Positive Screening on the Modified Checklist for Autism in Toddlers (M-CHAT) in Extremely Low Gestational Age Newborns

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Objective To test the hypothesis that children born preterm are more likely to screen positive on the M-CHAT for an autism spectrum disorder.

Study design We compared the M-CHAT positive rate of those with cerebral palsy, cognitive impairment, and vision and hearing impairments to those without such deficits.

Results Relative to children who could walk, the odds for screening positive on the M-CHAT were increased 23-fold for those unable to sit or stand independently and more than 7-fold for those requiring assistance to walk. Compared with children without a diagnosis of cerebral palsy, those with quadriparesis were 13 times more likely to screen positive, and those with hemiparesis were 4 times more likely to screen positive. Children with major vision or hearing impairments were 8 times more likely to screen positive than those without such impairments. Relative to those with a Mental Development Index (MDI) of >70, the odds for screening positive were increased 13-fold for those with an MDI of <55 and more than 4-fold for those with an MDI of 55 to 69.

Conclusions Major motor, cognitive, visual, and hearing impairments appear to account for more than half of the positive M-CHAT screens in extremely low gestational age newborns. Even after those with such impairments were eliminated, 10% of children—nearly double the expected rate—screened positive. *(J Pediatr 2009;154:535-40)*

The Council on Children with Disabilities of the American Academy of Pediatrics recommends that pediatricians screen for an autism spectrum disorder (ASD) if there are concerns about a child's development.[1] One ASD-specific screening tool is the Modified Checklist for Autism in Toddlers (M-CHAT).[2] When the M-CHAT was used as a screen in unselected children during well-child care visits between age 16 and 30 months, 5.7% screened positive for ASD.[3] In contrast, we found that 21% of infants born before the 28th week of gestation screened positive for ASD on the M-CHAT.[4] Four previous studies found that children born preterm are at greater risk for an autism diagnosis than children born at term,[5-8] and 2 other studies detected an association between low birth weight and increased risk of an autism diagnosis.[9,10] A recent study reported an increased rate of positive screening for ASD on the M-CHAT in a selected low birth weight cohort.[11]

Two compatible explanations for this apparently very high rate seem plausible. One is that extremely low gestational age newborns (ELGANs) are at increased risk for ASD. The other is that developmental impairments other than ASD (for which ELGANs are at increased risk)[4,12-14] increase the frequency of positive screens. For example, the parent of a child with severe motor impairment might mark as abnormal such items on the M-CHAT screen as "does not point to indicate interest" or "does not bring objects to you," 2 of the critical items on the M-CHAT, even though the child may demonstrate no language or social impairment. In the present study, we evaluated the extent to which

ASD	Autism spectrum disorder	M-CHAT	Modified Checklist for Autism in Toddlers
BSID-II	Bayley Scales of Infant Development, 2nd edition	MDI	Mental Development Index
		PDI	Psychomotor Development Index
CP	Cerebral palsy	PPV	Positive predictive value
ELGAN	Extremely low gestational age newborn	VABS	Vineland Adaptive Behavior Scales
GMFCS	Gross Motor Functional Classification System		

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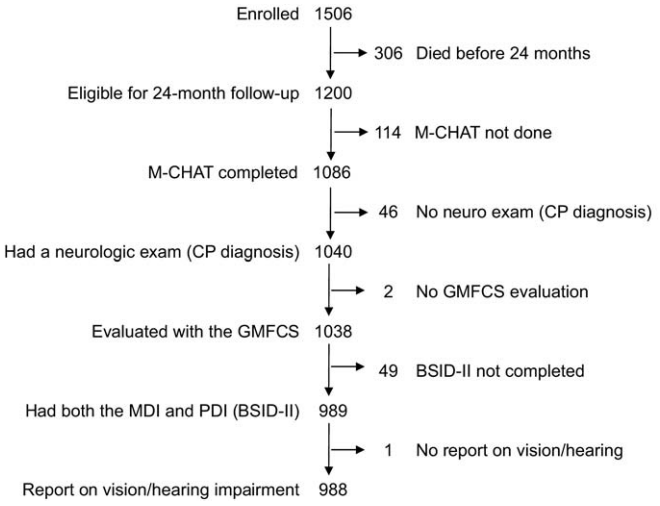

Figure. Sample description.

developmental impairments contribute to the risk of screening positive for ASD on the M-CHAT.

METHODS

The ELGAN Study

The ELGAN Study was designed to identify characteristics and exposures that increase the risk of structural and functional neurologic disorders in ELGANs. During the years 2002 to 2004, women delivering before 28 weeks gestation at 1 of 14 participating institutions in 11 cities in 5 states were invited to enroll in the study. The enrollment and consent processes were approved by the individual institutional review boards.

Mothers were approached for consent either on antenatal admission or shortly after delivery, depending on clinical circumstances and institutional preference. A total of 1249 mothers of 1506 infants consented; 257 women were either missed or did not consent to participate.

The 24-Month Developmental Assessment

Some 77% of the participants underwent developmental assessment within 23.5 to 27.9 months; of the others, about half were assessed before 23.5 months, and the other half were assessed after 27.9 months. Of the 1200 children who survived to 24 months corrected age, 988 underwent a complete developmental assessment that included a neurologic examination, a Gross Motor Functional Classification System (GMFCS) assessment, a Bayley Scales of Infant Development, 2nd edition (BSID-II) assessment, and several parent-reported assessments, including the M-CHAT (Figure). The parent or other caregiver who brought the child for the 24-month developmental assessment was also interviewed to complete a standardized 60-item interval medical history form. Questions included whether the child had a hearing problem and, if so, whether he or she needed a hearing aid or special services for hearing impairment, and whether the child had a vision problem or was considered legally blind.

M-CHAT

The M-CHAT asks the parent or other caregiver to report on 23 behaviors. A child was considered to screen positive if 2 of the 6 "critical" items (items 2, 7, 9, 13, 14, and 15) or 3 of any of the 23 total items were abnormal (Table I). Of the 23 items, 6 require a reasonably intact motor system (items 3, 6, 7, 9, 13, and 16), 13 require visual competence (items 2, 4, 5, 6, 7, 8, 10, 12, 13, 15, 17, 22, and 23), and 4 require intact hearing (items 11, 14, 20, and 21).

Cerebral Palsy

The clinicians who performed the neurologic examinations studied a manual, a data collection form, and an instructional CD designed to minimize examiner variability, and they demonstrated acceptably low variability.[15] The topographic diagnosis of cerebral palsy (CP) (ie, quadriparesis, diparesis, or hemiparesis) was based on an algorithm.[4] Those performing the neurologic examinations also completed the GMFCS form, assigning each child in the cohort to a level of gross motor function.

BSID-II

Certified examiners administered and scored the BSID-II.[12,16] All of the examiners had previous experience with the BSID-II and attended a 1-day workshop, at which the published guidelines for test administration and videotaped examinations were viewed and discussed. The examiners were aware of the infants' enrollment in the ELGAN Study but were not informed of any specifics of their medical history. Before testing, the examiner was informed of the child's corrected age. After completion of testing, the examiner was informed of the child's birth date, so that the unadjusted BSID-II Mental Development Index (MDI) and Psychomotor Development Index (PDI) scores could be obtained.

When a child's impairments precluded administration of the BSID-II, or when more than 2 items were omitted or judged to be "unscorable," the child was classified as nontestable on that scale. The Adaptive Behavioral Composite of the Vineland Adaptive Behavior Scales (VABS) was obtained for 26 of the 33 children who were considered nontestable with the BSID-II MDI. Of the 38 infants who were nontestable with the BSID-II PDI, 32 were assessed with the VABS Motor Skills domain. These children's scores on the Adaptive Behavioral Composite and the VABS served as the basis for imputation of the BSID-II scores.

Data Analysis

Among the candidate preterm-associated dysfunctions that possibly may account for the high rate of positive screens are those associated with motor, vision, hearing, and cognitive impairments. We compared the rates of motor, vision, hearing, and cognitive impairments between the children who screened positive and those who screened negative on the M-CHAT. We also evaluated the frequency with which items from the M-CHAT requiring intact motor, vision, and