# Early Findings of Preventive Child Healthcare Professionals Predict Psychosocial Problems in Preadolescence: The TRAILS Study

Merlijne Jaspers, MSc, Andrea F. de Winter, PhD, Gea de Meer, MD, PhD, Roy E. Stewart, PhD, Frank C. Verhulst, MD, PhD, Johan Ormel, PhD, and Sijmen A. Reijneveld, MD, PhD

**Objective** To develop and validate a prediction model for psychosocial problems in preadolescence using data on early developmental factors from routine Preventive Child Healthcare (PCH).

**Study design** The data come from the 1692 participants who take part in the TRacking Adolescents' Individual Lives Survey, a longitudinal study. Information on early developmental factors (ages 0 to 4 years) was collected from the PCH file. Parents complete the Child Behavior Checklist when their child is age 11. To examine the predictive value of PCH-registered developmental factors on preadolescent problems, several multiple logistic regression analysis were performed, in a derivation sample (n = 1058). The predictive performance of the models was then assessed with area under the curve (AUC) in a validation sample (n = 643) to evaluate the validity of these models.

**Results** PCH-registered behavioral problems, attention/hyperactivity problems, enuresis, education level of the father, and being male were found to significantly predict externalizing problems (odds ratios [OR] between 1.4 and 3.7). Internalizing problems were predicted by maternal smoking during pregnancy, sleep problems, and being male (ORs between 1.7 and 3.0). The model for externalizing problems had a modest discriminatory power (AUC 0.66, 95% confidence interval 0.59-0.72). However, for internalizing problems the AUC was 0.54 (95% confidence interval 0.47-0.60), indicating poor discriminatory power.

**Conclusions** Findings on early development as registered by PCH are modestly predictive for externalizing problems in preadolescents, but only slightly for internalizing problems. *(J Pediatr 2010;157:316-21)*.

The psychosocial (emotional and behavioral) problems of children and adolescents are a major burden for children, their parents, and others in the environment. There is now substantial evidence that some psychosocial problems have an early age of onset, coupled with high levels of recurrence over the course of life.[1-4] The period from conception until school age is considered extremely important for children's development and especially their socioemotional development, which affects psychosocial functioning later in life.[5,6] Consequently, early detection and treatment of psychosocial problems may considerably improve prognosis. Several reviews have emphasized the need for early detection and subsequent adequate treatment to prevent negative health effects.[7-9]

Community pediatric services that offer routine healthcare services to the young population as a whole, such as those in the United States and Europe, occupy a unique position in terms of early detection of psychosocial problems in children. In the Netherlands, preventive child healthcare (PCH) provides health and developmental monitoring to all Dutch children from birth until age 19, and the participation rate is more than 90%.[10] Identification of children with psychosocial problems is one of the explicit tasks of PCH, along with checking a wide range of factors as part of its routine health monitoring.

Detection of psychosocial problems in children is less than satisfactory, with many early psychosocial problems going undetected.[10,11] The aim of this study was to develop and validate a prediction model for psychosocial problems during preadolescence with data on early developmental factors found in routine PCH. This study used routine data from PCH to predict psychosocial problems in a community-based sample of children.

## Methods

The TRacking Adolescents' Individual Lives Survey (TRAILS) is a prospective cohort study among Dutch children from 10 to 12 years of age that focuses on adolescent psychosocial development and mental health.[12] The TRAILS target sample was recruited in 2001 from elementary schools in 5 municipalities in the northern part of the Netherlands.[12,13] Out of all the children approached for enrollment in the

| | |
|---|---|
| AUC | Area under the curve |
| CBCL | Child Behavior Checklist |
| CI | Confidence interval |
| OR | Odds ratio |
| PCH | Preventive child healthcare |
| TRAILS | TRacking Adolescents' Individual Lives Survey |

From the Departments of Health Sciences (M.J., A.W., G.M., R.S., S.R.) and Psychiatry (J.O.), University Medical Center Groningen, University of Groningen, the Municipal Health Service Fryslân (G.M.), Leeuwarden, and the Department of Child and Adolescent Psychiatry, Erasmus MC-Sophia Children's Hospital (F.V.), Rotterdam, The Netherlands

Funding and conflict of interest information available at www.jpeds.com (Appendix).

 10.1016/j.jpeds.2010.02.015

study (n = 3145), 6.7% were excluded because of mental or physical incapability or if no Dutch-speaking parent or parent surrogate was available. Of the remaining 2935 children, both children and parents of 76.0% (n = 2230, mean age = 11.09, SD = 0.56, 50.8% girls) of them agreed to participate. Responders and nonresponders did not differ with respect to the prevalence of teacher-rated problem behavior nor in terms of associations between sociodemographic variables and mental health outcomes.[13]

Written informed consent was given by 2139 (96%) parents to retrieve their child's file from the PCH. From these, 84.9% could be traced (n = 1816 PCH files, mean age = 11.06, SD = 0.54, 50.9% girls). Children with and without a PCH file differed with statistical significance for prevalence of parent-rated behavior problems (14.4% for the retrieved vs 20.0% for the non-retrieved, $P < .05$) but did not differ with statistical significance with respect to the prevalence of parent-rated emotional problems (16.6% vs 18.2%, respectively). This study was approved by the national ethical medical committee.

## Measures

Information on predictors had previously been collected by community physicians and nurses (PCH professionals) as part of the routine procedure of PCH. The assessments included a general physical examination, standardized screening procedures and a semi-structured interview with parents concerning health status and physical, emotional and behavioral developmental problems, all of which were documented in the PCH file. An assessment generally takes approximately 10 to 15 minutes. As potential predictors, we selected early childhood behaviors, prenatal and perinatal factors, and sociodemographic variables from the PCH file.

## Early Childhood Problems

Early childhood problems entailed PCH-registered behavioral features at age 4 (mean age = 3.88 years, SD = 0.15), from which we distinguished "sleeping, eating, and enuresis problems" and "emotional and behavior problems." During PCH visits, the PCH professional inquired into these problems with questions such as: "How is your child doing in terms of eating?," "How is your child doing in terms of sleeping?," and "How is your child doing in terms of toilet-training?" Descriptions of these behaviors were categorized as "yes" in case of problems and "no" or "missing." "Emotional and behavior problems" were collected from 2 open questions in the PCH files, namely, "How is the child's behavior?" and "How is the child's social behavior?" about which parents could provide one or more descriptions such as "overactive," "shy," "anxious," "social" or "aggressive" (**Table I**; available at www.jpeds.com). Eight PCH professionals independently categorized the PCH-registered descriptions—emotional, behavioral, attention/hyperactivity problems or positive social behavior—in terms of "yes," "no," or "not applicable." A PCH item could not be placed in more than one category by the PCH professionals. PCH professionals shared a very high consensus about the classification of the descriptions. The PCH descriptions were dichotomized as a "yes" if any of these were present and a "no" if none were present.

## Prenatal and Perinatal Variables

The prenatal and perinatal variables in the PCH files concerned maternal smoking during pregnancy and low birth weight (registered in grams) as provided by the obstetrician or midwife. Maternal smoking was assessed as: "Did the mother smoke during pregnancy?," dichotomized as always/never. Low birth weight was operationalized as < 2500 g, which is a standard clinical cut-off.[14]

## Sociodemographic Variables

The sociodemographic variables were the highest educational level of the father and highest educational level of the mother. We distinguished 3 groups: low (lower tracks of secondary education or less education), middle (higher tracks of secondary education), and high (university degree or more) educational levels, respectively.

## Behavioral and Emotional Problems

Behavioral and emotional problems at age 10 to 12 were assessed with the parent-completed Child Behavior Checklist (CBCL) for ages 4 to 18, an internationally validated questionnaire for emotional and behavioral problems of childhood.[15,16] In this study we used 2 broadband scales: externalizing and internalizing problems. Externalizing problems consist of the aggressive behavior and delinquent behavior syndrome scales. Internalizing problems consist of the anxious/depressed, somatic complaints and withdrawn/depressed syndrome scales. Cases were allocated to a normal score or a clinical (elevated) score, by use of the age and sex-specific 90th percentiles of the Dutch normative sample.[15,16]

## Analyses

An average of 8.8% (ranging from 1.2 to 20.3%) of the values of the potential predictors was missing. Missing data on potential predictors were labeled as a separate "unknown" category in the analysis. This was done to explore whether the missing values were missing at random in the PCH files. For the CBCL outcome measures, the number of missing data was quite low, ranging from 0 through 31, with a median of 3.0. Missing data on the CBCL were imputed with individual means by the corrected item mean imputation (CIM) with SPSS version 14 (SPSS, Chicago, Illinois). Analyses were restricted to those for whom PCH data, as well as parent-reported psychosocial problems were available (n = 1692).

First, descriptive statistics were calculated for general characteristics, developmental factors and for the outcome measures. We needed 2 data sets for our derivation and cross-validation analyses, with both sets large enough for sufficient statistical power. Because a minimum of 100 events and 100 nonevents is recommended for external validation samples,[17] and Peduzzi[18] states that ideally there should be at least 10 cases per candidate predictor, we randomly divided the total sample into 2 unequal subsamples. The derivation sample (approximately two thirds of the children, n = 1058) was used to build a predictive model. The validation sample (n = 634) was used for evaluation of the validity of the model. Statistical analyses were performed with SPSS version 14.