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Interventions and Management

1. *Dev Med Child Neurol.* 2015 Apr;57 Suppl 2:37-41. doi: 10.1111/dmcn.12684.

What assessments evaluate use of hands in infants? A literature review.

Krumlinde-Sundholm L1, Ek L, Eliasson AC.

AIM: To identify assessments, applicable to infants aged 3 months to 12 months, measuring hand function, and to discuss their usefulness in assessing infants at risk of developing unilateral cerebral palsy (CP). **METHOD:** Instruments described in two previous systematic reviews were scrutinized for inclusion of fine motor components. Additionally, a new literature search was performed in Medline, PsychInfo, PubMed, and Cinahl (2007-2013) to identify newly developed assessments of infant motor functioning. **RESULTS:** Five assessments from the two previous systematic reviews included fine motor components but only three provided separate measures of fine motor performance: the Peabody Developmental Motor Scales - version 2 (PDMS-2), the Bayley Scale of Infant and Toddler Development - version III, and the Posture and Fine Motor Assessment of Infants, each of which provided measures of the preferred hand only. From 531 papers retrieved, 10 new assessments were found, three of which met our inclusion criteria: the Infant Motor Profile (IMP), the Grasping and Reaching Assessment of Brisbane (GRAB), and the Hand Assessment for Infants (HAI). Only the GRAB and the HAI provide measures relevant for assessing infants at risk of developing unilateral cerebral palsy; however, both measures are still under construction. **INTERPRETATION:** No currently available assessment for infants aged 3 to 12 months old measures aspects of hand function suitable for quantifying asymmetry between hands or quality of bimanual performance.

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2. *Beijing Da Xue Xue Bao.* 2015 Feb 18;47(1):160-4.

Complications of selective posterior rhizotomy for lower limb spasticity of cerebral palsy [Article in Chinese]

Shao X1, Yu YB1, Zhang L1, Xu XL1, Xu J1, Liu J1, Liu HJ1, Yang WQ1.

OBJECTIVE: To investigate the complications of spastic cerebral palsy with selective posterior rhizotomy (SPR). **METHODS:** In the study, 2 593 patients who had undergone SPR from January 2000 to September 2012 were followed-up for at least one year. The complications were classified. **RESULTS:** Peri-operative complications: pulmonary system complications including bronchial spasm (5 cases, 0.19%) and aspiration pneumonia (4 cases,

0.15%); digestive system complications including abdominal bloating (145 cases, 5.6%) and colic (80 cases, 3.1%); urinary system complications including temporary bladder dysfunction (54 cases, 2.1%) and urinary tract infection (6 cases, 0.23%); peripheral nervous system complications including lower extremity weakness (327 cases, 12.6%) and lower extremity sensory disturbances (140 cases, 5.4%); central nervous system complications including headache (112 cases, 4.3%) and epileptic seizures (4 cases, 0.15%). None spinal or intracranial infection, intraspinal hematoma or intracranial hemorrhage were identified. General surgery complications including back pain (1 382 cases, 53.3%), delay wound healing caused by infection (5 cases, 0.19%) and cerebrospinal fluid leakage (8 cases, 0.31%). Long-term follow-up complications including lower limb decreased exercise capacity (incidence: 7.33%) and lower extremity sensory disturbance (incidence: 5.59%). Urination occurred in only one case and defecation function disturbance with no sexual dysfunction was identified. The incidences of scoliosis, thoracic kyphosis, spondylolisthesis and long-term back pain were 7.23% (31/429), 4.2% (18/429), 10.49% (45/429) and 9.72% respectively. **CONCLUSION:** SPR is one of the effective and safe surgical treatments for spastic cerebral palsy. Valid methods should be applied to reduce the incidence of postoperative complications, such as choosing the appropriate patients, meticulously operating in the surgery, assistance of electrophysiological guidance, reinforcing perioperative management and regular rehabilitation training after operation.

[PMID: 25686349](#) [PubMed - in process] Free full text

3. Gait Posture. 2015 Feb 3. pii: S0966-6362(15)00025-9. doi: 10.1016/j.gaitpost.2015.01.022. [Epub ahead of print]

The relationship between the Edinburgh Visual Gait Score, the Gait Profile Score and GMFCS levels I-III.

Robinson LW1, Clement N2, Fullarton M1, Richardson A3, Herman J3, Henderson G3, Robb JE3, Gaston MS4.

OBJECTIVE: To determine the relationship between the Edinburgh Visual Gait Score (EVGS) and the Gait Profile Score (GPS). **METHOD:** Three dimensional gait data and EVGS scores from 151 diplegic children (Gross Motor Function Classification System (GMFCS) levels I-III) were used for analysis. **RESULTS:** The EVGS correlated strongly with GPS ($r=0.816$). There was a significant difference in both gait scores between each level of the GMFCS. **CONCLUSIONS:** The strong correlation of GPS with EVGS implies that any advantages of using GPS can also be applied to centres without 3-dimensional gait analysis facilities if the EVGS is used.

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4. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:42-5. doi: 10.1111/dmcn.12686.

Activating the motor system through action observation: is this an efficient approach in adults and children?

Bassolino M1, Sandini G, Pozzo T.

Observing an action performed by another person to learn a new movement is a frequent experience in adult daily life, such as in sports. However, it is an especially common circumstance during the development of motor skills in childhood. Studies on healthy humans indicate that action observation induces a facilitation in the observer's motor system. This effect is supported by an action-perception matching mechanism available both in adults and in children. Because of the simplicity of action observation, it has been proposed to apply this method in clinical contexts. After a brief, non-exhaustive introduction of the essential features underlying action observation in healthy people, we review recent studies reporting beneficial effects of rehabilitative training based on a combination of action perception and execution. We focus on therapeutic interventions for patients with upper-limb motor disabilities such as adults after stroke or children with hemiplegia due to cerebral palsy. Further, we consider data from basic science demonstrating that the facilitation induced by visual perception of the action can be modulated by the combination of multimodal stimuli related to the movement (e.g. visual and acoustic action-related inputs). In line with this, we discuss possible new directions to improve basic knowledge and therapeutic applications of action observation.

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5. Ortop Traumatol Rehabil. 2014 Dec 29;16(6):581-93. doi: 10.5604/15093492.1135048.

Influence of neurophysiological hippotherapy on the transference of the centre of gravity among children with cerebral palsy.

Macków A1, Malachowska-Sobieska M1, Demczuk-Włodarczyk E1, Sidorowska M1, Szklarska A2, Lipowicz A2.

Background. The aim of the study was to present the influence of neurophysiological hippotherapy on the transference of the centre of gravity (COG) among children with cerebral palsy (CP). Material and methods. The study involved 19 children aged 4-13 years suffering from CP who demonstrated an asymmetric (A/P) model of compensation. Body balance was studied with the Cosmogamma Balance Platform. An examination on this platform was performed before and after a session of neurophysiological hippotherapy. In order to compare the correlations and differences between the examinations, the results were analysed using Student's T-test for dependent samples at $p = 0.05$ as the level of statistical significance and descriptive statistics were calculated. Results. The mean value of the body's centre of gravity in the frontal plane (COG X) was 18.33 (mm) during the first examination, changing by 21.84 (mm) after neurophysiological hippotherapy towards deloading of the antigravity lower limb ($p = 0.0001$). The other stabilographic parameters increased; however, only the change in average speed of antero - posterior COG oscillation was statistically significant ($p = 0.0354$). CONCLUSION: 1. One session of neurophysiological hippotherapy induced statistically significant changes in the position of the centre of gravity in the body in the frontal plane and the average speed of COG oscillation in the sagittal plane among CP children demonstrating an asymmetric model of compensation (A/P).

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6. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:31-6. doi: 10.1111/dmcn.12685.

Cognitive strategies for locomotor navigation in normal development and cerebral palsy.

Belmonti V1, Fiori S, Guzzetta A, Cioni G, Berthoz A.

Visual-spatial impairment is a fundamental disorder in cerebral palsy (CP). However, current spatial testing is restricted to reaching space, whereas navigational space is seldom assessed. The Magic Carpet test, derived from the Corsi Block-tapping Task (CBT) for visual-spatial memory, is a new developmental test for navigation. The performances of the Magic Carpet test and CBT were assessed in 17 children with unilateral and bilateral spastic CP. The results were compared with an equal number of typically developing children, matched for age and sex. Magnetic resonance imaging scans of children with CP were scored according to a newly validated semi-quantitative classification. CBT span was significantly lower in CP, especially in bilateral forms, than in the comparison group, whereas the Magic Carpet test span did not significantly differ between the groups. CBT span, but not the Magic Carpet span, was related to gestational age at birth and to basic visual function. Both the CBT span and the Magic Carpet test were related to overall right-hemispheric impairment. In addition, CBT correlated with right periventricular impairment. In CP, navigation is differently impaired than visual spatial memory, and less tightly related to preterm birth, basic visual function, and deep white matter injury. The exploration of navigational space could prove useful in enhancing spatial representation and reference-frame manipulation in CP.

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7. *Pediatr Phys Ther.* 2015 Feb 18. [Epub ahead of print]**Promoting Self-exploration and Function Through an Individualized Power Mobility Training Program.**

Kenyon LK1, Farris J, Brockway K, Hannum N, Proctor K.

PURPOSE: This case report describes the development and implementation of an intervention program that used a Power Wheelchair Trainer (Trainer) to enable an individual with severe impairments to participate in power mobility training. **CASE DESCRIPTION:** The participant was an 18 year-old female with spastic quadriplegic cerebral palsy, Gross Motor Function Classification Level V. The examination included the Power Mobility Screen and the Caregiver Priorities & Child Health Index of Life with Disabilities (CPCHILD). Switches on the participant's headrest provided control of the Trainer. Intervention consisted of power mobility training in an engaging environment that was set-up to focus on specific power mobility skills. **RESULTS:** Scores on the Power Mobility Screen and the CPOCHILD were higher after intervention. **DISCUSSION:** The outcomes of this case report appear to support the use of the Trainer, which allowed the participant to practice power mobility skills and participate in self-exploration of her environment.

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8. *J Clin Invest.* 2015 Feb 17. pii: 80820. doi: 10.1172/JCI80820. [Epub ahead of print]**Spare hypoxia, spoil the child?**

Boehme J, Maltepe E.

Clinical vignette: An 8-year-old boy presents to the pediatric ICU after two days of cough with increasing secretions. The patient is progressing to respiratory failure and requires noninvasive mechanical ventilation. His past medical history is remarkable for premature birth at 25 and 6/7 weeks gestational age, cerebral palsy, developmental delay, epilepsy, and gastrostomy tube dependence. His chest x-ray is remarkable for multifocal opacities that are consistent with atelectasis. A complete blood count reveals a wbc count of 9.2 with a normal differential, Hg of 11.7, and platelet count of 276,000. A respiratory viral panel from a nasal swab returns positive for rhinovirus. Additional patient history from the parents uncovers that he has been hospitalized three times over the course of the past 2 years with a similar presentation.

[PMID: 25689257](#) [PubMed - as supplied by publisher]

9. *Dev Med Child Neurol.* 2015 Apr;57 Suppl 2:46-51. doi: 10.1111/dmcn.12687.**Visual-perceptual impairment in children with cerebral palsy: a systematic review.**

Ego A1, Lidzba K, Brovedani P, Belmonti V, Gonzalez-Monge S, Boudia B, Ritz A, Cans C.

AIM: Visual perception is one of the cognitive functions often impaired in children with cerebral palsy (CP). The aim of this systematic literature review was to assess the frequency of visual-perceptual impairment (VPI) and its relationship with patient characteristics. **METHOD:** Eligible studies were relevant papers assessing visual perception with five common standardized assessment instruments in children with CP published from January 1990 to August 2011. **RESULTS:** Of the 84 studies selected, 15 were retained. In children with CP, the proportion of VPI ranged from 40% to 50% and the mean visual perception quotient from 70 to 90. None of the studies reported a significant influence of CP subtype, IQ level, side of motor impairment, neuro-ophthalmological outcomes, or seizures. The severity of neuroradiological lesions seemed associated with VPI. The influence of prematurity was controversial, but a lower gestational age was more often associated with lower visual motor skills than with decreased visual-perceptual abilities. **INTERPRETATION:** The impairment of visual perception in children with CP should be considered a core disorder within the CP syndrome. Further research, including a more systematic approach to neuropsychological testing, is needed to explore the specific impact of CP subgroups and of neuroradiological features on visual-perceptual development.

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10. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:15-20. doi: 10.1111/dmcn.12690.

New paradigms and tests for evaluating and remediating visuospatial deficits in children.

Berthoz A1, Zaoui M.

This review suggests several hypotheses about the cognitive developmental mechanisms involved in the motor deficits of children with cerebral palsy. We suggest a new theory that visuospatial deficits involving the manipulation of multiple spatial reference frames are crucial components of the disorder in spatial orientation, manipulation, locomotion, navigation, and even social interactions. We review basic knowledge about the brain networks involved in spatial memory and cognition. We then present several potential paradigms for studying specific deficits. We consider first the use of vestibular signals for egocentric spatial orientation in children and the 'locomotor trajectory paradigm' for studying gaze anticipation and perceptual components of walking. We then describe new paradigms for studying egocentric and allocentric strategies in spatial tasks: the 'virtual path length', the 'virtual palace' and the 'virtual star maze'. We also consider paradigms involving the use of other persons and perspective change from a first person's to a third person's viewpoint as reference in spatial tasks or social interactions: the 'designation' paradigm, the 'harlequin', and the 'tightrope walker'. Finally, we briefly present a new experimental set up involving a 'virtual carpet', which follows previous studies of cognitive strategies for generating locomotor trajectories using the 'magic carpet' and which will allow a large variety of studies involving executive functions and inhibition of the first-appearing strategies during development. Several of these new paradigms could be used for remediation.

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11. Mater Sociomed. 2014 Dec;26(6):392-4. doi: 10.5455/msm.2014.26.392-394. Epub 2014 Dec 14.

Oral health status of children with disability living in Albania.

Gaçe E1, Kelmendi M2, Fusha E3.

INTRODUCTION: This study was carried out at nine (9) special schools for disabled children in Albania. The aim of the study is to determine the caries prevalence and oral hygiene status of children with different disabilities attending different schools for disabled at Albania. **METHODS:** Participants are grouped according disability Autistic Spectrum Disorder, Down syndrome, Cerebral Palsy, Mental Retarded, Blind, Deaf-Mute and age group (0-5, 6-10, 11-14, 15-18 years old children). Caries and oral health status were examined and assessed according WHO 1997 criteria. **RESULTS:** Overall caries prevalence at permanent dentition for all groups is 85.3% and for primary dentition 72%. The mean deft index is 3.4 ± 3.5 ($p=0.029$), mean DMFT= 4.9 ± 4.6 ($p=0.001$) with significance difference across type of disability (Kruskal-Wallis test) for both dentition. The mean OHI-S of total population is 1.91; there is significant difference across disability type ($p=0.001$, Anova test) for OHI-S index. In total 43.2 % have good, 49.4% fair and 7.4% bad oral hygiene. **CONCLUSIONS:** The subjects in this study had a high prevalence of dental caries, poor oral hygiene and need for restorative care.

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Prevention and Cure

12. BJOG. 2015 Feb 18. doi: 10.1111/1471-0528.13299. [Epub ahead of print]

Perinatal outcomes following an earlier post-term labour induction policy: a historical cohort study.

Hedegaard M1, Lidegaard Ø, Skovlund C, Mørch L, Hedegaard M.

OBJECTIVE: To assess the changes in perinatal outcomes in children born from 37 weeks of gestation after implementation of a more proactive labour induction practice from 2009. **DESIGN:** Register-based cohort study. **SETTING:** Denmark, 2000-12. **POPULATION:** Newborns from 37 weeks of gestation. **METHODS:** Perinatal outcomes were estimated using a logistic regression analysis with adjustment for gestational age, maternal age, parity, plurality, smoking and body mass index. **MAIN OUTCOME MEASURES:** Perinatal outcomes. **RESULTS:** A total of 770 926 infants were included. Labour induction from 37 weeks increased from 9.7% in 2000-02 to 22.5% in 2011-12. From 2003-05 to 2011-12, the risk of umbilical cord pH < 7.0 decreased by 23%; odds ratio (OR) 0.77 (95% confidence interval 0.67-0.89), and the adjusted OR of Apgar score < 7 at 5 minutes was unchanged. The risk of admission to neonatal intensive care units increased by 56%; OR 1.56 (1.47-1.66), whereas the risk of neonatal deaths decreased by 44%; OR 0.56 (0.45-0.70). The risk of cerebral palsy was from 2000-02 to 2009-10 reduced by 26%; OR 0.74 (0.60-0.90). The proportion of infants born with fetal weight = 4500 g decreased by one-third; OR 0.68 (0.65-0.71). However, the risk of shoulder dystocia increased by 32%; OR 1.32 (1.21-1.44), whereas the risk of peripheral nerve injuries was reduced by 43%; OR 0.57 (0.45-0.71). **CONCLUSION:** The results suggest an overall improvement in perinatal outcomes as a result of a more proactive post-term labour induction practice.

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13. Brain Dev. 2015 Feb 12. pii: S0387-7604(15)00025-X. doi: 10.1016/j.braindev.2015.01.009. [Epub ahead of print]

The neurological outcomes of cerebellar injury in premature infants.

Kobayashi S1, Wakusawa K2, Inui T2, Tanaka S3, Kobayashi Y4, Onuma A5, Haginoya K3.

AIM: Cerebellar injury is a characteristic injury associated with preterm infants. However, the impact of cerebellar injury on the development of preterm infants is unclear. **METHOD:** We reviewed magnetic resonance image studies of preterm infants with cerebral palsy retrospectively and evaluated the developmental outcomes. **RESULTS:** Cerebellar injury was recognized in 9 (2.4%) of 381 patients with cerebral palsy who were born preterm. The median gestational age was 26 (range 23-32) weeks and the median birth weight was 938 (range 492-1450) g. Seven of the nine patients had severe symmetric injuries to the inferior cerebellar hemispheres, resulting in a pancake-like appearance of the residual upper cerebellum. Supratentorial lesions were also recognized: periventricular leukomalacia in seven; atrophy of the basal ganglia in two; and intraventricular hemorrhage in two. Importantly, the motor dysfunction was related to the reduction in the white matter volume and severity of basal ganglia atrophy, but not to the cerebellar injury. Four of the nine patients could walk without limitations despite extensive cerebellar disruption. Only four patients could speak meaningful words during the study and only one spoke two-word sentences. **INTERPRETATION:** The patients with cerebellar injury might have a communication handicap, rather than altered motor function. Prematurity-related cerebellar complications require more attention in terms of cognitive and speech function, in addition to neuromotor development.

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14. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:52-4. doi: 10.1111/dmcn.12694.

Phenotypic plasticity and the perception-action-cognition-environment paradigm in neurodevelopmental genetic disorders.

Dan B1, Pelc K, de Meirleir L, Cheron G.

Careful study of the phenotype can have implications at several levels, namely clinical diagnosis, pathophysiological reasoning, management planning, and outcome measurement. Behavioural phenotypes involve cognition, communication, social skills, and motor control. They can be documented in a host of neurodevelopmental conditions and approached with the recently refined perception-action-cognition-environment (PACE) paradigm, which focuses on the neurodevelopmental processes that underlie learning and adaptation to the environment through perception, action, and cognitive processing. Although this paradigm was originally developed in the context of cerebral palsy, it can be applied along developmental trajectories in several neurogenetic conditions, including Down syndrome, fragile X syndrome, Rett syndrome, Angelman syndrome, and Williams syndrome, to name but a few. It must be recognized, however, that relevant, valid tools for assessment and management strategies still need to be developed.

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15. Dev Med Child Neurol. 2015 Apr;57 Suppl 2:10-4. doi: 10.1111/dmcn.12692.

Translational studies exploring neuroplasticity associated with motor skill learning and the regulatory role of the dopamine system.

Diaz Heijtz R1, Forssberg H.

Cerebral palsy (CP) is a heterogeneous group of neurodevelopmental disorders associated with lifelong motor impairment and disability. Current intervention programmes aim to capitalize on the neuroplasticity of the undamaged part of the brain to improve motor functions, by engaging individuals in active motor learning and training. In this review, we highlight recent animal studies (1) exploring cellular and molecular mechanisms contributing to neuroplasticity during motor training, (2) assessing the functional role of the mesocortical dopaminergic system in motor skill learning, and (3) exploring the impact of naturally occurring genetic variation in dopamine-related gene expression on the acquisition and performance of fine motor skills. Finally, the potential influence of the dopamine system on the outcome of motor learning interventions in cerebral palsy is discussed.

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16. Eur J Paediatr Neurol. 2015 Feb 4. pii: S1090-3798(15)00012-4. doi: 10.1016/j.ejpn.2015.01.005. [Epub ahead of print]

Long-term motor and behavioral outcome after perinatal hypoxic-ischemic encephalopathy.

van Schie PE1, Schijns J2, Becher JG3, Barkhof F4, van Weissenbruch MM5, Vermeulen RJ2.

BACKGROUND: A cohort of children born with perinatal hypoxic-ischemic encephalopathy (HIE) was followed prospectively until school age. **AIMS:** To describe motor outcome and behavioral functioning of school-age children after perinatal HIE and the relationship with neonatal MRI and outcome at age 2. **METHODS:** Twenty-five children (19 males), born at term with perinatal HIE, were assessed at a mean age of 7 y 6 m (range 6 y 4 m-8y 2 m). Motor ability was assessed with the Movement Assessment Battery for Children (2nd version) and behavioral functioning was assessed with the Child Behavior Checklist. Neonatal MRI was scored according to Barkovich classification. **RESULTS:** Of the 25 included children, eight had cerebral palsy (CP). Of the 17 children without CP, nine had impaired motor ability (of which 3 scored definitely abnormal), and four had behavioral problems. There was a significant difference in motor performance ($p = 0.008$) between children with normal and children with abnormal

neonatal MRI. Two (of four) children with normal motor ability and seven (of 14) children with normal neurological examination at age 2 showed impaired motor ability at school age. **CONCLUSIONS:** Half of the children without CP had impaired motor ability at school age. A normal outcome after HIE at young age does not necessarily imply a good outcome at school age, even when neonatal MRI does not show any abnormalities. More research is needed on the behavioral and cognitive consequences of HIE at school age and on the consequences for quality of life for children with and without CP.

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17. JAMA. 2015 Jan 20;313(3):306-7. doi: 10.1001/jama.2014.15915.

Antenatal magnesium sulfate and outcomes for school-aged children--reply.

Doyle LW1, Anderson PJ2, Lee KJ3.

Comment on: School-age outcomes of very preterm infants after antenatal treatment with magnesium sulfate vs placebo. [JAMA. 2014]

Antenatal magnesium sulfate and outcomes for school-aged children. [JAMA. 2015]

[PMID: 25603007](#) [PubMed - indexed for MEDLINE]

18. JAMA. 2015 Jan 20;313(3):306. doi: 10.1001/jama.2014.15912.

Antenatal magnesium sulfate and outcomes for school-aged children.

Marret S1, Bénichou J2.

Comment in: Antenatal magnesium sulfate and outcomes for school-aged children--reply. [JAMA. 2015]

Comment on: School-age outcomes of very preterm infants after antenatal treatment with magnesium sulfate vs placebo. [JAMA. 2014]

[PMID: 25603006](#) [PubMed - indexed for MEDLINE]