Emotional and Behavioral Problems of Preterm and Full-Term Children at School Entry

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abstract

BACKGROUND AND OBJECTIVES: Preterm children, compared with term children, are at increased risk of emotional and behavioral problems (EB-problems). Prevalences of EB-problems seem to vary with degree of prematurity and age at assessment. We therefore assessed individual stability of EB-problems in preterm compared with term children first before school entry and again 1 year after school entry, and variation in stability within the preterm group.

METHODS: We used data of 401 early preterm (25–31 weeks' gestational age), 653 moderately preterm (32–35 weeks' gestational age), and 389 term children from the Longitudinal Preterm Outcome Project cohort study. We classified EB-problems based on the Child Behavior Checklist at ages 4 and 5; this resulted in 4 categories: consistently normal (2 normal scores), emerging (normal score at age 4 and clinical/subclinical score at age 5), resolving, and persistent EB-problems.

RESULTS: All preterm children had higher rates than term children of persistent (7.2% vs 3.6%), emerging (4.3% vs 2.3%), and resolving (7.5% vs 3.6%) EB-problems. Early preterm children had the highest rates of persistent (8.2%) and emerging (5.2%) problems, and moderately preterm children had the highest rates of resolving problems (8.7%). In both preterm and term children, predictive values of normal scores at age 4 for normal scores at age 5 were ~96%, and of clinical/subclinical scores at age 4 for clinical/subclinical scores at age 5 were ~50%, except for early preterm children (60%).

CONCLUSIONS: Compared with term children, all preterm children are at risk for persistent and changing EB-problems at school entry; individual stability, however, is difficult to predict based solely on the factor of preterm-birth.

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Ms Hornman conceptualized the study, designed and carried out the analysis, interpreted the data, and drafted the initial manuscript; Drs de Winter, Kerstjens, Bos, and Reijneveld conceptualized the study and analysis, interpreted the data, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Preterm children are at increased risk of emotional and behavioral problems compared with term children. Prevalences vary with degree of prematurity and assessment age. Unknown is whether stability of these problems at school entry differs between preterm and term children.

WHAT THIS STUDY ADDS: Preterm children have higher rates of persistent and changing emotional and behavioral problems at school entry than do term children. Problems in early preterm children are more persistent and in moderately preterm children more resolving.

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Approximately 11% of all children worldwide are born at <37 weeks' gestational age (GA), and the percentage of preterm children is growing.[1,2] Preterm birth has various adverse effects on children's development during childhood, including increased risks of motor,[3,4] cognitive,[5,6] emotional, and behavioral problems.[5–7] In preterm children, prevalence rates of emotional and behavioral (EB) problems vary between 8% and 39%, depending on their GA; in term children, these rates vary between 5% and 10%.[8] Preterm children have increased risks of both internalizing and externalizing problems.[5,6,8,9] More specifically, they have increased risks of attention problems, hyperactivity, anxiety/depression, social problems, and somatic complaints.[5,6,8,9]

Many studies have determined the long-term risks of EB problems for preterm children at 1 specific time point, but less is known about the stability of these problems over time.[8] Literature on this subject demonstrates higher rates of persistent EB problems for preterm children <32 weeks' GA (early preterm children) and/or for extremely low birth weight children.[10–13] Preterm children between 32 and 36 weeks' GA (moderately preterm children) may, on the other hand, have no more persistent problems than term children between ages 4 and 12.[13,14] Although these studies give insight into persistent problems of preterm children, evidence on emerging and resolving problems is scarce. Furthermore, these study populations not only included children with a low GA but also children with only a low birth weight.[10,11] It is therefore difficult to determine from these studies the specific influence of prematurity and GA, rather than small for gestational age (SGA), on the stability of EB problems.

More evidence about the stability of EB problems in preterm children is needed to determine differences between preterm and term children. This evidence may help to determine before school entry which children are likely to have increased risks of EB problems when attending school. Consequently, earlier detection of EB problems in preterm children could facilitate early interventions, increasing the likelihood of successful school entry. We therefore assessed individual stability of EB problems in preterm children compared with term children first before school entry and again 1 year after school entry, as well as variation in this stability within the preterm group.

METHODS

Study Design, Participants, and Procedure

This study was part of the Longitudinal Preterm Outcome Project (LOLLIPOP), a Dutch cohort study that focuses on the growth and development of moderately preterm children. The LOLLIPOP study was approved by our local institutional review board. From a community-based preventive child health care cohort of 45 455 children born in 2002 and 2003, we sampled all children with a GA <36 weeks. For every second preterm child sampled, we selected for comparison the next term child (38.0–41.9 weeks' GA) from the same preventive child health care cohort. The cohort was expanded with early preterm children (<32 weeks' GA) born in 2003 who had been admitted to any of 5 of the 10 NICUs in the Netherlands. Children were included at ages 43 to 49 months at their last routine well-child visit before starting school. A total of 677 children (20.4%) refused to participate, could not be traced, or missed the invitation. Furthermore, 112 children (3.4%) were excluded because of major congenital malformations, congenital infections, or syndromes (n = 28), an unclear or missing GA (n = 37), lost to follow-up (n = 27), or other reasons (n = 20).[15] The total LOLLIPOP sample included 2517 children (76.1% of the original sample): 698 early preterm children (among which 434 from the NICU enrichment), 1145 moderately preterm children, and 674 term children.[4]

A month before the child's well-child visit at age 43 to 49 months, parents received written information about the LOLLIPOP study as well as the Child Behavioral Checklist (CBCL) and a questionnaire about family and perinatal characteristics.[16] Parents returned the completed questionnaires at their well-child visit. After obtaining informed parental consent, we retrospectively recorded perinatal characteristics taken from discharge letters of child and mother, as well as information from birth registers. Data were crosschecked for the different sources. As a matter of routine, children start school exactly at age 4. Approximately 4 to 6 weeks before the child's fifth birthday, thus 1 year after school entry, parents again received the CBCL, which they returned by mail.

Parents of 2013 4-year-old children completed the CBCL, and of these, 1443 again completed the CBCL when their children reached age 5. Of these 1443 children, 1054 were preterm and 389 were term. The children with a CBCL at age 4 but not at age 5 had, in comparison with the children with a CBCL at both ages, comparable rates of clinical/subclinical CBCL scores at age 4 (15.4% vs 12.7%, P = .10), but their parents more frequently had a low education level (29.2% vs 14.9%, P < .001). Rates of loss to follow-up were similar for preterm and term children (28.0% vs 29.3%, P = .60).

Measures

EB Problems: CBCL

EB problems were measured using the validated Dutch version of the CBCL, applicable for ages 1.5 to 5 years.[16,17] The Dutch CBCL has good psychometric properties, also for non-Netherlands-born parents,[18] and is widely used in diverse service settings and in research.[16–18] The checklist consists of 99 problem items. Each item can be rated by the parent as not true (0), somewhat/sometimes true (1), or very/often true (2). From these ratings, total, internalizing, and externalizing problem scales were constructed. These problem scales were classified into 2 categories: normal (<84th percentile) and subclinical/clinical (≥84th percentile).[16]

The dichotomized CBCL outcomes at ages 4 and 5 years were combined, resulting in 4 categories: consistently normal, emerging problems, resolving problems, and persistent clinical/subclinical problems. The consistently normal group had normal scores at both ages, the emerging problems group had a normal score at age 4 and a clinical/subclinical score at age 5, the resolving problems group had an abnormal score at age 4 and a normal score at age 5, and the persistent problems group had abnormal scores at both ages.

GA

GA in >95% of the cases was based on early ultrasound measurements and measured in completed weeks. In the remaining cases, only clinical estimates based on last menstrual date were available; these were checked against clinical estimates of GA after birth. Children who's GA could not be confirmed were excluded. In this study, the preterm children were categorized by GA into an early preterm group (25.0–31.9 weeks' GA) and a moderately preterm group (32.0–35.9 weeks' GA).

Covariates

We selected covariates based on previous cross-sectional studies of EB problems in preterm children.[8,12,17,19,20] Perinatal characteristics were gender, being SGA, being part of a multiple pregnancy, and maternal smoking during pregnancy. SGA was determined on the basis of birth weight <10th percentile of Dutch growth charts.[21]

Family characteristics were low education of both mother and father, non-Dutch birth country of at least 1 parent or the child, multiparity of the mother, and 1-parent family. Low education was defined as primary school or less and/or low-level technical and vocational training. Multiparity referred to mothers who had gone through a previous pregnancy.

Analyses

First we tested differences in characteristics between the preterm and term children, using χ^2 and Mann-Whitney *U* tests. Second, we computed prevalence rates of persistent, resolving, and emerging total internalizing and externalizing problems for the term and the total preterm group, and we computed these rates again separately for the 2 preterm categories. Additionally, "predictive values (PVs) of a clinical/subclinical score at age 4" and "PVs of a normal score at age 4" were calculated. The PV of a clinical/subclinical score at age 4 was defined as the proportion of children with clinical/subclinical scores at age 5 from the children with a clinical/subclinical score at age 4, and the PV of a normal score at age 4 as the proportion of children with a normal score at age 5 from the children with a normal score at age 4. Third, we constructed scatterplots for preterm and term children, comparing continuous total, internalizing, and externalizing problem scores at ages 4 and 5. Fourth, we assessed risks of persistent, emerging, and resolving problems by computing the odds ratios (ORs) and 95% confidence intervals (CI) in univariable and multivariable analyses. These analyses were performed for the total preterm group and for the 2 preterm categories separately, with the term group and the consistently normal group as reference in both cases. The multivariable analyses were corrected for gender, SGA, smoking during pregnancy, being part of a multiple pregnancy, multiparity, low education level of the parents, and 1-parent family. All performed tests were 2-tailed and considered as significant with a *P* value < .05.

RESULTS

Characteristics of the preterm and term children of this study sample are presented in Table 1. Almost all characteristics differed between preterm and term children with statistical significance.

Table 2 shows the rates of persistent and changing problems and the PVs for the total preterm and term groups and the 2 preterm categories. The majority of the children scored consistently normal (83.6%), but this proportion was smaller for preterm children (81.0%) than for term children (90.5%). Compared with term children, preterm children had higher rates of persistent (7.2% vs 3.6%), emerging (4.3% vs 2.3%), and resolving (7.5% vs 3.6%) EB problems. As for the differences within the 2 preterm categories, moderately preterm children more often had resolving problems (8.7% vs 5.5%), whereas early preterm children more often had persistent (8.2% vs 6.6%) and emerging problems (5.2% vs 3.7%). As a result, the PV of a clinical/subclinical score at age 4 was higher for early preterm children and lower for moderately preterm children compared with term children (0.60 and 0.43 vs 0.50). Within the total preterm group, rates of persistent internalizing problems

TABLE 1 Characteristics of the Term and Preterm Children in This Study

	Term	Preterm	*P*
	(*n* = 389)	(*n* = 1054)	
	n (%)	*n* (%)	
GA, median (25–75 percentile)	40 (39–40)	33 (30–35)	<.001[a]
Boy	185 (47.6)	576 (54.6)	.02[a]
SGA	26 (6.7)	150 (14.2)	<.001[a]
Smoking during pregnancy	45 (11.9)	200 (19.3)	.001[a]
Twin	5 (1.3)	289 (27.4)	<.001[a]
Multiparity	244 (62.9)	315 (29.9)	<.001[a]
1-parent family	8 (2.1)	65 (6.3)	.002[a]
Low education level of both parents	46 (11.9)	169 (16.1)	.04[a]
Low education level mother	86 (22.2)	268 (25.5)	.19
Low education level father	96 (25.3)	303 (29.2)	.03[a]
Non-Dutch birth country of parent or child	18 (4.7)	86 (8.3)	.019[a]

[a] Significant *P* value.

were only slightly higher than those of persistent externalizing problems (10.7% vs 8.4%) and the rates of changing problems were comparable.

Findings on continuous-level CBCL scores showed patterns of stability and change similar to those on dichotomized CBCLs. These are shown in Fig 1, which provides scatterplots for the continuous-level CBCL scores at ages 4 versus 5 years for preterm and term children. Emerging and resolving problems were based mostly on large differences in scores between ages 4 and 5 years. For example, regarding the total score, the median difference was 21 (range 4–79).

The results of the univariable and multivariable multinomial logistic regression analyses are presented in Table 3. In both the crude and adjusted analyses, the total preterm group more often had resolving and persistent problems than did the term group. In multivariable analyses, the OR (95% CI) for resolving problems was 2.71 (1.43–5.15), and for persistent problems 2.02 (1.07–3.81). Between the 2 preterm categories, the early preterm children more often had persistent clinical/subclinical problems (OR 2.17 [1.07–4.41] vs OR 1.93 [0.99–3.74]), and the moderately preterm children more often had resolving problems (OR 3.10 [1.61–5.96] vs OR 1.94 [0.92–4.12]). In both the total preterm group and the 2 separate preterm categories, externalizing problems were more likely to emerge (total preterm group, OR 2.54 [1.21–5.32] vs 1.23 [0.72–2.09] for internalizing), and internalizing problems to resolve (total preterm group, OR 2.18 [1.16–4.09] vs 1.54 [1.21–5.32] for externalizing) in comparison with term children.

TABLE 2 Rates of Persistent and Changing CBCL Scores Between Ages 4 to 5 Years and PVs of a Normal CBCL 4-Year Score and of a Clinical/Subclinical CBCL 4-Year Score, Divided for Term and Preterm Children, and the 2 Preterm Categories

	Term	Preterm Overall	Preterms per GA Category	
	(*n* = 389)	(*n* = 1054)	Moderately Preterm	Early Preterm
			(*n* = 653)	(*n* = 401)
Total outcome				
Consistently normal, *n* (%)	352 (90.5)	854 (81.0)	529 (81.0)	325 (81.0)
Emerging problems, *n* (%)	9 (2.3)	45 (4.3)	24 (3.7)	21 (5.2)
Resolving problems, *n* (%)	14 (3.6)	79 (7.5)	57 (8.7)	22 (5.5)
Persistent clinical/subclinical, *n* (%)[a]	14 (3.6)	76 (7.2)	43 (6.6)	33 (8.2)
PV normal CBCL at age 4[b]	0.98	0.95	0.96	0.94
PV clinical/subclinical CBCL at age 4[c]	0.50	0.49	0.43	0.60
Internalizing outcome				
Consistently normal, *n* (%)	329 (84.6)	786 (74.6)	493 (75.6)	293 (73.1)
Emerging problems, *n* (%)	23 (5.9)	76 (7.2)	44 (6.7)	32 (8.0)
Resolving problems, *n* (%)	16 (4.1)	78 (7.4)	49 (7.5)	29 (7.2)
Persistent clinical/subclinical; n (%)[a]	21 (5.4)	113 (10.7)	66 (10.1)	47 (11.7)
PV normal CBCL at age 4[b]	0.98	0.91	0.92	0.90
PV clinical/subclinical CBCL at age 4[c]	0.50	0.59	0.57	0.62
Externalizing outcome				
Consistently normal, *n* (%)	340 (87.4)	833 (79.1)	507 (77.8)	326 (81.3)
Emerging problems, *n* (%)	11 (2.8)	56 (5.3)	35 (5.4)	21 (5.2)
Resolving problems, *n* (%)	21 (5.4)	76 (7.2)	55 (8.4)	21 (5.2)
Persistent clinical/subclinical, *n* (%)[a]	17 (4.4)	88 (8.4)	55 (8.4)	33 (8.2)
PV normal CBCL at age 4[b]	0.97	0.94	0.94	0.94
PV clinical/subclinical CBCL at age 4[c]	0.45	0.54	0.50	0.61

[a] Persistent clinical/subclinical = subclinical score and/or clinical score at both measurements.

[b] PV normal CBCL at age 4 = proportion of the children with a normal score at age 4 y who consistently scored normal.

[c] PV clinical/subclinical CBCL at age 4 = proportion of the children with a clinical/subclinical score at age 4 y who had persistent problems.

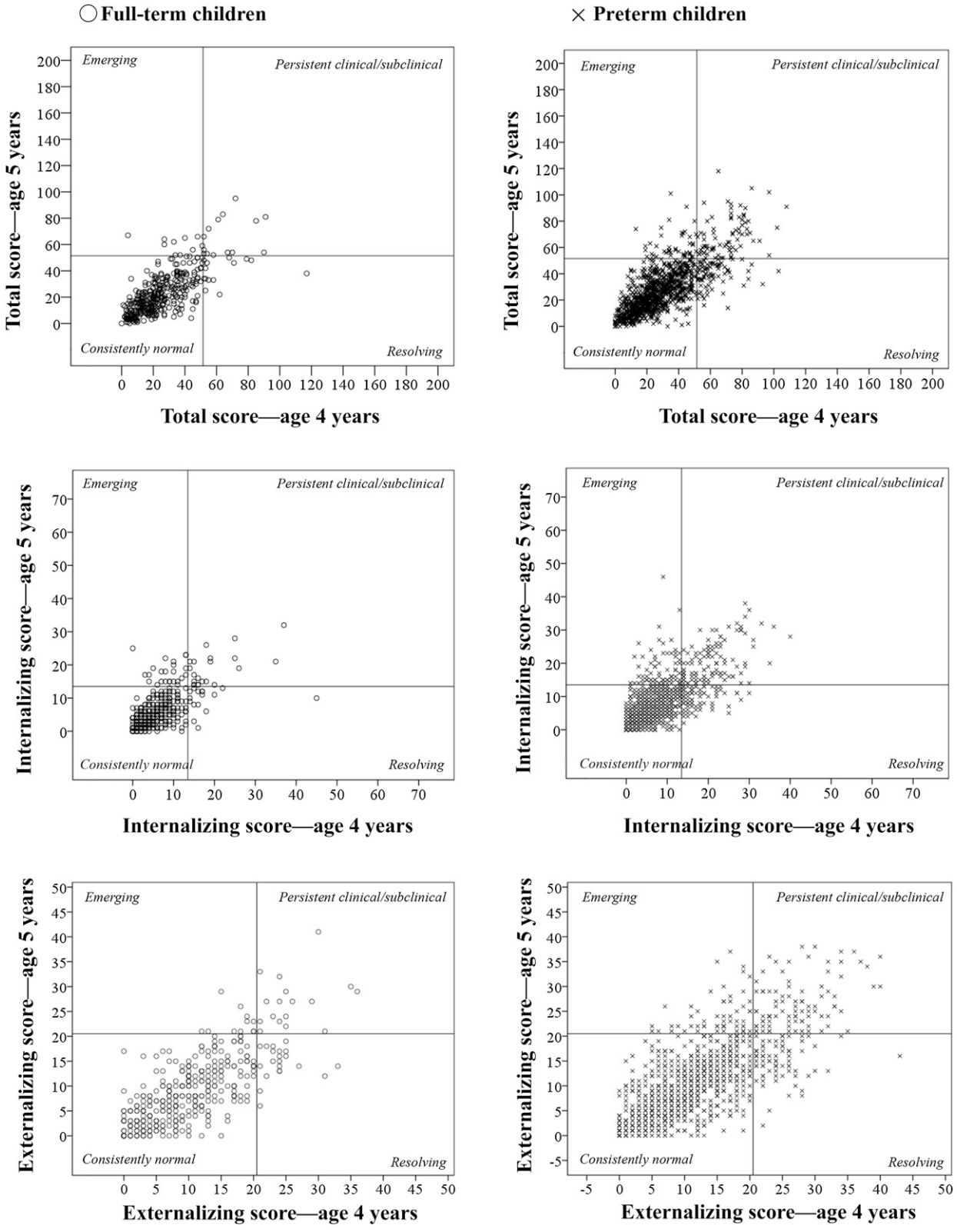

FIGURE 1

Scatterplots of the continuous total, internalizing, and externalizing CBCL scores at ages 4 and 5 years with the cutoff point for clinical/subclinical problems, divided for term (0, left plots) and preterm children (X, right plots).

TABLE 3 Likelihood of Having Emerging, Resolving, and Persistent EB Problems for Preterm Compared With Term Children, OR (CI)

	Preterm Overall (n = 1054)		Preterm per GA Category			
			Moderately Preterm (n = 653)		Early Preterm (n = 401)	
	Univariable	Multivariable	Univariable	Multivariable	Univariable	Multivariable
Total problems						
Emerging	2.06 (1.00–4.26)	1.58 (0.71–3.49)	1.17 (0.82–3.86)	1.42 (0.62–3.27)	2.53 (1.14–5.60)[a]	1.88 (0.78–4.52)
Resolving	2.33 (1.30–4.16)[a]	2.71 (1.43–5.15)[a]	2.71 (1.49–4.94)[a]	3.10 (1.61–5.96)[a]	1.70 (0.86–3.38)	1.94 (0.92–4.12)
Persistent[b]	2.24 (1.25–4.01)[a]	2.02 (1.07–3.81)[a]	2.04 (1.10–3.79)[a]	1.93 (0.99–3.74)	2.55 (1.34–4.86)[a]	2.17 (1.07–4.41)[a]
Internalizing						
Emerging	1.38 (0.85–2.24)	1.23 (0.72–2.09)	1.28 (0.76–2.15)	1.17 (0.67–2.05)	1.56 (0.89–2.73)	1.34 (0.73–2.49)
Resolving	2.04 (1.17–3.55)[a]	2.18 (1.16–4.09)[a]	2.04 (1.14–3.66)[a]	2.16 (1.13–4.15)[a]	2.04 (1.08–3.82)[a]	2.22 (1.09–4.51)[a]
Persistent[b]	2.25 (1.39–3.65)[a]	2.04 (1.21–3.45)[a]	2.10 (1.26–3.49)[a]	1.90 (1.10–3.29)[a]	2.51 (1.47–4.30)[a]	2.31 (1.28–4.17)[a]
Externalizing						
Emerging	2.08 (1.08–4.01)[a]	2.54 (1.21–5.32)[a]	2.13 (1.07–4.26)[a]	2.63 (1.23–5.63)[a]	1.99 (0.95–4.19)	2.37 (1.03–5.47)[a]
Resolving	1.48 (0.90–2.43)	1.59 (0.90–2.81)	1.76 (1.04–2.96)[a]	1.85 (1.03–3.32)[a]	1.04 (0.56–1.95)	1.07 (0.53–2.17)
Persistent[b]	2.11 (1.24–3.61)[a]	2.25 (1.26–4.03)[a]	2.17 (1.24–3.80)[a]	2.31 (1.26–4.23)[a]	2.02 (1.11–3.71)[a]	2.14 (1.10–4.15)[a]

Results of univariable and multivariable multinomial regression analyses leading to ORs and 95% CIs. Findings for the "stable normal" category are not shown because these are the complementary of the findings for the other 3 categories. Multivariable analyses were corrected for gender, SGA (<10th percentile), smoking during pregnancy, being part of a multiple, parity, educational level of the parents, and single-parent family.

[a] $P < .05$.

[b] Clinical/subclinical.

DISCUSSION

This study demonstrated that preterm children had higher rates of persistent, emerging, and resolving EB problems compared with term children, as assessed from just before school entry to 1 year after school entry. However, although preterm children had more problems, the majority of them scored consistently normal (81.0% vs 90.5% for term children). Between the preterm categories, problems were more often persistent and emerging in early preterm children, and more often resolving in moderately preterm children. Regarding both preterm and term children, clinical/subclinical problems existing before school entry were persistent after school entry in approximately half of the children. Within the total preterm group, for internalizing and externalizing problems, the rates of persistence and change were comparable.

Preterm children had higher rates of persistent EB problems, with highest rates among the early preterm children. Higher rates of persistent EB problems were also reported in studies made at school entry with early preterm children.[10–12,22] Conversely, studies by Gurka et al[14] on preterm children between 34 and 36 weeks' GA and Schothorst et al[13] on preterm children <37 weeks' GA reported no significant differences in the persistence of EB problems at age 6 to 12 years in preterm children as compared with term children. The difference between our findings and those of Gurka et al[14] and Schothorst et al[13] might partly be explained by the much smaller study sample of Gurka et al[14] (n = 53) and by the fact that both studies used a mean score instead of a dichotomized score as well as using different ages of assessment.[13,14] Further studies should determine whether moderately preterm children also have outcomes similar to those of term children at age 12, despite their higher rates of resolving problems at school entry.

An explanation for preterm children's higher rates of persistent and changing EB problems is the immaturity of their brain at birth, combined with increased risks of postnatal complications.[23–25] This disruption of brain development has important consequences for these children's long-term brain development,[26–28] including poorer school readiness skills.[29] Consequently, preterm children have fewer adaptive skills to help them learn in groups and maintain positive relationships with peers,[29–31] factors that will also influence the stability of EB problems at school entry. In addition, moderately preterm children may have fewer persistent and more resolving problems than their younger preterm counterparts because of their more mature brain at birth and their lower risk of postnatal complications[32]; they may also have better school-readiness skills than preterm children with a younger GA.[29] As a result, moderately preterm children may have more adaptive abilities to correct initial problems.[8,33] However, further studies are needed to confirm this hypothesis. Another explanation for the scores on resolving and emerging problems is that relatively high scores are more likely to be accidental and thus to return to lower values at the next measurement (ie, regression to the mean). However, such accidentally high scores would also occur in moderately preterm and term children.

Problems at age 4 were persistent after school entry in half of both the preterm and term children, and problems emerged in 2% of the term and 5% of the preterm children with

normal scores at age 4, resulting in medium PVs. These PVs were comparable with findings of previous studies of term children[34] and low birth weight (<2500 g) preterm children.[12] The latter study also showed that the preterm children with changing problems between ages 3 and 5 also frequently had changing problems between ages 5 and 8. These results and ours show that pathways of EB problems may vary per child, and that EB problems before school age are not always predictive of EB problems during school age.

Looking at a more detailed level within the total preterm group, rates of persistent problems were higher for internalizing than for externalizing problems, but externalizing problems were more likely to emerge, and internalizing problems to resolve. These findings contrast with those of Treyvaud et al,[10] who reported higher rates of persistent problems for externalizing than for internalizing problems in a preterm group below 30 weeks' GA and/or below 1250 g. Internalizing problems, such as anxiety, may resolve because the school environment may offer new opportunities for children to interact with other children, which can increase the child's self-confidence. Externalizing problems, such as behavior problems, may emerge because these problems will become an issue when children have to stick to certain rules and to perform tasks for a longer time span at school. Our results suggest that, in addition to subtle differences between the preterm categories, both internalizing and externalizing problems of preterm children were affected in a comparable way by school entry.

The strengths of our study are its large community-based sample, covering almost the whole range of GA, and the fact that these were longitudinally followed. Furthermore, we adjusted for important covariates associated with preterm birth and EB problems, such as SGA, smoking during pregnancy, and parental education levels. However, our study also has limitations. We determined only the short-term influence of attending school on EB problems, which may differ from its longer term influence. However, EB problems may change particularly at the time of school entry, when children need to be able to adapt to a new social environment.[29–31] Another limitation is that we could not adjust for interventions between or before ages 4 and 5, which might have affected persistence. Furthermore, we had no clinical diagnosis of EB problems made by a psychiatrist or psychologist. However, for EB problems the CBCL is a well-established questionnaire with excellent psychometric properties.[16,35]

This study underlines the impact of prematurity on the stability of EB problems. Earlier detection of EB problems in preterm children could facilitate early interventions, increasing the likelihood of successful school entry. Provision of additional support to them, if needed, in the school setting and timely referral to specialized care are part of the current Dutch guidelines on preterm children.[36] Such measures require a valid identification of those with the highest risks of persistent and emerging problems. It may therefore be useful to determine the influence of other factors on the stability of EB problems in preterm and term children, including interventions provided to them at school entry.

CONCLUSIONS

All preterm children had twice as many increased rates of persistent, emerging, and resolving EB problems as did term children. Among preterm children, persistence of these problems was more likely in early preterm children, and their resolution was more likely in moderately preterm children. Our results show that pathways of EB problems may vary per child and GA. This variation in persistency of EB problems for different GAs may offer opportunities to improve children's long-term outcomes also among the most vulnerable groups.

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ABBREVIATIONS

CBCL: Child Behavioral Checklist
EB: emotional and behavioral
CI: confidence interval
GA: gestational age
LOLLIPOP: Longitudinal Preterm Outcome Project
OR: odds ratio
PV: predictive value
SGA: small for gestational age

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