்தல்.
3 හදිසියේ ඇතිවූ විශාල ශබ්දයකට තම ක්‍රියාකාරිත්වය නැවැත්වීමෙන් හෝ එය වැඩි කිරීමෙන් ප්‍රතිචාර දක්වයි.				3. பெரிய சத்தத்திற்கு தனது செய்கையில் மாற்றத்தை ஏற்படுத்தல்.
4 යම් උත්තේජනයක් සඳහා ප්‍රතිචාර දැක්වීමක් ලෙස අ:---- ඕ----ඊ----වැනි ශබ්ද නඟයි.				4. தூண்டலுக்கு அ:ஆ ஓஓ ** போன்ற ஒலி எழுப்புதல்.
5 මව හඳුනාගෙන සිනාසෙයි.				5. தாயைக் கண்டவுடன் புன்னகைத்தல் (சமூக புன்னகை).
මාස 3 සිට 6 දක්වා				**3 மாதம் தொடக்கம் 6 மாதம் வரை**
1 මුහුණ අතට සිටින විට හිස හා පපුව ඉහළට ඔසවයි.				1. குப்புற படுத்திருக்கும் போது தலையையும் மார்பையும் உயர்த்துதல்.
2 ඇඟිලි එකිනෙක පටලවා ගනිමින් තම අත් සමඟ සෙල්ලම් කරයි.				2. விரல்களை பின்னுதல் கைகளால் விளையாடுதல்.
3 යම් ද්‍රව්‍ය දෙසට අත දිගු කර මුළු අත්ලෙන්ම අල්ලා ගනියි.				3. பொருட்களைப் பற்றிப் பிடித்தல்.
4 ශබ්දයක් ඇසුනු විට ඒ දෙසට හිස හරවයි.				4. ஒலியை நோக்கி தலையைத் திருப்புதல்.
5 තනි අකුරේ ශබ්ද පිට කරයි ග)---ඩ)---ට)-----බ)-------				5. கா டா ரா பா போன்ற சத்தங்களை உச்சரித்தல்.
6 ශබ්ද නඟා සිනාසෙයි.				6. பலமாகச்சிரித்தல்.
වයස මාස 6 සිට 9 දක්වා				**6 மாதம் தொடக்கம் 9 மாதம் வ**
1 උඩු අතට හැරිව සිටින විට හිස ඔසවයි.				1. முதுகுப்புறமாக படுக்கும்போ தலையை உயர்த்துதல்.
2 උඩු අතට සිට මුහුණ අතටත් මුහුණ අතට සිට උඩ අතටත් හැරෙයි.				2. உடலை முதுகுப்புறமா வயிற்றுப்புறமாகவும் பிரட்
3 එක් අතකින් අනික් අතට යම් දේ මාරු කරයි.				3. ஒரு கையிலிருந்து மற்ற பொருட்களை மாறுதல்
4 යම් ශබ්දයක් නැවත නැවත ශබ්ද කරයි ඩා-ඩා-බා-බා-ටා-ටා.				4. டாடா, ராரா, லா போன்ற ஒலிகளை

*(අම්ම කොටස මව / පියා / රැකබලාගන්නන් විසින් පිරවීම සඳහාය)
*தாய் / தகப்பன் / பராமரிப்பவர்களால் நிரப்பப்படல் வேண்டும்)

**(පසුල සෞඛ්‍ය සේවා නිලධාරිණිය විසින් දරුවා පරීක්ෂා කර බලා පිරවීම
** குடும்ப நல உத்தியோகத்தர் குழந்தையைப் பரிசோதித்து நிரப்ப வேண்டு

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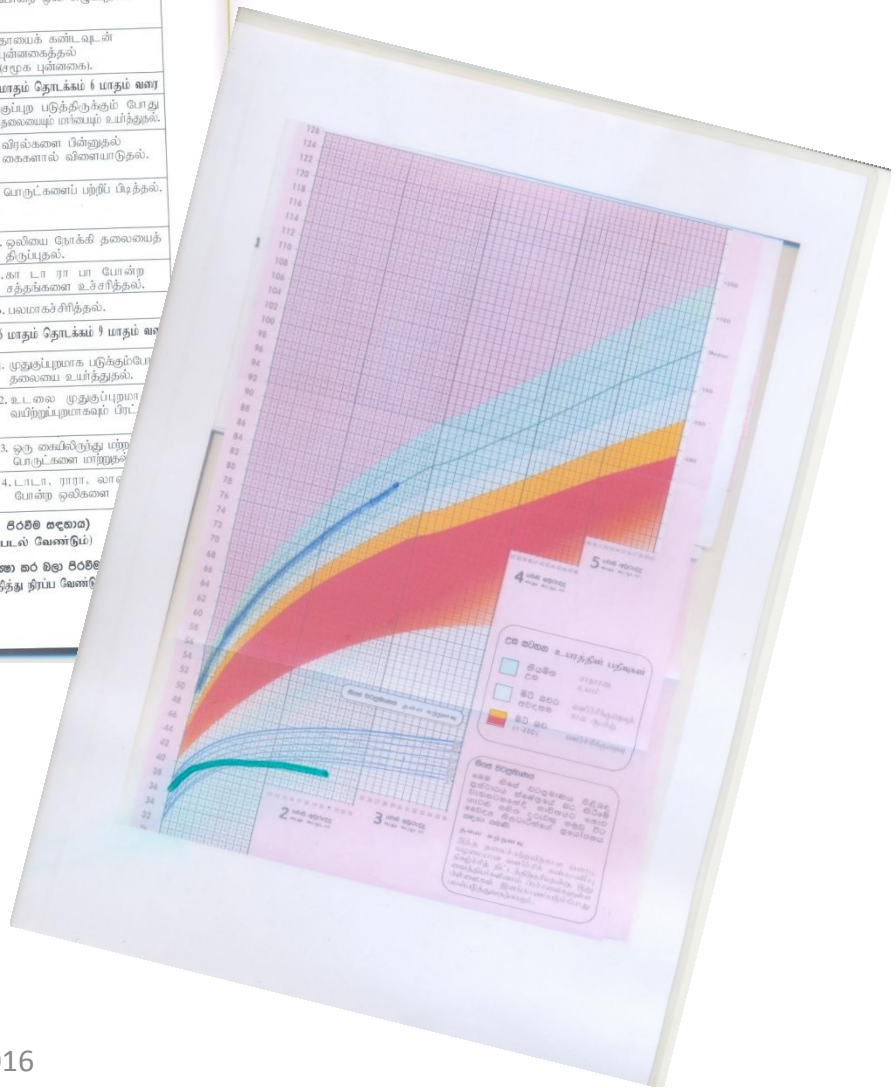


Diagnosis

Diagnosis

- Clinical
- Supported by investigations

Investigations

Confirmative

- Brain imaging: USS, MRI
- Metabolic screening
- Chromosomal analysis

Supportive

- Visual and hearing assessment
- EEG

Differential diagnosis

- Children with hypotonia
  - Eg: muscular atrophies
- Dystonias
  - Eg: dopa sensitive dystonias, Leisch nyhan syndrome
- Developmental regression
- Toe walking
  - Eg: autism

Management

Communication with parents

- Suspicion of the condition
- Need for early intervention and consistent work
- Honest, factual information
- Realistic goals for the child taking into parental requirements and circumstances

Interventions

At the clinical suspicion

- At the earliest possible time

I must explain to parents and start interventions immediately

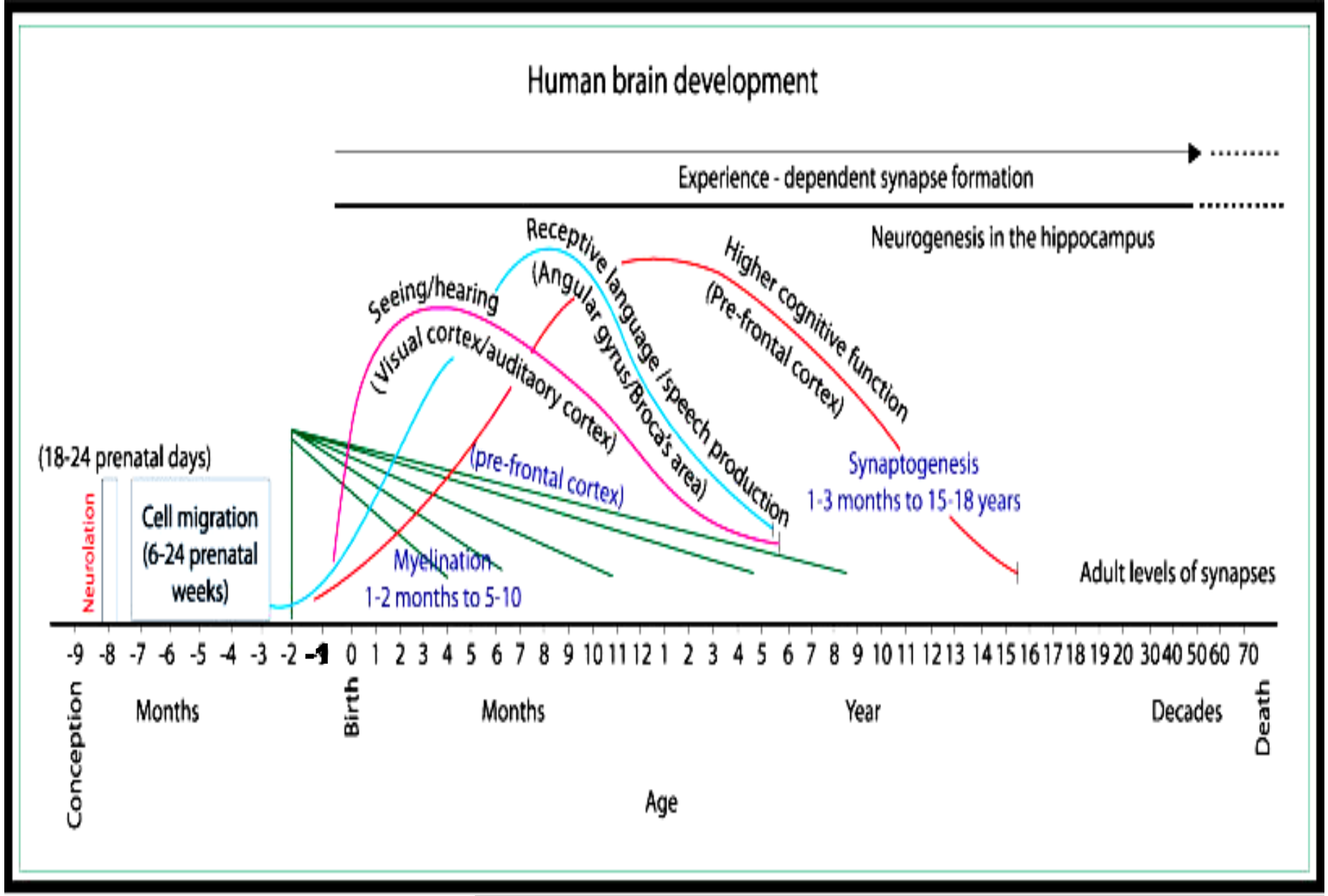
I should watch and wait. I must not upset the parents

I can make the referrals now and I trust my colleagues to do the talking

- Cerebral palsy is an evolving diagnosis
- Early intervention is the rule
- However aggressive intervention at any stage can improve the outcomes

Why should intervention take place early?

- Brain development takes place maximally at a defined time frame
- New learning needs to coincide this for optimal results

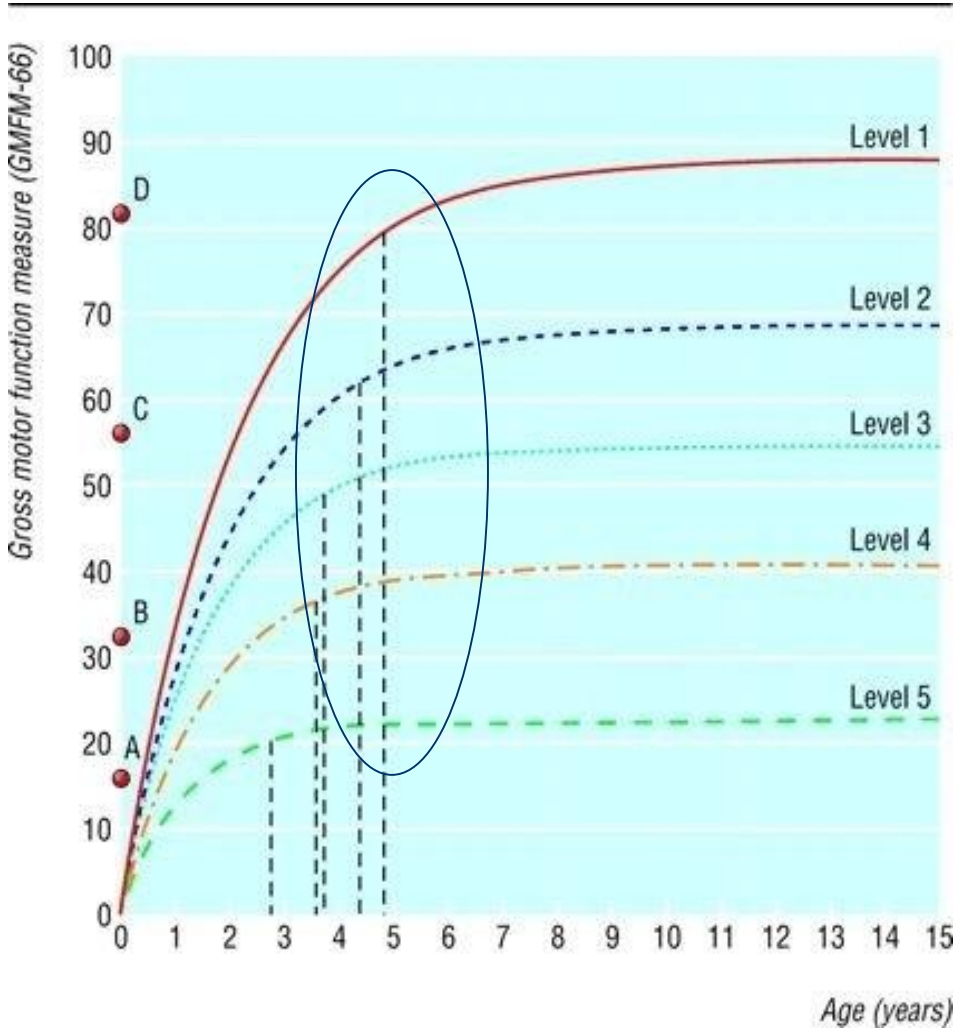


Thompson RA, Nelson CA. Developmental science and the media: early brain development. *Am Psychol 2001;* ***56: 5–15***

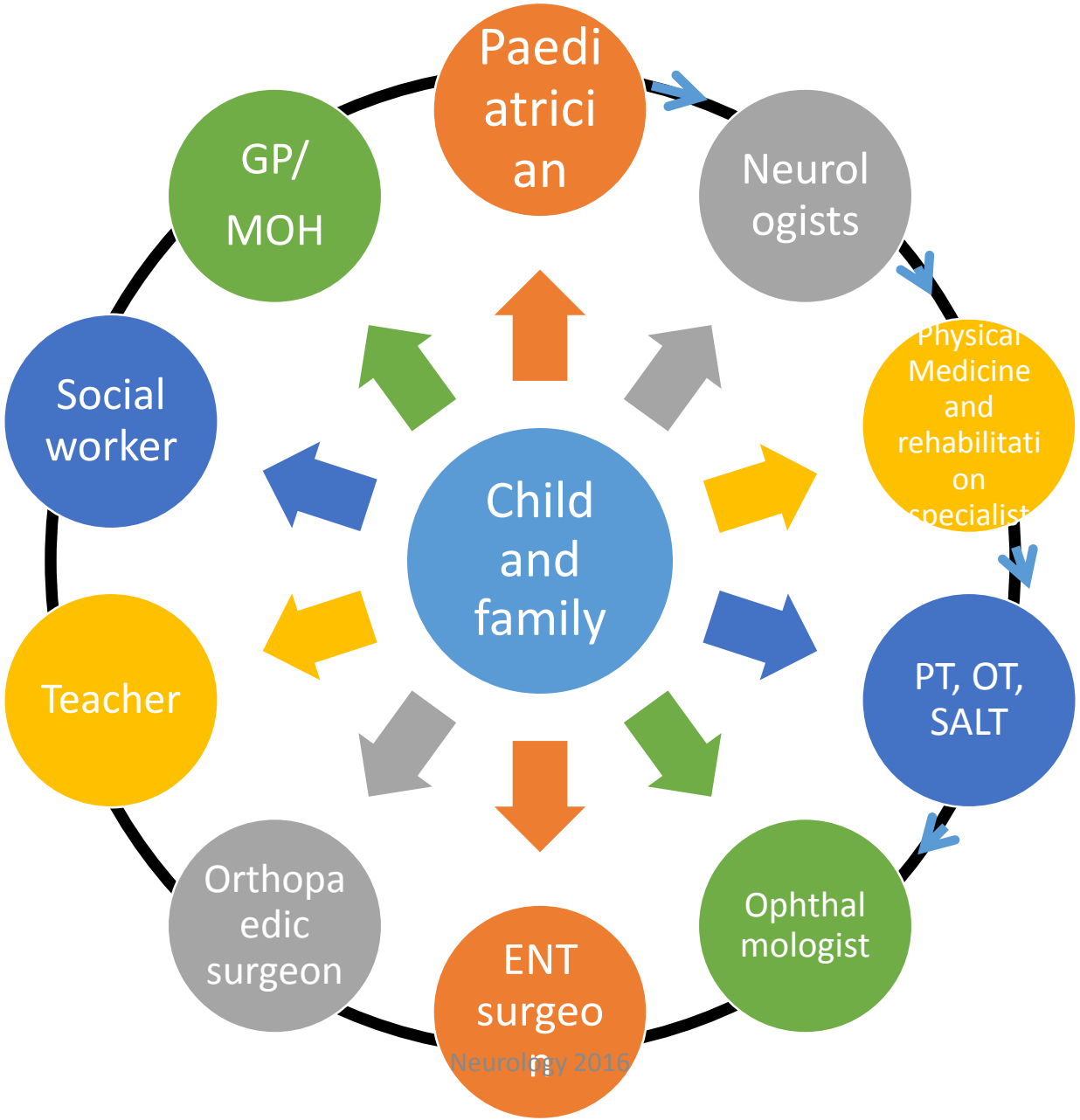
Developing Gross Motor Ability

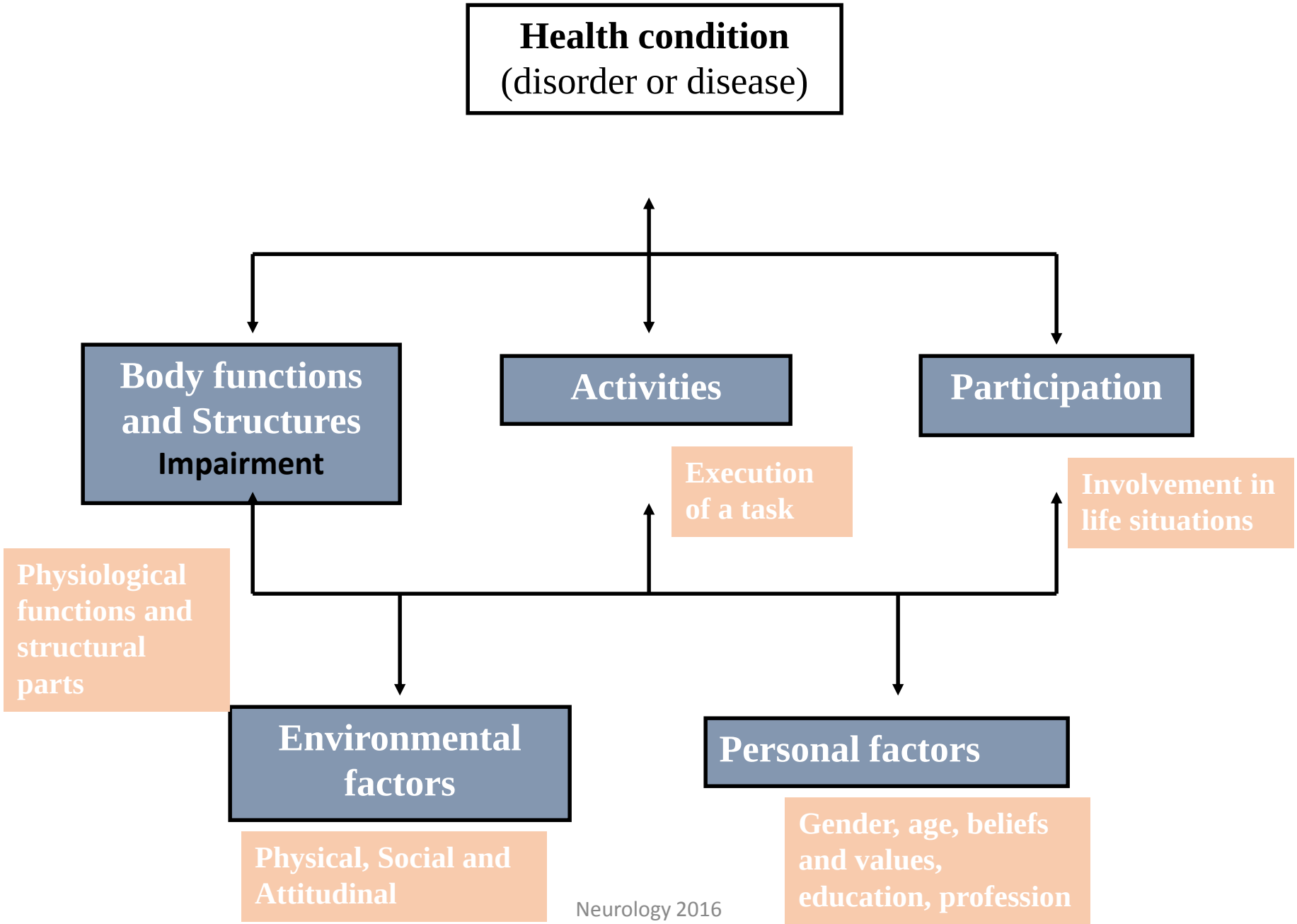
- Repeat Gross Motor Function Measures over time
- Total 2632 assessments in 657 children

- A= Lift and maintain head posture in supported sitting
- B= Sit unsupported
- C= Walk 10 steps
- D= Walk down 4 steps unsupported
- Vertical dotted lines indicate achievement of 90% of motor skills



Multidisciplinary care




Health condition
(disorder or disease)
Body functions and Structures
Impairment
Activities
Participation
Execution of a task
Involvement in life situations
Physiological functions and structural parts
Environmental factors
Physical, Social and Attitudinal
Personal factors
Gender, age, beliefs and values, education, profession

Aims of management

- Optimise activity and participation of child
- Address the needs of the child and the family
- Awareness on objective measures in CP

Total child

- Gross motor skills
- Visual stimulation: cortico visual impairment
- Hand skills
- Cognitive skills
- Language development
- Attention and behaviour reinforcement

Activities of Daily Living

- Dressing
- Feeding
- Toileting
- etc

Principles in providing rehabilitation

- Arrive at a definitive diagnosis and a classification for directed treatment strategies
  - Drugs
  - Therapies
  - Assess levels of functionality : CLASSIFY

NEED TO WORK WITH A TEAM

- A tentative diagnosis can lead to general interventions
- Pre and post intervention OBJECTIVE ASSESSMENTS a must: Use specified assessment tools

Gross motor function

- Muscle tone
- Power
- Balance and coordination
- Reflexes

Movement
Posture
Motor skills

Gross Motor Function Assessment

- GMFM (GMF measure)
  - Video assessment
  - Break down a skill and score it

Assessing function in the upper limb

- Manual Ability Classification System (MACS)
- Robust classification of hand function in children with cerebral palsy
- Looks at child's usual ability in handling everyday objects rather than best ability
- Can be used for children age 4-18 years
- GMFCS hand "equivalent"
- Stable over time

MACS

What do you need to know to use MACS?

The child's ability to handle objects in important daily activities, for example during play and leisure, eating and dressing.

In which situation is the child independent and to what extent do they need support and adaptation?

I. **Handles objects easily and successfully.** At most, limitations in the ease of performing manual tasks requiring speed and accuracy. However, any limitations in manual abilities do not restrict independence in daily activities.

II. **Handles most objects but with somewhat reduced quality and/or speed of achievement.** Certain activities may be avoided or be achieved with some difficulty; alternative ways of performance might be used but manual abilities do not usually restrict independence in daily activities.

III. **Handles objects with difficulty; needs help to prepare and/or modify activities.** The performance is slow and achieved with limited success regarding quality and quantity. Activities are performed independently if they have been set up or adapted.

IV. **Handles a limited selection of easily managed objects in adapted situations.** Performs parts of activities with effort and with limited success. Requires continuous support and assistance and/or adapted equipment, for even partial achievement of the activity.

V. **Does not handle objects and has severely limited ability to perform even simple actions.** Requires total assistance.

Distinctions between Levels I and II

Children in Level I may have limitations in handling very small, heavy or fragile objects which demand detailed fine motor control, or efficient coordination between hands. Limitations may also involve performance in new and unfamiliar situations. Children in Level II perform almost the same activities as children in Level I but the quality of performance is decreased, or the performance is slower. Functional differences between hands can limit effectiveness of performance. Children in Level II commonly try to simplify handling of objects, for example by using a surface for support instead of handling objects with both hands.

Distinctions between Levels II and III

Children in Level II handle most objects, although slowly or with reduced quality of performance. Children in Level III commonly need help to prepare the activity and/or require adjustments to be made to the environment since their ability to reach or handle objects is limited. They cannot perform certain activities and their degree of independence is related to the supportiveness of the environmental context.

Distinctions between Levels III and IV

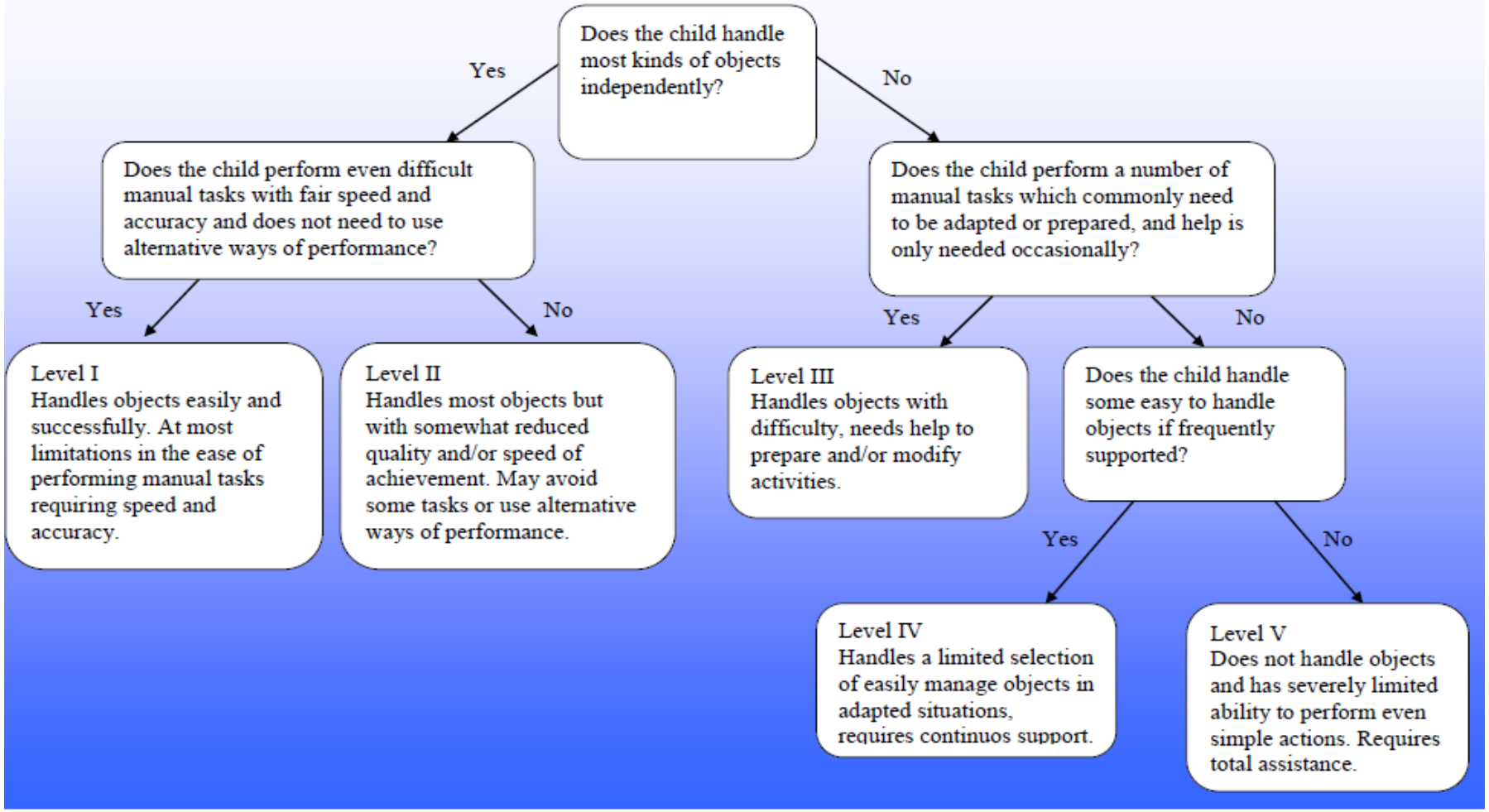
Children in Level III can perform selected activities if the situation is prearranged and if they get supervision and plenty of time. Children in Level IV need continuous help during the activity and can at best participate meaningfully in only parts of an activity.

Distinctions between Levels IV and V

Children in Level IV perform part of an activity, however, they need help continuously. Children in Level V might at best participate with a simple movement in special situations, e.g. by pushing a button or occasionally hold undemanding objects.

Supplementary MACS level identification chart

To be used together with the MACS leaflet



MACS 1

- Handles objects easily
- Some difficulty with tasks requiring speed and accuracy
- Independent in daily activities

MACS 2

- Handles most objects: reduced quality and speed
- Alternative ways of performing
- Does not limit most activities of daily living

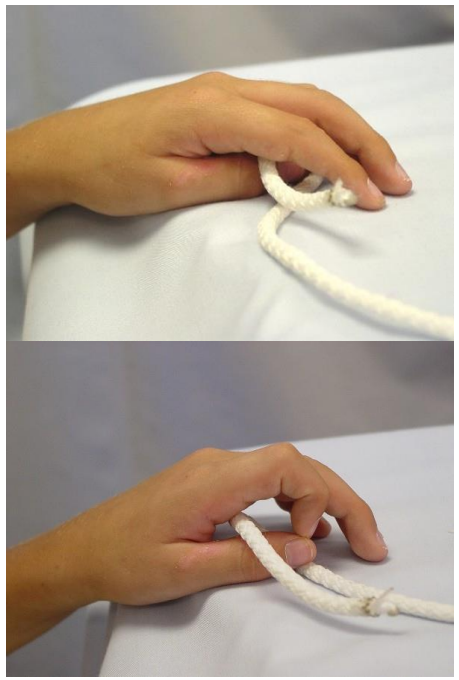
MACS 4

- Handles limited selection of objects with adaptations
- Requires continuous support for even partial achievement
- Video - MD 2 years post ITB UL

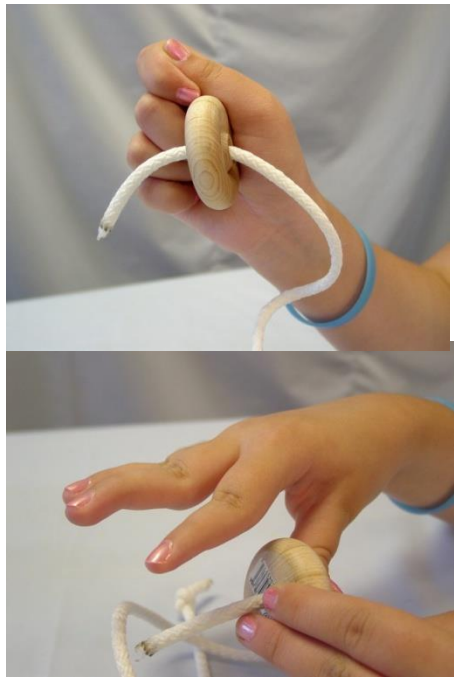
MACS 3

- Handles objects with difficulty
- Performance slow and limited success
- Needs help to prepare and/or modify

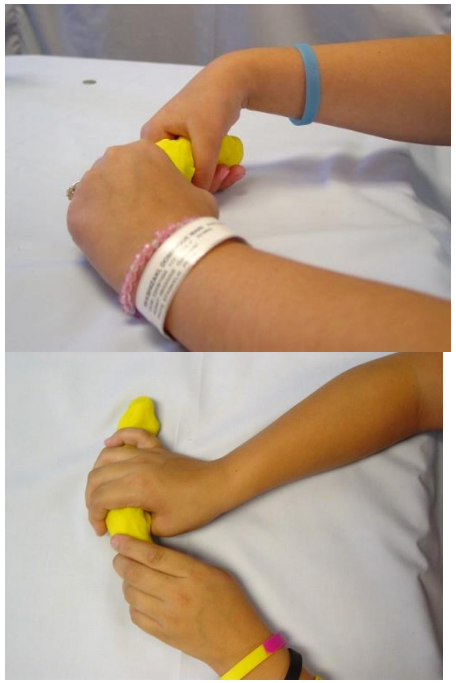
Hand skills Assessment tool



Thumb



Fingers



Wrist and hand

- Function analysis
- Grasp and release
- Constraint induced movements
- Activities of daily living
- MACS

Shriners Hospital upper extremity evaluation. Peace and Wagner 2011.

Language

- Receptive and expressive
- Introduction of objects, verbs, colours
- Clear simple phrases
- Concrete examples: play based
- Use of communicative augmentative devices

Children with cerebral palsy are locked in their motor disability

Communication Function CFCS

- Levels 1- 5

Cognitive

- Sensory integration
- Required for overall functioning

Orthotic Treatment Goals

- To Correct or Prevent Deformity
- To Provide a Base of Support
- To Facilitate Training in Skills
- To Improve Efficiency in Gait

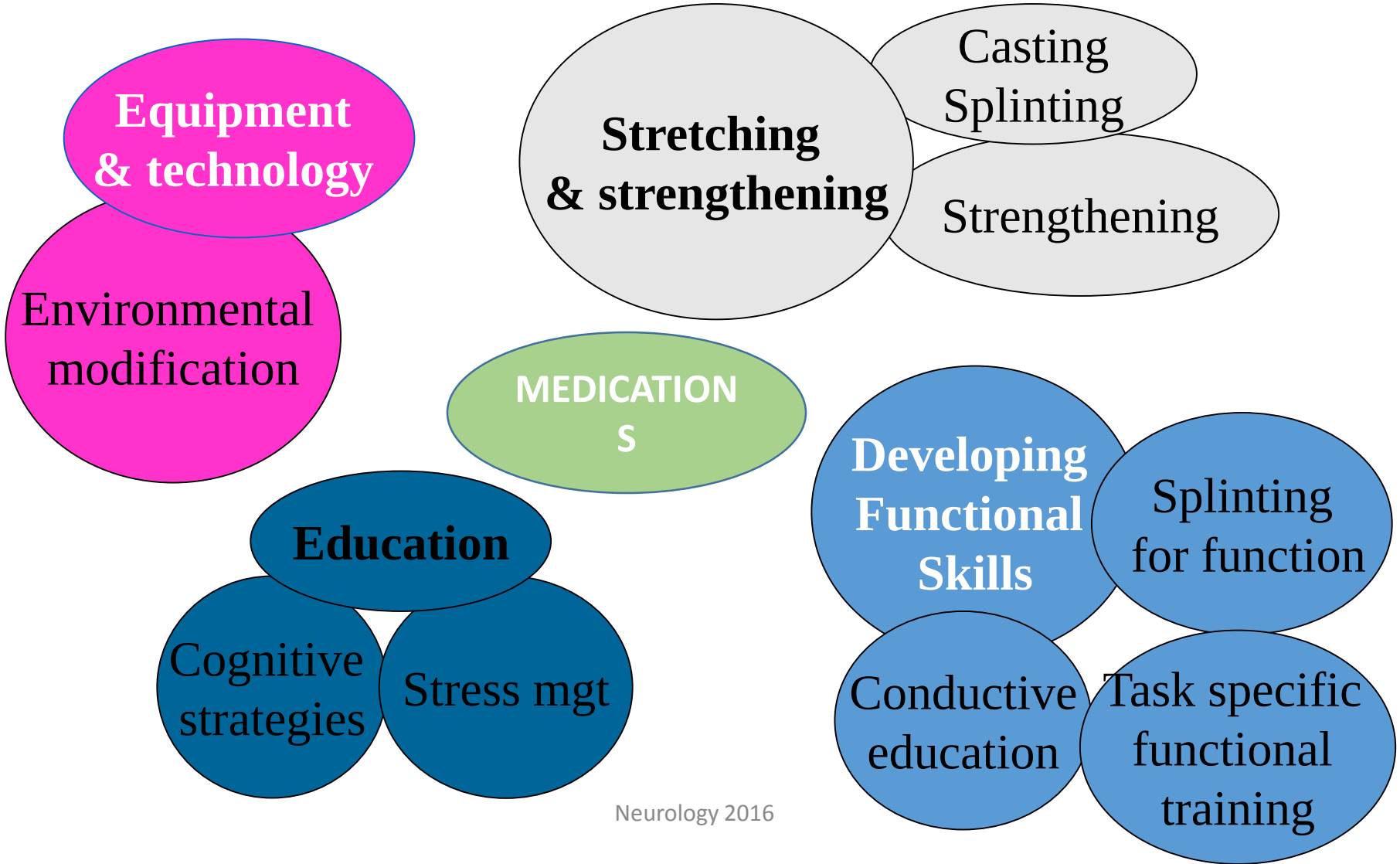
Visual stimulation: Cortico visual impairment

- Bright colourful lights
- With movement
- Latency to focus

General interventions: Designing a simple intervention plan

- Awareness about the child development sequence
- Awareness about the rehabilitation basics
  - Play based
  - Consistent
  - Regular
  - Cheap and abundant material
- Stimulation

Therapy Strategies Available



Medications

- Spasticity: Baclofen
- Dystonia: Benzhexol and Levodopa
- Botulinum toxin

- Need to start at the earliest stage for best intervention results

Continuous care

Acute management

Co-morbidities

- Epilepsy
- Visual impairment
- Hearing impairment
- Drooling
- GORD
- Constipation
- Behaviour issues

Complications

- Muscular skeletal
  - Hip dislocation
  - Bone fractures
  - Contractures
- Gastrointestinal
  - Poor dental hygeine
  - Dysphagia
  - Constipation
- Respiratory
  - Recurrent aspiration pnuemonia
- Genitourinary
  - UTI
- Dermatological
  - Pressure sores
  - Infestations

Reasons for acute presentation with excessive crying , increased spasticity

As the child grows

- Medical
- Health
- Nutrition
- Immunization

- Regular follow up of children
- Prescribe medications
- Ensure they follow the rehab plan
- Look for evolving co-morbidities/ complications: Hip surveillance
- Look for new health and related complications

Address these or refer for appropriate services

Commonly prescribed medicines

- Anti epileptics
- GORD medications
- Inhalers for wheezing
- Medications for spasticity and dystonia
- Local applicants for skin infestations
- Anti drooling
- Sedatives
- Antibiotics

Contiuous care

Long term management

- Education
  - An educational assessment
  - Awareness of service availability
  - Letters to the authorities with recommendations for environmental and teaching methodology adaptations
- Social welfare
  - Aides
  - Environmental modifications
- Supported employement
- Advocacy

Thank you

Questions?

Comments?

Summary

CP is a disorder in the motor system due to an insult to the developing brain

It is a complex and an evolving condition

Can be diagnosed as early as 5 months of age

Needs a team for management

https://www.gillettechildrens.org/uploads/care-and-conditions/CP_Roadmap.pdf