CHILDHOOD DEVELOPMENTAL SCREENING 2020
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UNIT NO. 2

CHILD DEVELOPMENT SCREENING 18 MONTHS TO 4 YEARS OLD

Adj Asst Prof Mascarenhas Sandra Sylvia, Dr Agarwal Pratibha Kashev, Adj Assoc Prof Lourdes Mary Daniel

ABSTRACT

Developmental delay is common and is often associated with long term problems in learning, behaviour and mental health. Early intervention before three years of age is crucial for improving long-term outcomes. With the rising prevalence of child developmental problems in Singapore, primary care physicians as part of a child developmental surveillance program, are well placed to identify children with developmental delays early and refer for further evaluation. Developmental surveillance is recommended at every well-child visit. Parents play an important role in their child's development and can monitor the development by completing the developmental checklists in the health booklet. This article aims to outline an approach to child development surveillance and screening for children 18 months to four years old in primary practice and accompanies the guidelines on Child Development Screening (CDS) developed by the Ministry of Health.

Keywords: child development, developmental screening, developmental surveillance, primary care.

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INTRODUCTION

Developmental delay is common, with rising prevalence over the years, [1,2,3] and affects 5 - 15 percent of the children under five years of age.[4] It is defined as delays in areas of speech and language development, motor development, social-emotional development and cognitive development.[5] It may indicate an underlying diagnosis such as a genetic syndrome or an environmental problem such as neglect or lack of stimulation. It is also associated with long term problems in learning, behaviour and mental health. Children with undetected developmental delays are at risk of socio-emotional and school problems.[4] Effective identification of children at risk of developmental issues leads to timely diagnosis and referral to early intervention, with significant difference to outcomes. Parents and carers always seek reassurance that their child is developing normally, and the evaluation of a child's development is an important component of general practice. Early identification leads to parental guidance and support in providing developmentally appropriate activities in order to improve the developmental trajectory.[4]

In Singapore, there is a rising prevalence of children with developmental and behavioural disorders referred to the KKH's Department of Child Development and NUH's Child Development Unit with a 76 percent increase in children presenting with developmental issues from 2010 to 2014.[2] The mean age of referral for children with developmental delays to government-funded early childhood intervention programs in Singapore is 35.8 months, suggesting that early detection could be improved.[6] Even though parents are usually the first to raise concerns about the child's development, a local study evaluating the parental perceptions of the child development screening in the health booklet found that only half the parents completed the developmental checklist and only one in four parents took their child to the two to three-year developmental monitoring visit.[7] General Practitioners (GPs), through the Child Development Surveillance Programmes, are well placed to bridge this service gap by identifying those who are not meeting their developmental milestones. However, variability in knowledge and skills of family physicians in screening for early developmental delays, combined with limited time in the clinic may impact prompt identification.[8] This may delay early detection and referral of those with developmental delay or atypical development resulting in less satisfactory developmental trajectories as children are more responsive to early intervention if started before three years of age.[9]

This topic review aims to provide an overview on the child development screening between 18 months to four years and includes normal development, international recommendations on Child Developmental Surveillance including screening for Autism Spectrum Disorder and the current situation in Singapore. It accompanies the guidelines on Child Development Screening developed by the Ministry of Health.

Normal Child Development

Child development is a continuous interactional process that is affected by biological and psychosocial risk factors. It relates to a child's ability to move, use of his or her hands, communicate, learn, interact with others and self-care. Changes in these areas occur throughout childhood. The pattern of development is predictable, and milestones are acquired in a sequential manner with minor individual variation. If a child is late in achieving milestones which 90 percent of the children have met, then it is cause for concern. Assessing a child's development involves observing a child's step-wise acquisition of skills in different developmental domains and detecting delays or deviations in normal development.

MASCARENHAS SANDRA SYLVIA, Consultant

AGARWAL PRATIBHA KASHEV, Consultant

LOURDES MARY DANIEL, Consultant

Department of Child Development,
KK Women's and Children's Hospital

Developmental Delay

The term 'developmental delay' is used when a child fails to develop and/or achieve skills in the expected time frame.[10] A child may be delayed in a single domain (e.g. motor skills or language). Global developmental delay refers to a developmental trajectory greater than two standard deviations below the mean in two or more developmental domains, usually in a child less than five years of age. [11]

Approach to Developmental Surveillance

Developmental Surveillance is a longitudinal, continuous process that takes into account the dynamic nature of a child's development. It has five components and involves: 1) eliciting parents' concerns about their child's development (Fig. 1), 2) documenting and maintaining a developmental history (Fig. 2); 3) making skilful observations of the child; 4) identifying risk and protective factors (Fig. 3 & 4), and 5) maintaining an accurate record of findings. [12] It helps to identify those at risk of delay and who may need continued monitoring. In addition, it may identify those with developmental delay if it is obvious from history and observations. Any parental concerns should be promptly addressed, and further evaluation undertaken using a developmental screening tool.[13]

Figure 1. Eliciting Parental concerns [12]

Do you have any concerns about the way your child:

- Moves, climbs or runs
- Uses his/her hands to manipulate objects
- Talks and understands what is being said
- Makes eye contact, interacts with you or others
- Learns to do things for himself / herself
- is behaving or learning

Do you have any concerns about your child's vision or hearing?
Do you have concerns that your child is not able to do something that he / she could previously do?

Figure 2. Developmental history[12]

Ask about changes seen in child's development since the last visit.

Enquire about age specific skills in the various domains of development.

Figure 3. Risk Factors[12, 14, 15]

Biological risk factors
Prenatal infections including HIV, drug use and alcohol use, smoking; Intrauterine growth restriction
Perinatal and postnatal complications: Prematurity, very low birth weight Birth asphyxia, Sepsis, head injury and meningitis
Genetic conditions
Poor Infant and child nutrition, Iron deficiency anaemia, Iodine deficiency
Environmental toxins e.g. Lead
Psychosocial risk factors
Socio- economic difficulties
Parental mental health problems or Postnatal Depression
Parents with Intellectual disabilities
Adverse childhood experiences*
Inadequate opportunities for stimulation and learning
Low level parental education and household income[30]

*Adverse childhood experiences refer to ten categories of adverse childhood experiences (ACEs): abuse (physical, emotional, or sexual); neglect (physical or emotional); and growing up with household substance abuse, criminality of household members, mental illness among household members, and parental discord and illicit drug use. [16]

Figure 4. Protective Factors [12,36]

Strong connections within a loving family
Opportunities to interact with other children
Opportunities to grow in an environment with appropriate structure (e.g. high quality child-care)
Active parent -child engagement (book sharing, back and forth conversation)
Breast feeding
Maternal Education

Developmental Screening

Developmental screening involves the use of a standardised tool to look at a child's development more closely and is used in conjunction with developmental surveillance. In order to improve the identification of developmental delay early, the American Academy of Pediatrics (AAP) in 2006, released a policy statement and algorithm that recommended screening children for developmental disorders at the 9-, 18-, and 24- or 30-month well-child visits using standardised measures.[12] The identification of developmental-behaviour problems in primary care without validated screening tools has a sensitivity of 14-54 percent[17] and children who participated in a developmental screening programme were more likely to be identified with delays and referred to early intervention services in a timelier fashion.[18] A study on paediatricians' self-reported use of formal developmental screening tools suggests that the use of developmental screening tools has tripled over the years (21 percent in 2002 to 63 percent in 2016) and resulted in a concomitant increase (41 to 59 percent) in patients identified to be at risk and needing a referral for early intervention services.[19] While these results are encouraging, one-third of the paediatricians cited lack of time as a barrier to using developmental screening tools.[20]

Table 1 lists validated common screening tools that may be used

if a primary care physician has concerns about development or at specific well-child visits. Developmental screening tools may rely solely on the parental report to identify a delay in the developmental domains or on direct elicitation of a child's developmental skills in conjunction with a parental report. Researchers in developmental screening tools regard a sensitivity and specificity of 70-80 percent as acceptable.[21]

Table 1. Common Screening Tools [12,22]

Instrument	Domains covered	Age	Method of administration	Time to administer	Sensitivity and Specificity
ASQ	Communication, gross motor, fine motor, problem-solving and personal-social	1-66 months	Parent completed	10-15 min	Sensitivity 0.7-0.9 Specificity 0.76-0.91
PEDS	Global/ Cognitive, Language and articulation, gross motor and fine motor, behavior and social- emotional, self-help and school	0-8 years	Parent completed	5-10 min	Sensitivity 0.74-0.79 Specificity 0.70-0.80
Brigance screen	Expressive and receptive language; gross motor and fine motor, Academics	0-7years	Directly administered	15 min	Sensitivity 0.7-0.8 Specificity 0.7-0.8
DDST	Expressive and Receptive language, gross motor and fine motor, Academics	2-71 months	Directly administered	15-25 min	Sensitivity 0.56-0.83 Specificity 0.43-0.80
Child Development Inventory	social, self-help, motor, language, and general development skills	18-months to 6 years	Parent completed	30-50 min	Sensitivity 0.8 -1.0 Specificity 0.94-0.96
Capute Scales	visual-motor/problem solving, expressive and receptive language	3-36 months	Directly administered	15-20 min	Sensitivity 0.21 to 0.67 in low-risk population (and 0.05–0.88 in high-risk populations; specificity: 0.95–1.00 in low-risk population and 0.82–0.98 in high-risk populations
M-CHAT	Autism screening tool	16-48 months	Parent completed	5-10 min	sensitivity: 0.85-0.87 specificity: 0.93-0.99

ASQ- Ages and Stages Questionnaire; PEDS – Parents evaluation of Developmental status; DDST- Denver developmental screening test; M- CHAT- Modified checklist for Autism in Toddlers; Capute scales - Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale; M-CHAT- Modified checklist of Autism in Toddlers

Screening for Autism Spectrum Disorder (ASD)

The increasing prevalence of Autism spectrum disorder [2, 23] and the evidence that early intervention improves outcomes have emphasised the need to screen for Autism at well child visits.[24] While many studies have shown that parents of children with Autism initially raised concerns before 18 months of age, the average age of diagnosis is only at four years.[25] The American Academy of Pediatrics recommends Autism screening at 18 months and 24 months well-child visits.[26]

A systematic review that included studies reporting psychometric properties of autism screening tools in unselected populations of children of 16- 40 months of age across primary practice, showed that Autism screening tools can correctly identify many children with ASD.[27] The Modified Checklist for Autism in Toddlers (M-CHAT) is a parent-completed questionnaire to identify children between 16 to 30 months of age at risk of a diagnosis of Autism. For screen failures, the MCHAT- Revised with additional items on follow up is administered to identify those that need a diagnostic evaluation. In a large M- CHAT study [28] of 18,989 toddlers in the US, of the 61 percent who screened positive on M-CHAT and MCHAT-Revised/Follow up, 54 percent had Autism, and 98 percent were identified to have clinically significant developmental concerns needing intervention. M-CHAT (total cut off score >=7) can be used as an effective screening instrument to identify those at risk and needing further evaluation.

Child Development Surveillance and Screening in Australia, Canada and the United Kingdom

The approach for developmental surveillance and screening varies across different national health systems. In the Australian state of New South Wales (NSW), parents are provided the Personal Health record (PHR) (commonly known as the 'Blue book') at birth that has information on the recommended health and developmental checks. Child and Family Health Nurses (CFHNs) are primarily responsible for provision of health and developmental screening for children during the first five years of age. GPs are advised to offer developmental screening, which does not attract any specific funding. The Parents' Evaluation of Developmental Status (PEDS), a ten-item parent -completed standardised questionnaire, is included in the PHRs to be completed at 6, 12, 18 months and at two, three and four years of age. Parents are encouraged to complete the PEDS in the Blue book and discuss any concerns with the CFHNs or GPs during health checks or immunisation visits. [29,30] M -CHAT and Developmental Behaviour Checklist (DBC), a parent-completed questionnaire of emotional and behavioural problems that include an autism screening algorithm for child aged 18–48 months are also recommended.[31] In Canada (Ontario), developmental surveillance is recommended at every review. Milestones listed in Rourke baby record and Nipissing developmental screen are promoted. M- CHAT is used in response to concerns at 18-24 months.[30] In the United Kingdom, developmental surveillance based on parental concerns and structured observations is conducted during four home child health visits by a health worker as part of the Healthy Child Program. A validated developmental questionnaire (ASQ, M-CHAT) is used if initial surveillance indicates a possible concern.[30]

Child Development Surveillance in Singapore

In Singapore, child development screening is part of the Child Development Surveillance Program and aims to identify developmental concerns and early developmental delays. Every child is scheduled to be seen for developmental screening at seven recommended touchpoints, from one month to five years. (Table 2) A physical examination of the child is required at the recommended four weeks, 3, 12, 18 and 48 months to check for medical issues. AAP's last recommended screening is at 30 months of age, but the gap between 30 months and school entry at age seven was considered to be too wide for the Singapore context hence a touchpoint was added at 48 months. Currently, the recommendations in Singapore do not include the use of standardised developmental screening tools. Instead, the developmental checklists in the parent-held Child Health Booklet, which are based on validated items in the Denver Developmental Screening Test (DDST), Singapore are recommended. [32] These can be used to ensure that children achieve their key milestones at the appropriate ages and to identify those who do not. The checklists screen for development in four areas - gross motor, fine motor- adaptive, language, and personal-social. As the cut-offs in the development checklist indicate 90th percentile norms (i.e. 90 percent of Singaporean children will achieve the milestone at the indicated

age), special attention needs to be paid to children who do not achieve their appropriate milestones. Section C in the Guidelines on Childhood Developmental Screening (CDS) for primary care clinicians provides recommendations for follow up actions. Key additional considerations for early referrals for motor concerns include a child who cannot sit unsupported at 12 months or stand unsupported at 18 months.

An important role of the primary care clinician is to guide how parents can stimulate their children at home, especially those at risk or with developmental delay. There are specific topics that should be discussed with parents. e.g. child safety issues should always be discussed with the help of the child safety lists on pages 52-54 of the health booklet. Some topics are relevant at specific ages, e.g. management of temper tantrums can be discussed in the second year of life when the 'terrible two's' begin. When there are developmental concerns, parental stimulation at home is important. A list of topics and the available resources can be found on pages 5 and 6 of the guidelines.

Several ongoing research projects will help to determine the need for and type of standardised developmental tools at a primary health care level. In addition, they will determine the need for further improvements in the current surveillance structure, in order to identify earlier the children who may need further assessment and/or intervention. To improve early identification of autism, online screening tools are being assessed as an alternative to MCHAT in Singapore. Until then, the autism red flags listed as "parental concerns" in the coloured boxes in the developmental pages of the Health Booklet should be used. These steps are necessary to establish a Child Developmental Surveillance system that is suitable for Singapore, where the vast majority of children are managed by family practitioners.

Table 2. Recommended Touchpoints for Child Development Screening in Singapore

Recommended touchpoints for CDS	(Age Range)
4 weeks	4 – 8 weeks
3 months	3 – 5 months
6 months (physical examination if deemed necessary)	6 – 12 months
12 months	
18 months	15 – 22 months
30 months	24 – 36 months
48 months	48 – 60 months

KKH - KK Women's and Children's Hospital; NUH - National University Hospital; UNHS - Universal Newborn Hearing Screen

What happens when a child is referred?

When a child is referred for developmental concerns, the specialist will undertake a detailed developmental, medical, family and social history (Fig. 4),[33,34] observe the behaviour and examine the child for underlying causes. A developmental screening test[35] or a formal assessment tool[34] will also be undertaken to ascertain the severity of the developmental delay. The assessment will establish the developmental profile of the child, strengths and weaknesses and ongoing risk factors. Developmental paediatricians work as part of a multi-disciplinary team comprising of therapists, social worker, and psychologists to make a diagnosis or formulation and offer a co-ordinated plan of intervention and support to child and family. Intervention is provided by the hospitals, by community organisations or a combination of both.

Figure 5. Structured history taking to identify the underlying cause of developmental delay[33]

Antenatal history
• Maternal health: any medical condition, use of medications, drugs, smoking, alcohol consumption, presence of any infections in pregnancy (TORCH, ZIKA)
Birth and neonatal history
• Gestational age at birth, birth weight, Apgar scores, perinatal events, newborn blood spot results, • Universal newborn hearing screen results
Developmental milestones
• Current functioning of the child across the various developmental domains (gross motor, fine motor and vision, language and hearing, personal– social skills including activities of daily living)
• Play (solitary vs. parallel vs. interactive play, choice of toys)
• Atypical development, e.g. perseverance/obsessions/ compulsions, rigidity and poor task transitioning, motor mannerisms, sensory issues, atypical language (echolalia, odd prosody)
• Behaviour in different settings, e.g. home vs. school
• School performance, e.g. academics, behaviour, socialisation skills with peers, reports from teachers
• Reports from professionals working with the child, e.g. external therapists
• Early temperament in infancy, e.g. social responsiveness, feeding, sleeping, crying
• History of any developmental regression
• Dietary history, sleep habits
Social history
• Main caregiver(s) spoken language at home, medical illnesses (especially mental wellness) in the family, recent stressors, domestic violence, financial difficulty, any past
Physical examination
• Growth parameters (weight, height, occipitofrontal circumference)
• Dysmorphism
• Neurocutaneous stigmata
• Systemic examination
• Full neurological examination (tone, reflexes, gait, cranial nerves, cerebellar)
• Spine, hips
• Behavioural observations during consult
• Hearing and vision assessment

CONCLUSION

Developmental delay is common and may indicate an underlying cause. Early identification and referral for early intervention before three years of age is crucial. Primary care physicians play an important role in early identification and family centred support of healthy child development and make appropriate referrals when needed. Parents should be encouraged to monitor their child's development by the completion of developmental checklists in the health booklet.

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LEARNING POINTS

- **Majority of children develop normally and follow the same sequence with minor variation in development.**
- **Early detection of developmental delay and early intervention improves long term outcomes especially if started before three years of age.**
- **General practitioners play a vital role in developmental surveillance and screening that includes family centred care in supporting healthy development.**
- **Parents play an important role in the child's development and should be strongly advised to complete the developmental checklists in health booklet as well as to actively stimulate their child's development.**