Evaluation of Early Childhood Social-Communication Difficulties in Children Born Preterm Using the Quantitative Checklist for Autism in Toddlers

Hilary S. Wong, MRCPCH, MSc[1], Angela Huertas-Ceballos, MSc, FRCPCH[2], Frances M. Cowan, PhD, FRCPCH[1], and Neena Modi, MD, FRCPCH[1], on behalf of the Medicines for Neonates Investigator Group*

Objectives To characterize early childhood social-communication skills and autistic traits in children born very preterm using the Quantitative Checklist for Autism in Toddlers (Q-CHAT) and explore neonatal and sociodemographic factors associated with Q-CHAT scores.

Study design Parents of children born before 30 weeks gestation and enrolled in a study evaluating routinely collected neurodevelopmental data between the post-menstrual ages of 20 and 28 months were invited to complete the Q-CHAT questionnaire. Children with severe neurosensory disabilities and cerebral palsy were excluded. Participants received neurodevelopmental assessments using the *Bayley Scales of Infant and Toddler Development, 3rd edition* (Bayley-III). Q-CHAT scores of this preterm cohort were compared with published general population scores. The association between Bayley-III cognitive and language scores and neonatal and sociodemographic factors with Q-CHAT scores were examined.

Results Q-CHAT questionnaires were completed from 141 participants. At a mean post-menstrual age of 24 months, the Q-CHAT scores of the preterm cohort (mean 33.7, SD 8.3) were significantly higher than published general population scores (mean 26.7; SD 7.8), indicating greater social-communication difficulty and autistic behavior. Preterm children received higher scores, particularly in the categories of restricted, repetitive, stereotyped behavior, communication, and sensory abnormalities. Lower Bayley-III language scores and non-white ethnicity were associated with higher Q-CHAT scores.

Conclusions Preterm children display greater social-communication difficulty and autistic behavior than the general population in early childhood as assessed by the Q-CHAT. The implications for longer-term outcome will be important to assess. *(J Pediatr 2014;164:26-33)*.

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The risk for autism spectrum disorders (ASD), which are characterized by impairments in communication, reciprocal socialization, and repetitive behavior,[1,2] is significantly higher among children born preterm compared with their term-born counterparts.[3,4] The estimated prevalence of ASD has been reported to be 5% in children born weighing less than 2000 g[4] and 8% in children born at <26 weeks gestation.[3] This represents an approximate 10-fold increase over the 2-9 per 1000 prevelance estimate in the general population.[5,6] Reported risk factors common among preterm children that are associated with autism include multiple birth, small for gestational age, and birth by cesarean delivery.[7,8]

Since 2007, the American Academy of Pediatrics has recommended universal ASD-specific screening of all children at 18 to 24 months of age.[9] However, the pattern of early development of social-communication skills and autistic traits among children born preterm and, hence, the applicability of the recommended screening tools, is unknown. Several authors have studied the use of the Modified Checklist for Autism in Toddlers (M-CHAT) in the high-risk preterm population. The M-CHAT consists of binary items that dichotomize children into 'high risk' or 'low risk' for autism. Using the M-CHAT, high positive screening rates of 25% in very low birth weight (<1500 g) infants[10] and 21%-41% in infants born before 28 weeks gestation[11,12]

ASD	Autism spectrum disorders
Bayley-III	*Bayley Scales of Infant and Toddler Development, 3rd edition*
IMD	Index of multiple deprivation
M-CHAT	Modified Checklist for Autism in Toddlers
NNRD	National Neonatal Research Database
Q-CHAT	Quantitative Checklist for Autism in Toddlers

From the [1]Section of Neonatal Medicine, Department of Medicine, Chelsea and Westminster Hospital, Imperial College London and [2]Neonatal Service, University College London Hospital NHS Foundation Trust, London, United Kingdom

*A list of members of the Medicines for Neonates Investigator Group is available at www.jpeds.com (Appendix).

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were found. Although an increased rate of positive screening for autism might be expected among children born preterm, it has also become apparent that the M-CHAT is poor at differentiating autistic symptoms from neurosensory, cognitive, and motor impairments and that the specificity of screening for ASD in the preterm population is confounded by the high prevalence of these coexisting morbidities.[11-13]

The Quantitative Checklist for Autism in Toddlers (Q-CHAT) is a recent revision of the M-CHAT.[14] It is a parent-completed questionnaire consisting of updated items, with each item having a 5-point rating scale instead of a binary scoring system. Assessments of the test properties and clinical validity of the Q-CHAT are ongoing. In a preliminary report, the authors showed that the Q-CHAT scores from an unselected group of 754 toddlers aged between 17 and 26 months (mean age 21.2 months), living in Cambridgeshire, United Kingdom, followed a near-normal distribution and were significantly lower than the scores of children with ASD.[14] The quantitative nature of the Q-CHAT and the near-normal distribution of its scores make it a useful tool as an autistic trait measure. Therefore, we aimed to use the Q-CHAT at 24 months post-menstrual age (age corrected for prematurity) to characterize the social-communication skills and autistic traits in children born before 30 weeks gestation. We compared the Q-CHAT scores of the preterm cohort with the reported scores of the general population, examined correlations with the cognitive and language scores from the *Bayley Scales of Infant and Toddler Development, 3rd edition* (Bayley-III),[15] and investigated associated neonatal and sociodemographic factors.

Methods

Between June 2010 and July 2012, children born before 30 weeks gestation were invited to enroll in a larger study evaluating the reliability of routinely collected neurodevelopmental data at 2 years post-menstrual age in one of 13 participating hospitals (the United Kingdom Clinical Research Network Study Portfolio ID 8626). The 13 study sites included hospitals within the North-East and North-West London Neonatal Networks, St. Thomas' Hospital in South-East London, and Addenbrooke's Hospital in Cambridge, United Kingdom. The study received approval from the Royal Free Hospital National Research Ethics Committee (10/H0720/35). Children from non-English speaking families whose parents required interpretation of the English language were excluded for the following reasons: (1) no provision for English translation was available to ensure that informed consent was obtained; (2) it was not possible to conduct the Bayley-III neurodevelopmental assessment reliably; and (3) the parents would not be able to complete the Q-CHAT questionnaire independently.

In addition to their routine follow-up assessment, all participants had a Bayley-III assessment and a standardized neurologic examination, based on the Hammersmith Infant Neurological Examination,[16] conducted by a single trained assessor (H.W.) who was blinded to the past medical history of the child. The Bayley-III includes assessments of cognitive and language domains. For each domain, a composite score standardized to a mean 100 and SD 15 was calculated using the participant's post-menstrual age at the time of assessment. The language composite score was converted from combining subscale scores, which were standardized to a mean 10 and SD 3, from the receptive communication and expressive communication subtests.

Q-CHAT

The parents of all participants were sent the Q-CHAT questionnaire prior to the appointment for the neurodevelopmental assessment. If the questionnaire was not completed by the time of the appointment, the parents were given a further copy of the questionnaire and asked to return it by mail. Parents were asked to complete the questionnaire independently at home rather than at the appointment in order to minimize information bias that may result from subjective influence from the researcher.

To reduce the potential confounding effect of coexisting neurosensory and physical impairments on the association between preterm birth and Q-CHAT scores, for the purpose of assessing the applicability of the Q-CHAT for the majority of children born preterm, we excluded children with cerebral palsy and severe neurosensory impairments (defined as a hearing deficit not correctable with hearing aids or a visual deficit not correctable with glasses).

All returned questionnaires were scored according to the methods described by the research team who developed the Q-CHAT.[14] Each of the 25 items was scored using a 5-point Likert scale (0-4 points) with higher scores indicating a higher frequency of autistic behavior. Responses that were ambiguous or incomplete were scored 0, in accordance with the conservative approach adopted by the developers of the Q-CHAT. Questionnaires with more than 6 incomplete responses were excluded. The scores from all items were summed to obtain a total Q-CHAT score within a possible range of 0-100.

To examine different aspects of autistic behavior, we classified the Q-CHAT items into categories that explored social-relatedness (9 items), restricted, repetitive, stereotyped behavior (9 items), communication (4 items), and sensory abnormalities (3 items), based on the nature of the questions.

Neonatal and Sociodemographic Data Collection

The following neonatal and sociodemographic factors were identified a priori for analysis as possible variables associated with Q-CHAT scores: birth gestation, birth weight z-score, sex, single vs multiple pregnancy, ethnicity (white/non-white), maternal age, mode of delivery, length of mechanical ventilation, supplemental oxygen requirement at 36 weeks post-menstrual age, received breast milk during neonatal unit stay, and index of multiple deprivation (IMD). Multiple deprivation relates to the concurrent occurrence of several forms of social and economic disadvantage. The IMD is a summary measure of relative area deprivation, calculated