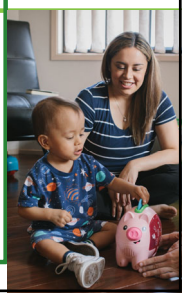
Cerebral Palsy ALLIANCE

THE UNIVERSITY OF SYDNEY

COGNITION IN INFANTS WITH CEREBRAL PALSY: EVIDENCE BASED ASSESSMENT AND TREATMENT

Dr Cathy Morgan
Senior Research Fellow



QUESTIONS

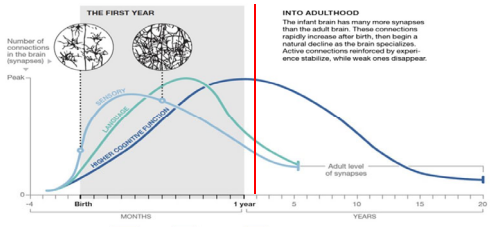
Can you really reliably assess children with CP at a really young age?

So is it "too late" to assess children with CP cognitively at a later age? Do you sort of miss some window of opportunity to intervene?

2

THE NEURAL NETWORK

The brain begins developing in the womb and achieves dramatic levels of growth during the first few years of life. During this time positive experiences contribute to building a strong brain architecture.



Over time, a child acquires increasingly complex skills

Vision
Hearing
Touch

Symbols, ideas
Social relationships
Talking

Critical thinking
Reflective thinking
Considered response

GRAPHIC: LAWSON PARKER, NOM STAFF. SOURCE: CHARLES NELSON, HARVARD MEDICAL SCHOOL; PAT LEVITT, CHILDREN'S HOSPITAL, LOS ANGELES
SYNAPSE DRAWINGS BASED ON GOLGI STAIN PREPARATIONS FROM CONEL (1939–1967)

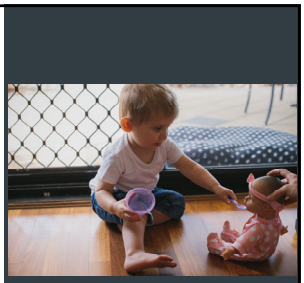
3

THE GOLD STANDARD

Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants (Review)

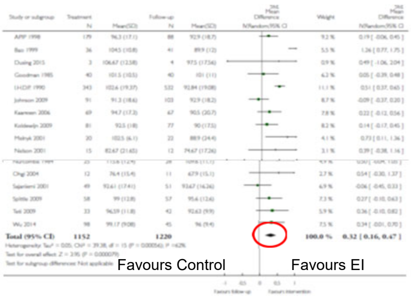
Spittle A, Orton J, Anderson PJ, Boyd R, Doyle LW

THE COCHRANE COLLABORATION®

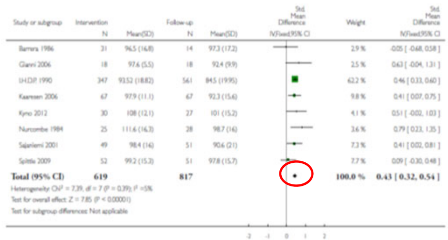


4

COGNITIVE OUTCOMES - Infancy



COGNITIVE OUTCOMES- preschool



EVIDENCE OF NEUROPLASTICITY FROM EXPERIENCE DEPENDENT INTERVENTIONS

Reviews/Mini-Reviews

CLINICAL and TRANSLATIONAL NEUROSCIENCE

Neuroplasticity in children and adolescents in response to treatment intervention: A systematic review of the literature

Lisa L Weyandt[1], Christine M Clarkin[2,3], Emily Z Holding[4], Shannon E May[3], Marisa E Marraccini[4], Bergljot Gyda Gudmundsdottir[5], Emily Shepard[4], and Lauren Thompson[3]

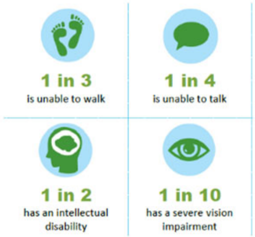
SAGE

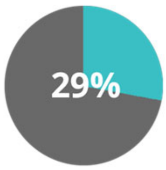
7

EARLY DETECTION AND EARLY INTERVENTION SUMMIT 2014

- Hduo|#Ghwhfwlrq#ri#FS
- Hduo|#Lqwhuyhqwlrq#lq#FS
- Hduo|#Dvvhvvphqw#lq#FS

COGNITION IN CP



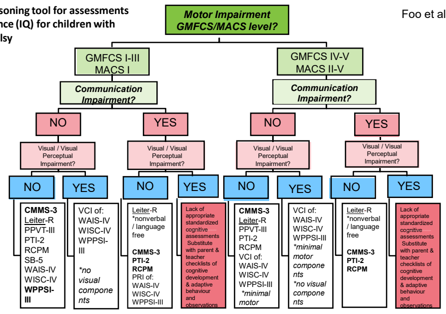


....cannot use standardised assessments of cognition

Sherwell et al 2014

Clinical reasoning tool for assessments of intelligence (IQ) for children with cerebral palsy

Foo et al, 2012

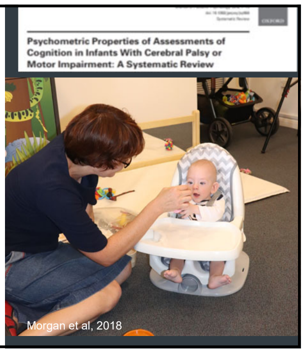


UHDVRQV#IRU#DVVHVVPHQJ Ÿ

Glvfulplqdwlrq	Suhglfwlrq	Rxwfrph# Phdvxuhphqw
Gldjqrvh 2ghvfuleh	Suhglfw# uhfryhu|#2# srwhqwldo	Hydoxdwh# wuhdwphqw# hiihfw

AIMS

- Identify appropriate or low motor/motor free cognitive assessments for infants less than 2-years of age, with CP or motor impairment
- Evaluate the clinimetric properties of these assessments
- Make recommendations about which of these tools are appropriate for discriminative, predictive and evaluative purposes.



Morgan et al, 2018

UHVHDUFK#TXHVWLRQ

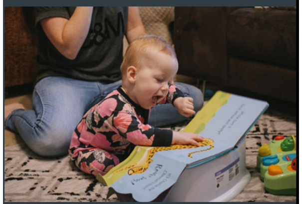
What are the most valid, reliable and sensitive to change measures of cognitive function in infants with/at high risk of cerebral palsy?

SRSXODWLRQ: infants aged 0-2 with or at risk of motor impairment

LQWHUYHQWLRQ: assessments of cognition (*based on original search*)

FRPSDULVRQ -none

RXWFRPH#clinimetric properties



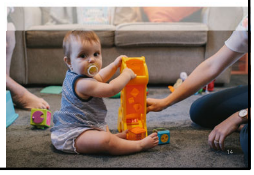
STUDY SELECTION

Inclusion criteria:

- ✓ Mean age <24 mths
- ✓ ≥ 50% sample had motor impairment
- ✓ Cognition assessed
- ✓ ≥ 1 psychometric property evaluated
- ✓ Motor free/low motor assessments of any cohort

Exclusion criteria:

- ✗ Full text unavailable
- ✗ Cross cultural validity only
- ✗ Languages other than English
- ✗ Out dated versions of assessments were used



RATING QUALITY & MAKING RECOMMENDATIONS

FRVPLQ=

FRqvhqvxv0edvhg#
Vwdqgdugv#iru#wkh#
vhohfwlrq#ri#khdowk#
Phdvxuhphqw#
LQvwuxphqwv1

JUDGH=

Wkh#Judglqj#ri#
Uhfrpphqgdwlrqv#
Dvvhvvphqw#
Ghyhorsphqw#dqg#
Hydoxdwlrq

UHVXOWV##IORZ#GLDJUDP

- 3339 potential studies identified of 26 assessments → 3289 excluded after screening titles and abstracts
- Full text evaluation of 50 relevant papers → 35 excluded after full text review
- 5 included after hand searches
- 20 papers included in review
- 9 assessments with relevant data

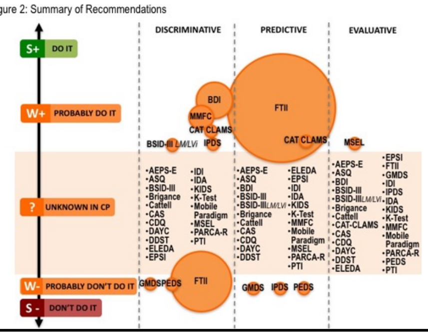
RESULTS:

TEST	PARTICIPANTS	PSYCHOMETRICS ASSESSED	
EDWHOOH 6#vwxglhv	q@732#q@632#q@9: Prwru#.20vhqvru|#lp sdlup hqw	Validity	POOR-FAIR
		Uhddeldw|	SRRU
FDW2FODPV 5#vwxglhv	q@762#q@76 Prwru#2FS	Yddglw|	IDLU
Julilwkv 4#vwxg|	q@;3#53#xqhvwdeo, Hqfhskdorsdwk|2FS	Yddglw|	JRRG
ISGV 5#vwxglhv	q@;<2#q@5: FS2##Prwru#lp sdlup hqw	Yddglw|	SRRU0IDLU
PXOOHQV 4#vwxg|	q@#67# +q@4:#p rwru#ghod|hg,	Uhvsrqvlyhqhvv	SRRU
SHGV 4#vwxg|	q@44< OEZ dqg#p l{hg#glvdeldw|	Yddglw|	SRRU

LOW MOTOR/MOTOR FREE ASSESSMENTS

TEST	PARTICIPANTS	PSYCHOMETRICS	
Low Mot/Vi BSID-III 1 study	N=104 TD +Motor +/- sensory impairment	Validity (Concurrent with BSID-III)	EXCELLENT
FAGAN 7 studies	N= 18-196 Mixed TD and High risk	Validity Reliability	POOR-GOOD POOR
Mayes Motor Free Compilation 2 studies	n=34/ n=50 Typically developing	Validity (concurrent with BSID-II)	FAIR-GOOD

Figure 2: Summary of Recommendations



Low level of evidence

Inconsistency of results

Weak recommendations

UHFR P P HQ GDWLR Q V

CONDITIONAL +

1. It is important to understand if an infant with CP has a cognitive impairment in order to inform intervention plans.
2. The choice of assessment of cognition for infants 0-2 with CP should be made with the purpose of the test in mind (discrimination, prediction or evaluation) and after assessment of the child's motor ability.
3. Children with impaired upper limb function should be tested on a low motor or motor free assessment such as the Mayes Motor-Free Compilation or the Low Motor/Vision version of the BSID-III.

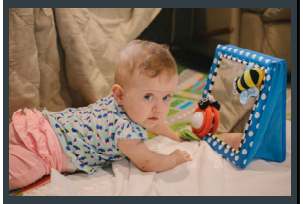
21

UHFR P P HQ GDWLR Q V

CONDITIONAL +

4. The CAT-CLAMS and the Fagan Test of Infant Intelligence have the highest sensitivity for predicting a later cognitive impairment in infants with a motor impairment

5. When evaluating the effects of intervention, only the Mullens Scales of Early Learning has evidence for responsiveness in infants with motor impairment



22

QUESTIONS

What's the recommendation for cognitive assessments for children with CP in Australia? Do you have national guidelines?

23

FUTURE DIRECTIONS

Low Motor Bayley Study

- Validate the translation of BSID-III LM/LVVi from Dutch to English.
- Compare how children with Mini MACS scores of 2-5 perform on the cognitive and language domains of the LM/LVVi BSID-III compared to the standard BSID-III.
- Look at administrator experience of conducting the LM/LVVi BSID-III compared to the standard BSID-III with children with reduced manual abilities.

24

HDUO\ FRJQLWLYH# LQWHUYHQWLRQV

What is the effectiveness of early intervention for improving the cognitive skills of infants (0-2 years old) with/at high risk of cerebral palsy?

JAMA Pediatrics | Review
Early Intervention for Children Aged 0 to 2 Years With or at High Risk of Cerebral Palsy
International Clinical Practice Guideline Based on Systematic Reviews

FRFKUDQH#ULVN#RI#ELDV##44UFWv

Reference	Random Sequence generation	Allocation Concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data addressed	Free of selective reporting	Free of Other bias
Reddihough et al (1998)	U	H	H	H	H	H	H
Ohgi et al (2004)	U	L	H	L	L	L	L
Morgan et al (2016)	L	L	U	L	L	L	L
Blauw-Hospers et al (2011)	H	H	H	L	H	H	U
Badr et al (2006)	L	H	H	L	H	H	H
Palmer et al (1988, 1990)	H	H	H	L	L	L	L
Mayo (1991)	L	U	U	L	U	H	H
Nelson et al (2000)	H	U	U	L	U	H	H
Weindling et al (1996)	L	L	L	L	H	U	U
Harbourne et al (2019)	L	L	H	L	L	L	H
Hielkema et al (2019)	L	U	H	L	L	L	U

BEST PRACTICE PRINCIPLES

1. Immediate referral for intervention after "high risk" diagnosis
2. Parent-set goals that are task specific, with appropriate level of challenge
3. Build parental capacity for attachment & expertise

RECOMMENDATION

Targeted cognitive interventions:

- self-generated movements with consequences
- social interaction
- multi-modal
- parent participation
- early years enrichment

Strong Recommendation (For) Cognitive Intervention

RECOMMENDATION

Generic Developmental Education Alone &/or Sole Focus on Passive Movement

E.g. NDT, handling, postural reactions for cognitive development

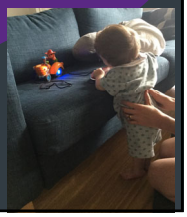
Conditional Recommendation (Against)

HOW WE WORK….

- Very few psychologists working in CP
- All babies under 2 have cognitive assessments…despite the limitations of the tests
- mMACS I –III use regular tests with accommodations as required
- mMACS IV-V more difficult
- All therapists work to embed cognitive skills in therapy based on goals and via play
- mMACS IV-V very early use of technology eg switching

In Sweden, many neuropsychologists spend a lot of time working with kids with neuropsychiatric diagnoses such as autism and ADHD, leaving less time for kids with CP. What is it like in Australia/your clinic?

- Are psychologists part of the multidisciplinary team that cares for kids with CP? Is that the norm?



D FNQ R Z OHGJ HP HQ WV

ASSESSMENT	INTERVENTION
Dr Ingrid Honan	Dr Stacey Dusing
Ms Abigail Allsop	Dr Reggie Harbourne
Prof Iona Novak	Prof Linda Fetters
Prof Nadia Badawi	