

# Appendix K: Speech, Language and Hearing

## Facts about Speech, Language and Hearing

### What is Communication?

Communication is the sending and receiving of information.

There are four main aspects to communication:

1. Hearing is essential for the acquisition of oral communication, speech and language.
2. Language is the coded system which enables understanding, organization and expression of meaning, thoughts and ideas. It takes the form of words and patterns of words in grammatical structures. Language can be conveyed in an oral, written or gestural/sign form. It can be further subdivided into expressive language (how we express ourselves using words, gestures, etc.) and receptive language (how we understand words, gestures, etc.).
3. Speech is the production of sounds and sequences of sounds. This can be further subdivided into voice quality, fluency and articulation that all contribute to the intelligibility of what is said.
4. Pragmatics is the social aspect of turn-taking and joint attention that facilitates communication.

### Causes of Speech and Language Problems

Historically causes of most communication disorders have not been known. Genetic research in the past decade has linked the most common disorder, specific language impairment, to inherited cerebral structure and function. Other speech, language and hearing disorders have been attributed to a variety of factors including maternal infection, genetics, traumatic brain injury, maxillo-facial anomalies such as cleft lip/palate, birth trauma, or syndromes (e.g. Autism Spectrum Disorder, Down Syndrome).

The home environment is also a factor to consider. Limited stimulation and family stressors can cause delay in speech/language development, but do not cause disorders. Delays due to environmental factors can be reversed with good language stimulation.

When a family member has a speech/language/hearing disorder, the children are at higher risk for communication difficulties. Pay special attention if there is a positive family history for: learning disabilities, permanent early childhood hearing loss, congenital syndromes, or if the parent indicates concern.

### Key Warning Signs

#### Emotion and Use of Eye Gaze

- Limited ability to share attention and/or emotions with eye gaze and facial expressions

- Limited use of eye gaze shifts between people and objects
- Delayed ability to understand and follow others' eye gaze and finger pointing

### Use of Communication

- Limited use of gestures and/or vocalizations to communicate
- Low rate of communication using gestures and/or vocalization
- Limited number of reasons for communication (e.g., child only communicates to protest and request food, but not to greet, label objects, etc.)
- Limited use of communication to share interest/attention with another

### Use of Gestures

- Limited number of gestures (e.g., giving, showing, reaching, pointing)
- Limited use of symbolic gestures (e.g., waving, nodding head, gesture for talking on phone)
- Reliance on gestures and a limited use of vocalizations to communicate

### Use of Sound

- Limited number of consonants
- Immature syllable structure (e.g., uses only consonant plus vowel combinations to represent words of varying lengths, such as na/banana or wa/water)

### Understanding and Use of Words

- Delayed in understanding language and using language

### Use of Objects

- Limited use of symbolic play (e.g., use of toy object to represent real object - phone, feed baby)
- Delayed spontaneous use of actions on objects in symbolic play
- Limited ability to imitate actions on objects

### Other

- Positive family history
- Heightened parental concern

### When to Refer

Refer all children to the Preschool Speech and Language System when the parent expresses concern or the child presents with high risk indicators or does not meet developmental milestones on the Rourke Record or Nipissing District Developmental Screen™.

<p><i>Developmental Milestones</i> The skills listed below mark children’s progress as they learn to communicate and gain speech and language abilities. If your child is not meeting one or more of these milestones or if you have concerns about your child’s hearing, please contact your local Preschool Speech and Language Program, listed on the back of this brochure</p>	<p><i>By 6 months</i> Orients to sounds Startles in response to loud noises Makes different cries for different needs (i.e. hungry, tired) Watches your face as you talk Smiles/laughs in response to your smiles and laughs Imitates coughs or other sounds (e.g. “ah”, “eh”, “buh”)</p>
<p><i>By 9 months</i> Responds to his/her name Responds to the telephone ringing or a knock at the door Understands being told “no” Gets what s/he wants through gestures (e.g. reaching to be picked up) Plays social games with you (e.g. “Peek-A-Boo”) Enjoys being around people Babbles and repeats sounds such as “babababa” or “duhduhduh”</p>	<p><i>By 12 months</i> Follows simple one-step directions (e.g. “sit down”) Looks across the room to a toy when adult points at it Consistently uses 3 to 5 words Uses gestures to communicate (e.g. waves hi/bye, shakes head “no”) Gets your attention using sounds, gestures and pointing while looking at your eyes Brings you toys to show you “Performs” for social attention and praise Combines lots of sounds together as though talking (e.g. “abada baduh abee”) Shows an interest in simple picture books</p>
<p><i>By 18 months</i> Understands the concepts of “in &amp; out”, “off &amp; on” Points to several body parts when asked Uses at least 20 words consistently Responds with words or gestures to simple questions (e.g. “Where’s teddy?”, “What’s that?”) Demonstrates some pretend play with toys (e.g. gives teddy a drink, pretends a bowl is a hat) Makes at least 4 different consonant sounds (e.g. p, b, m, n, d, g, w, h) Enjoys being read to and sharing simple books with you Points to pictures using one finger</p>	<p><i>By 24 months</i> Follows two-step directions (e.g. “Go find your teddy bear and show it to Grandma”) Uses 100-150 words Uses at least two pronouns (e.g. “you”, “me”, “mine”) Consistently combines 2 to 4 words in short phrases (e.g. “Daddy hat”, “truck go down”) Enjoys being around other children Begins to offer toys to peers and imitate other children’s actions and words Words are understood by others 50% to 60% of the time Forms words/sounds easily and effortlessly Holds books the right way up and turns pages “Reads” to stuffed animals or toys Scribbles with crayons</p>

<p><i>By 30 months</i>  Understands the concepts of size (big/little) and quantity (a little/a lot, more)  Uses some adult grammar (e.g. “two cookies”, “bird flying”, “I jumped”)  Uses over 350 words  Uses action words (e.g. run, spill, fall)  Begins taking short turns with peers, using both words and toys  Demonstrates concern when another child is hurt/sad  Combines several actions in play (e.g. feeds doll and then puts her to sleep, puts blocks in train then drives train, drops blocks off)  Puts sounds at the start of most words  Produces words with two or more syllables or beats (e.g. “ba-na-na”, “com-pu-ter”, “a-pple”)  Recognizes familiar logos and signs involving print (e.g. golden arches of McDonalds, “Stop” sign)  Remembers and understands familiar stories</p>	<p><i>By 36 months</i>  Understands “who”, “what”, “where” and “why” questions  Creates long sentences (e.g. using 5 to 8 words)  Talks about past events (e.g. trip to Grandparents’ house, day at childcare)  Tells simple stories  Shows affection for favourite playmates  Engages in multi-step pretend play (e.g. pretending to cook a meal, repair a car, etc.)  Understood by most people outside of the family most of the time  Aware of the function of print (e.g. in menus, lists, signs)  Beginning interest in, and awareness of, rhyming</p>
<p><i>By 48 months</i>  Follows directions involving 3 or more steps (e.g. “First get some paper, then draw a picture, last give it to Mom”)  Uses adult-type grammar  Tells stories with a clear beginning, middle and end  Talks to try to solve problems with adults and other children  Demonstrates increasingly complex imaginative play  Understood by strangers almost all of the time  Able to generate simple rhymes (e.g. “cat-bat”)  Matches some letters with their sounds (e.g. “letter T says ‘tuh’)</p>	<p><i>By 60 months</i>  Follows group directions (e.g. “All the boys get a toy”)  Understands directions involving “if...then” (e.g. “If you’re wearing runners, then line up for gym”)  Describes past, present and future events in detail  Seeks to please his/her friends  Shows increasing independence in friendships (e.g. may visit neighbour by him/herself)  Uses almost all of the sounds of their language with few to no errors  Knows all the letters of the alphabet  Identifies the sounds at the beginning of some words (e.g. “Pop starts with the ‘puh’ sound”)</p>

# Appendix L: Autism Spectrum Disorder

## **Developmental Surveillance: Focus on 18-36 Months: Approach to Children with Identified Developmental Difficulty** By Wendy Roberts and Anita Jethwa

When a child has specific delays in communication and is not using verbal or nonverbal means to share interest with other people by 12 months of age there is cause for concern, and a careful diagnostic appraisal needs to be done from a developmental point of view. Similarly, any child who loses the use of language or social skills, particularly between the age of 9 and 24 months, needs to be looked at very carefully. When the absolute indicators for immediate evaluation are met, consideration must be given as to whether the child could have an Autism Spectrum Disorder (ASD).

The term Autism Spectrum Disorder is now replacing the term Pervasive Developmental Disorder (PDD) since Pervasive Developmental Disorder has become a confusing term for parents. Some parents have been given the diagnosis of PDD, and are then shocked a couple of years later to find out that, in fact, their child has autism. The use of the term Autism Spectrum Disorder allows the idea of progress and skill development during the initial labelling process, shifting the child in a positive direction along the spectrum. Parents may be less likely to feel that the autistic label is a permanent life sentence. Research has shown that even experienced professionals are not reliably able to differentiate between the various types of Pervasive Developmental Disorder particularly in the preschool years. The term "high functioning" has become confusing because it may be used to describe a child who is either intellectually high functioning or who has less autistic symptoms.

Early identification of an Autism Spectrum Disorder is critical since outcome has been shown to be quite different if children have intensive input in the preschool years. Many high functioning children have been missed in the past because, particularly with parent's scaffolding and support, observed interactions between the child and parent during a short visit to the clinic have failed to show any outstanding abnormality. A prolonged period of observation (e.g., 5–10 minutes) of the child in a play situation is needed.

Glascoc has shown that parent's concerns are in fact very accurate and need to be paid attention to. The current 1 to 3 -year lag, documented between the time when parents are first worried and when a physician first gives a diagnosis, must be reduced.

### **Early Parental Concerns in Autism**

- Extremes in temperament (passive to irritable)
- Poor eye contact
- Lack of or inconsistent response to name
- Difficult to engage in social play

### **Early Identified Behavioural Manifestations of Autism (Zwaigenbaum et al, 2005)**

- Atypical early temperament (passive to extreme reactions)
- Atypical eye contact
- Atypical orientation to name
- Atypical social interest and affect
- Poor imitation skills

Some of the more classical features of autism and those seen in older children may be missing in the early years. There is not the same degree of stereotypic and compulsive behaviours. There is not the same insistence on routines and rituals. Many children are quite affectionate both in accepting and in looking for affection, and many will have eye contact particularly to get their needs met, although not sustaining eye contact for social interaction. The absence of the more typical signs has led in many cases to people making incorrect definitive statements such as, "this is definitely not autism."

When developmental delays in the social and communication are suspected in an infant or toddler it raises concern regarding the possibility of an autism spectrum disorder. These children require immediate further investigation. The best current screening tool is the Modified Checklist for Autism in Toddlers (M-CHAT). This tool was developed by Dr Diana L. Robins and her research team and was adapted from the Checklist for Autism in Toddlers (CHAT) the pioneer autism tool (Baron-Cohen et al., 1996). This checklist documents parent reports of social interest, social play, pretend play, pointing to show and bringing an object to share interest. Primary care providers should either be prepared to provide this further screening or to make appropriate referral so that further screening is completed. Specific screening for ASD at 18 to 24 months using the M-CHAT should be performed on all children with any of the following: failed items on the social/emotional/communication skills inquiry, sibling with autism, or developmental concern by parent, caregiver, or physician. If the M-CHAT is abnormal, use the M-CHAT Follow-up Interview to reduce the false positive rate and avoid unnecessary referrals and parental concern. Information regarding appropriate use of the M-CHAT tool and follow-up interview are found at: [www.mchatscreen.com](http://www.mchatscreen.com). (See Appendix M) Research articles that discuss the sensitivity and specificity of available screening tools for ASD can also be found on the website. Continued surveillance regarding social development is important even when the M-CHAT is initially negative.

When a child is referred on for a diagnostic assessment usually by a Developmental Paediatrician or a Psychiatrist, the clinician must be experienced and up-to-date in the assessment of autism. A diagnostic interview and observation scale must be used, in addition to either questionnaires or observing videotapes from home and a community setting. The specific use of DSM-IV criteria in children under 3 is not a reliable way to make a diagnosis. Using the DSM-IV criteria as a checklist is particularly unreliable in younger children; clinicians need to be able to interpret DSM-IV criteria and apply them in an informed age-specific manner during the history-taking process.

A unique difference in younger children with ASD is unusual sensory interests. This can include seeking of tactile input such as rubbing surfaces, squeezing balls that have different textures; dropping objects and watching them fall, or listening to them fall; watching unusual light patterns; flicking light switches on and off; and looking through their fingers at a light in the background. Sensory peculiarity may greatly limit food intake and some children will only eat very crisp food or very cold food. Many will not accept any mixtures at all. Sensory limitations from diet can lead to quite significant iron deficiency, particularly after the 18-month period.

Younger children have less of the typical autistic repetitive behaviours such as jumping, spinning, or running around in circles. Many will have subtle hand flapping or flicking and hyperextension of fingers.

Medical investigations should always include an audiological assessment with ABR's if there is any doubt about hearing. Most chromosome assessments will not reveal particular abnormalities unless there are significant dysmorphic features. The research is focusing particularly on chromosome 7 and 15, but there is no diagnostic test yet. Children will usually be screened through DNA analysis for Fragile X syndrome. If there is a history of pica, a lead level is suggested; if there is dietary restriction, look for decreased ferritin. If there is any history suggestive of a metabolic disorder then a metabolic screen should be done. Many children, especially those with disturbed sleep and those with significant regression, will have abnormalities on an overnight EEG. An awake EEG is not helpful, and most sleep deprived EEG's are difficult to interpret.

When autism is suspected, intervention must be urgent and intrusive. It involves the working together of a team that must include parents. If a child is under 2 years, a referral to the Infant Development Program so that work can start in home in terms of teaching skills to parents and working with the child to develop social reciprocity and communication. The Preschool Speech and Language Initiative needs to be involved with the speech pathologist being a key member of the team. The Hanen Parent Program "More Than Words" has been very helpful to give parents intensive education and modeling of intrusive interaction leading to the understanding of communication starting in the child. The Regional Autism Services Program and the Preschool Behavioural Autism Program should be contacted so that the child can be assessed for eligibility. Parent support and education programs run through the Geneva Centre in Toronto, which is a Children's Mental Health Centre for children with autism, as well as local autism services, such as Autism Ontario can be helpful.

During the last few years we have learned more about autism and have seen the results of early intervention. It is clear that children can do better when they are detected at an earlier age, when families are able to access more support and more financial aid for both their child's education and respite care when it is needed. In the long term, society will pay less as children do better and families cope better.

# Appendix M: Checklist for Autism in Toddlers (CHAT)

## Instructions and Permissions for Use of the M-CHAT™

The Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, & Barton, 1999) is available for free download for clinical, research, and educational purposes. There are two authorized websites: the M-CHAT and supplemental materials can be downloaded from [www.firstsigns.org](http://www.firstsigns.org) or from Dr. Robins' website, at <http://www.mchatscreen.com>

Users should be aware that the M-CHAT continues to be studied, and may be revised in the future. Any revisions will be posted to the two websites noted above.

Furthermore, the M-CHAT is a copyrighted instrument, and use of the M-CHAT must follow these guidelines:

- (1) Reprints/reproductions of the M-CHAT must include the copyright at the bottom (© 1999 Robins, Fein, & Barton). No modifications can be made to items or instructions without permission from the authors.
- (2) The M-CHAT must be used in its entirety. There is no evidence that using a subset of items will be valid.
- (3) Parties interested in reproducing the M-CHAT in print (e.g., a book or journal article) or electronically (e.g., as part of digital medical records or software packages) must contact Diana Robins to request permission ([drobins@gsu.edu](mailto:drobins@gsu.edu)).

### Instructions for Use

The M-CHAT is validated for screening toddlers between 16 and 30 months of age, to assess risk for autism spectrum disorders (ASD). The M-CHAT can be administered and scored as part of a well-child check-up, and also can be used by specialists or other professionals to assess risk for ASD. The primary goal of the M-CHAT was to maximize sensitivity, meaning to detect as many cases of ASD as possible. Therefore, there is a high false positive rate, meaning that not all children who score at risk for ASD will be diagnosed with ASD. To address this, we have developed a structured follow-up interview for use in conjunction with the M-CHAT; it is available at the two websites listed above. Users should be aware that even with the follow-up questions, a significant number of the children who fail the M-CHAT will not be diagnosed with an ASD; however, these children are at risk for other developmental disorders or delays, and therefore, evaluation is warranted for any child who fails the screening.

The M-CHAT can be scored in less than two minutes. Scoring instructions can be downloaded from <http://www.mchatscreen.com> or [www.firstsigns.org](http://www.firstsigns.org). We also have developed a scoring template, which is available on these websites; when printed on an overhead transparency and laid over the completed M-CHAT, it facilitates scoring. Please note that minor differences in printers may cause your scoring template not to line up exactly with the printed M-CHAT.

Children who fail more than 3 items total or 2 critical items (particularly if these scores remain elevated after the follow-up interview) should be referred for diagnostic evaluation by a specialist trained to evaluate ASD in very young children. In addition, children for whom there are physician, parent, or other professional's concerns about ASD should be referred for evaluation, given that it is unlikely for any screening instrument to have 100% sensitivity.

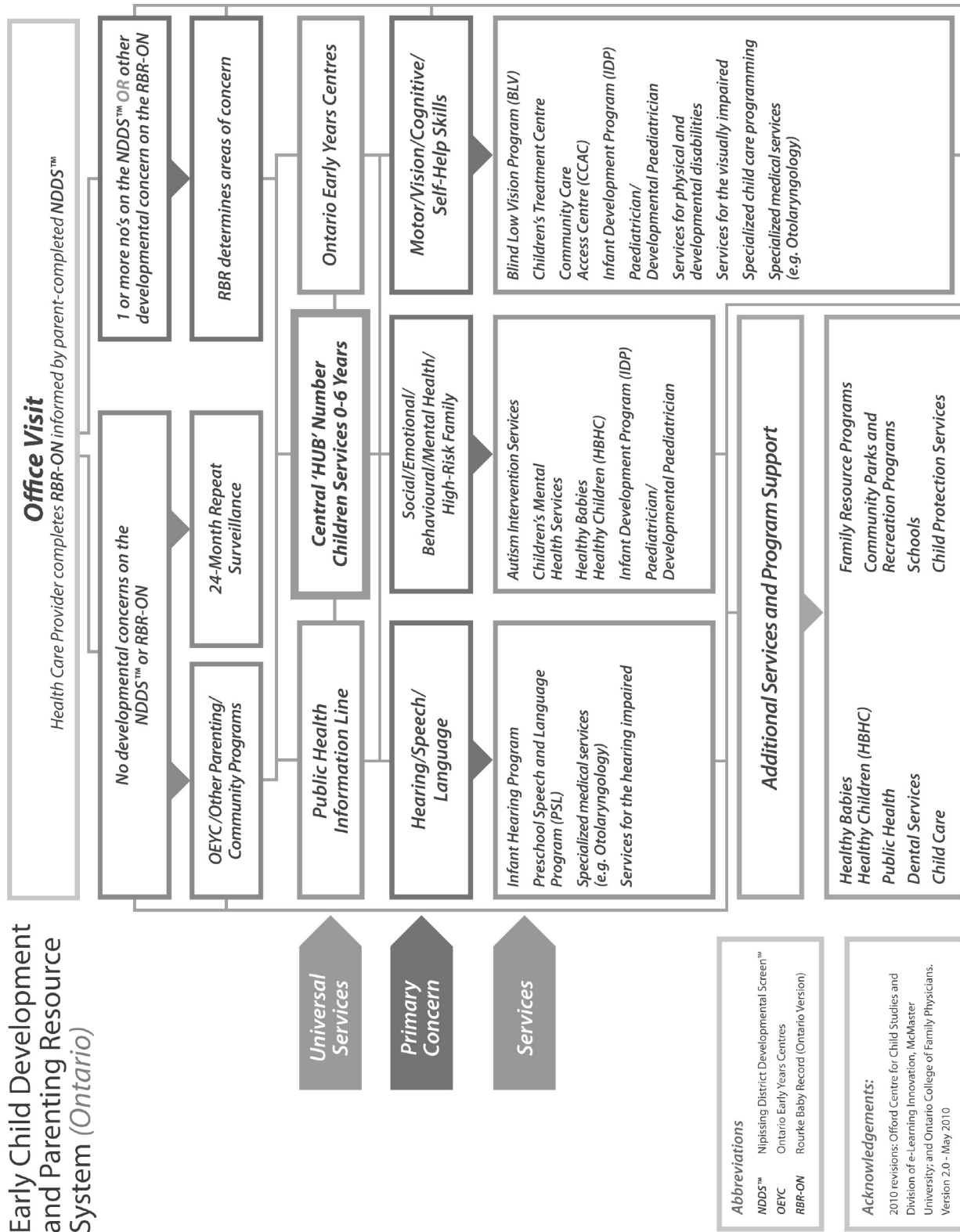
## M-CHAT

Please fill out the following about how your child usually is. Please try to answer every question. If the behavior is rare (e.g., you've seen it once or twice), please answer as if the child does not do it.

- |  |     |    |
|--|-----|----|
| 1. Does your child enjoy being swung, bounced on your knee, etc.?  | Yes | No |
| 2. Does your child take an interest in other children?   | Yes | No |
| 3. Does your child like climbing on things, such as up stairs?   | Yes | No |
| 4. Does your child enjoy playing peek-a-boo/hide-and-seek?   | Yes | No |
| 5. Does your child ever pretend, for example, to talk on the phone or take care of a doll or pretend other things?       | Yes | No |
| 6. Does your child ever use his/her index finger to point, to ask for something?   | Yes | No |
| 7. Does your child ever use his/her index finger to point, to indicate interest in something?                            | Yes | No |
| 8. Can your child play properly with small toys (e.g. cars or blocks) without just mouthing, fiddling, or dropping them? | Yes | No |
| 9. Does your child ever bring objects over to you (parent) to show you something?  | Yes | No |
| 10. Does your child look you in the eye for more than a second or two?   | Yes | No |
| 11. Does your child ever seem oversensitive to noise? (e.g., plugging ears)  | Yes | No |
| 12. Does your child smile in response to your face or your smile?  | Yes | No |
| 13. Does your child imitate you? (e.g., you make a face-will your child imitate it?)                                     | Yes | No |
| 14. Does your child respond to his/her name when you call?   | Yes | No |
| 15. If you point at a toy across the room, does your child look at it?   | Yes | No |
| 16. Does your child walk?  | Yes | No |
| 17. Does your child look at things you are looking at?   | Yes | No |
| 18. Does your child make unusual finger movements near his/her face?   | Yes | No |
| 19. Does your child try to attract your attention to his/her own activity?   | Yes | No |
| 20. Have you ever wondered if your child is deaf?  | Yes | No |
| 21. Does your child understand what people say?  | Yes | No |
| 22. Does your child sometimes stare at nothing or wander with no purpose?  | Yes | No |
| 23. Does your child look at your face to check your reaction when faced with something unfamiliar?                       | Yes | No |

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# Appendix N: 18 Month Visit Flowchart



Early Child Development and Parenting Resource System (Ontario)

# Appendix 0: Developmental Issues in an Older Child

## TEACHING CASE REPORT

### Why every office needs a tennis ball:

#### a new approach to assessing the clumsy child

**The Case:** A 7-year-old boy is brought to your office by his mother at the urging of his school. Although he reads extremely well and seems to understand material that is taught, he has great difficulty producing written work, initiating and finishing tasks and participating in gym class. He has trouble sitting still, often bumps into things and other people, and his behaviour is interfering with his academic progress. Socially he is isolated, especially on the school playground, where he avoids physical activity. After educational testing, the learning resource teacher concludes that there is no evidence of a learning disability. The patient appears to be a healthy, communicative boy who slouches noticeably in his chair. His mother is teary and anxious when describing his continuing difficulties.

What is your differential diagnosis? How would you assess this child?

Motor coordination problems in otherwise healthy children of normal intelligence are common. Such children are often noted by parents, caregivers and teachers to have problems with daily tasks such as dressing themselves, to trip when they run, to spill things frequently and to have messy handwriting and drawing. They may be labelled as “clumsy,” “awkward” and “lazy.” Research has shown that children with these motor coordination problems often end up with serious academic and social impairments and problems with self-esteem. Developmental coordination disorder (DCD) is the term used when a child’s delayed motor skill development affects his or her ability to perform age-appropriate daily activities (Box 1).

A total of 5%–6% of children meet the criteria for DCD.<sup>1</sup> This means that,

on average, at least 1 child in every primary school classroom is affected. Children with DCD are more likely than their peers to experience learning, emotional and behavioural problems (including learning disabilities, anxiety and attention-deficit hyperactivity disorder). Further, the deficits of DCD usually persist through adolescence and into adulthood. Early recognition of the condition by primary care providers may reduce its ultimate academic, emotional and behavioural impact.

#### Epidemiology and natural history

DCD is commonly diagnosed after age 5, when minor motor problems (often noted when the child was young) are highlighted by the structured demands of a school environment.<sup>2</sup> The ratio of boys to girls varies from 2:1 to 5:1, depending on the group studied. The cause of DCD is poorly understood, since the results of genetic studies, im-

aging tests and other laboratory investigations are all inconclusive.

Children with DCD may appear to be inattentive because they have difficulty stabilizing their bodies and joints, so they look restless. They may also actively avoid tasks that require motor skills and become anxious in social situations. DCD and attention-deficit hyperactivity disorder frequently occur together, but the contribution of the motor difficulties to children’s academic and social problems is often overlooked.

Although the pathophysiology is unknown, affected children appear to have underlying difficulties in *motor planning* (planning movements such as sitting down on a chair or figuring out how to jump), the *timing and amount of force* needed during movement (e.g., using too much or too little force to pick things up, being late reaching to catch a ball), and the *integration of information* from sensory and motor systems (e.g., relying heavily on visual information to climb stairs or fasten buttons).<sup>3</sup> Children may also show poor balance, slow reaction and movement times, and difficulty executing fine motor skills needed for performing self-care activities, handwriting and drawing.<sup>2</sup>

The natural history of DCD is of con-

#### Box 1: Diagnostic criteria for developmental coordination disorder<sup>1</sup>

- A. Performance in daily activities that require motor coordination is substantially below that expected, given the person’s chronological age and *measured* intelligence. This may be manifested by:
  - Marked delays in achieving motor milestones (e.g., walking, crawling, sitting)
  - Dropping things
  - Clumsiness
  - Poor performance in sports
  - Poor handwriting
- B. The disturbance in criterion A significantly interferes with academic achievement or activities of daily living
- C. The disturbance is not due to a general medical condition (e.g., cerebral palsy, hemiplegia or muscular dystrophy) and does not meet criteria for a pervasive developmental disorder
- D. If mental retardation is present, the motor difficulties are in excess of those usually associated with it

Note: For a comprehensive review of the examination of clumsiness in children, please refer to the article by Hamilton.<sup>2</sup>

cern, not because of the motor coordination problem itself but because of its impact on everyday activities and participation. Parents express concern about coordination difficulties when the child is young, but by early school age, these concerns are more evident as problems with self-care and academic activities. By the end of elementary school, social isolation, poor self-image and victimization are evident. Physical health concerns (childhood obesity and reduced physical fitness) and mental health problems (anxiety and depression) are commonly noted by early adolescence (Fig. 1).

### Screening

Annual health examinations are ideal times to screen for DCD. Parents can be asked to complete a self-administered

questionnaire (see example in Appendix 1, available at [www.cmaj.ca/cgi/content/full/175/5/471/DC1](http://www.cmaj.ca/cgi/content/full/175/5/471/DC1)), or the physician can conduct a structured interview, listening for difficulties commonly associated with DCD. In addition, the physician can assess the child using simple screening activities administered in his or her office (see Appendix 2, available at [www.cmaj.ca/cgi/content/full/175/5/471/DC1](http://www.cmaj.ca/cgi/content/full/175/5/471/DC1)). Children with symptoms or signs of a motor coordination disorder require further evaluation.

An assessment that takes into account the differential diagnosis of DCD (Box 2) is necessary, since DCD is a diagnosis of exclusion. Elements of the child's history, physical examination and laboratory test profile that would make alternate diagnoses more likely are indicated.

### Referral and treatment

Early referral to an occupational therapist or pediatric multidisciplinary team can help confirm the diagnosis and rule out comorbid conditions such as speech or language difficulties, attentional problems, learning difficulties and mental health problems. This type of team can also help devise early management plans that may improve the child's developmental outcomes. Successful treatment approaches involve various allied health professionals, and the child's parents, physician and teachers.<sup>2,3</sup>

Armed with a diagnosis of DCD, parents are in a position to advocate for their child and to adapt their child's environment to encourage independence and self-esteem. Children with DCD lack confidence in situations where motor

Age, yr	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Motor	Delays in fine and gross motor skills; late riding tricycle; cannot catch or throw ball with accuracy; cannot ride bicycle; difficulty jumping or skipping; decreased fitness															
Self-care	Difficulty using utensils; needs help dressing and grooming; cannot tie shoes or do zippers and buttons; messy eater, cannot cut meat															
Academic	Awkward pencil grasp; difficulty completing written work; gap between verbal ability and performance on evaluations; frustration with writing and homework															
Social	Limited participation in sports and extracurricular activities; tends to watch instead of participating; victimization/ bullying; social isolation →															
Behavioural/ emotional	<b>Behavioural</b> <ul style="list-style-type: none"> <li>• Avoids active play and fine motor activities</li> <li>• Dislikes sports and active recreation</li> <li>• Is frustrated and avoids tasks →</li> </ul>								<b>Emotional</b> <ul style="list-style-type: none"> <li>• Self-deprecating comments</li> <li>• Decreased self-esteem</li> <li>• Poor perceived competence</li> <li>• Anxious, depressed, withdrawn →</li> </ul>							

**Fig. 1:** Concerns typically noted by parents of children with developmental coordination disorder at different ages.

skills are required. Simple changes such as Velcro fasteners instead of buttons and laces can speed up dressing. Physical activities that naturally incorporate repetition and a constant environment, such as swimming, can be encouraged rather than team games. Teachers can reduce a child's stress and encourage academic progress by "matching" the child's abilities to the task. For example, reducing writing requirements, giving more time to complete tasks and encouraging different roles in physical education class can be helpful.<sup>4</sup> Resources containing teaching tips and strategies for parents and educators can be found at the *CanChild* Centre for Childhood Disability Research ([www.canchild.ca](http://www.canchild.ca)).

## The case revisited

Physical examination reveals that the patient has normal hearing and vision,

is slightly overweight and has low muscle tone (slouches and has unstable posture in sitting and standing positions). Administration of the screening activities shows that the boy's one-legged balance is poor. His pencil grasp is awkward, he uses excessive pressure, and his printing is slow. His sitting posture at the desk is "floppy" and he props his head upright by leaning on his other hand. The patient is unable to bounce and catch a tennis ball (see video clip, available at [www.cmaj.ca/cgi/content/full/175/5/471/DC2](http://www.cmaj.ca/cgi/content/full/175/5/471/DC2)).

In the parent questionnaire, the mother indicates that her son has great difficulty with many motor-based activities, is slow to learn new motor skills and becomes easily frustrated. Further questions about his disruptive behaviour in the classroom reveal that he misbehaves only when written work is required; he is not otherwise inattentive.

### Box 2: Differential diagnosis of developmental coordination disorder (DCD)

The physician should systematically establish the presence or absence of other disorders that can be associated with motor incoordination, including:

- Genetic disorder (e.g., Down syndrome)
- Neurologic disorder (e.g., cerebral palsy)
- Degenerative condition (e.g., Duchenne's muscular dystrophy, brain tumour)
- Musculoskeletal disorder (e.g., Legg-Perthes disease)
- Physical impairment (e.g., impaired visual acuity)
- Cognitive impairment (e.g., developmental delay)
- Pervasive developmental disorder (e.g., autism)
- Injury (e.g., traumatic brain injury)
- Environmental contaminant (e.g., lead, pesticides)

If any of the following are present, the coordination difficulties are probably *not* DCD:

- History of recent head injury or trauma
- History of deterioration (child has "lost" motor skills that he or she used to have)
- History of headaches, eye pain, blurred vision
- History of global developmental delays
- Increased muscle tone, fluctuating tone or significant hypotonia
- Asymmetry of tone or strength
- Musculoskeletal abnormality
- Neurocutaneous lesion
- Avoidance of eye contact, unwilling to engage socially
- Gowers' sign (difficulty rising to a standing position)
- Ataxia, dysarthria
- Absence of deep tendon reflexes
- Dymorphic features
- Visual impairment (untreated)

DCD is diagnosed. The physician provides the boy's parents with a variety of educational materials and suggests a referral to an occupational therapist and a review in 3 months.

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## ADDITIONAL RESOURCES

- *CanChild* Centre for Childhood Disability Research ([www.canchild.ca](http://www.canchild.ca)): educational material for parents, teachers, service providers and members of the community available free
- DCD PACK — Physician Allied Health Collaboration Kit ([www.dcdpack.ca](http://www.dcdpack.ca) [enter "dcdpack" as username and "dcdchild" as password]): educational material for primary care physicians