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USEFULNESS OF MATERNAL ASSESSMENT OF CHILDREN DEVELOPMENT BASED ON REPORTED AGE OF ACHIEVED MILESTONES

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ABSTRACT

STUDY OBJECTIVE. The aim of the study was to examine the usefulness of maternal recall of selected developmental milestones by testing their correlations with the Bayley Scales of Infant Development (BSID-II).
MATERIAL AND METHODS. Prospective cohort study. The cohort recruited prenatally, included 387 children. The BSID-II tests were carried out in each child at the end of the 12th, 24th and 36th month of life. When children were 3 years old, mothers were questioned about their child's age at attainment of 8 significant developmental milestones.
RESULTS. The infants who attained developmental milestones earlier in their first years of life were more likely to achieved a better scores on the motor scale of the BSID-II. Correlation coefficients ranged from -0.117 for bladder control to -0.424 for standing without assistance and -0.586 for walking unassisted. Correlation arose when the difference between the time of achieving a particular milestone and time of managing the BSID-II was smaller.
CONCLUSION. Our study demonstrated that maternal reports of developmental milestones of children under 3 years old are sufficiently reliable to be used in clinical judgment.

Key words: *children, developmental assessment, milestones, Bayley Scales*

Abbreviations: BSID-II - Bayley Scales of Infant Development second edition,
PDI-Psychomotor Development Index, MDI-Mental Development Index

INTRODUCTION

The evaluation of children's developmental progress is an important part of routine pediatric care. Developmental delay occurs in up to 5% of children under 5 years of age (1). Early diagnosis of the problems and intervention may successfully influence child development (2). General practitioners and pediatricians are best placed to play a central role in the early detection of developmental problems in young children. Pediatricians frequently report using developmental milestones in monitoring young children's development (3). They often rely on clinical judgment derived from observations or parental concerns to identify children with developmental problems, despite evidence that use of standardized screening tests improves detection of developmental delays. The standardized methods are expensive, time-consuming and not feasible in pediatric care, and parent information is still important in the assessment of children's development. The younger the child, the more essential is the parental information on its development and symptoms (4).

The aim of the study was to examine the usefulness of maternal recall of selected developmental milestones by testing their associations with the Bayley Scales of Infant Development (BSID-II) outcomes - a "gold standard" in assessing children's development (5).

MATERIAL AND METHODS

All of the children involved in this study were part of a larger cohort study being followed in a collaborative study with Columbia University in New York on the vulnerability of fetus and child to environmental factors. The cohort recruited prenatally included the children of non-smoking women aged 18 to 35 years, with singleton pregnancies, who had lived in Krakow for at least one year prior to pregnancy. Mothers were free from chronic diseases, HIV infection and illicit drug use. The study population included

387 children (196 boys and 191 girls) who were born in Krakow in the years 2001 to 2003 (table I).

Table I. Characteristic of the study group

		N	%
Gender	Boys	196	50.6
	Girls	191	49.4
Parity	1	250	64.6
	2+	137	37.4
Weeks of pregnancy	≤ 37 weeks	28	7.2
	38-42 weeks	358	92.5
	> 43 weeks	1	0.3
Birth weight	< 2500	11	2.8
	≥ 2500	376	97.3
Mothers age	18 - 24	74	19.1
	25 - 29	192	49.6
	30 - 34	121	31.3
Mothers education	primary or vocational school	35	9.0
	technical college	44	11.4
	high school or college	103	26.7
	university	205	53.0
Mothers work after delivery	non-working to 30th month of child	170	43.9
	beginning work between 1st and 12th month of child	155	40.0
	beginning work between 13th and 30th month of child	62	16.0

The Mental and Motor Scales of BSID-II were administered to each child at the end of the 12th, 24th and 36th months of life. When children were 3 years old, mothers were questioned about their child's age at attainment of 8 significant developmental milestones skills in the following order: lifting head while prone, sitting without support, standing without assistance, walking alone, walking upstairs, bladder trained, bowel trained and first meaningful words. The direct interview was conducted by pediatricians.

The Mann-Whitney nonparametric test was used to compare boys with girls. The Spearman rank correlation was used to establish the relationship between milestone attainment in months and score on the mental and motor scale of the BSID-II at three age levels.

Table II. BSID-II scores in gender groups

Indexes	Boys		Girls		Statistical significance
	Mean	Standard Deviation	Mean	Standard Deviation	
PDI-12th month	96.88	11.185	97.24	12.404	ns[a]
PDI-24th month	97.06	9.859	101.01	10.305	$p < 0.001$
PDI-36th month	102.16	10.358	107.13	10.108	$p < 0.001$
MDI-12th month	99.98	10.709	102.28	10.399	$p = 0.033$
MDI-24th month	98.12	11.939	105.11	13.603	$p < 0.001$
MDI-36th month	100.94	9.891	105.48	10.065	$p < 0.001$

[a] ns - non-significant

RESULTS

Characteristics of studied population was shown in table I. Girls had a significantly higher outcomes on the mental scale of the BSID-II than boys in all age groups (table II). The motor scale score of the BSID-II at the age of 24th and 36th months was also higher in girls. Differences between boys and girls in attainment of developmental milestones were only found in successful toilet training (table III).

Maternal reports on all studied milestones, except the time of the first words spoken, correlated inversely with the outcomes of the motor scale of the BSID-II at the 12th month. The infants who attained developmental milestones earlier in their first years of life were more likely to achieved a better score on the motor scale of the BSID-II. Correlation coefficients ranged from -0.117 for bladder control to -0.424 for standing without assistance and -0.586 for walking unassisted (table IV). All physical developmental milestones also correlated inversely with outcomes on the motor scale of the BSID-II at the 24th month (r_s from -0.146 to -0.291). The score on the motor scale of the BSID-II at 36th month was associated with age of lifting head, sitting up, walking alone and

Table III. Mothers' reported developmental milestones in gender groups

Reaching particular developmental milestones (in months)	Boys		Girls		Statistical significance
	Median	$Q_1 - Q_3$**	Median	$Q_1 - Q_3$	
Lifting head while prone	2	2 - 3	2	2 - 3	ns
Sitting without assistance	6	6 - 7	6	6 - 7	ns
Standing with assistance	9	8 - 10	9	8 - 10	ns
Walking alone	12	10 - 13	12	10 - 12	ns
Walking upstairs	17	14 - 20	17	14 - 20	ns
Bladder control	28	24 - 36	24	22 - 32	$p = 0.01$
Bowel control	26	22 - 30	24	20 - 27	$p < 0.001$
Speaking first meaningful words	12	10 - 13	11	10 - 12	ns

* ns - non-significant

** $Q_1 - Q_3$ - the first and third quartile

Table IV. Correlation between BSID-II scores and early development milestones reported by mothers of 3-year-old children

		PDI			MDI		
		12th month	24th month	36th month	12th month	24th month	36th month
Lifting head while prone	r_s*	**-0.2083**	**-0.1763**	**-0.1060**	*-0.0716*	*-0.0557*	*-0.0468*
	*p***	<0.0001	0.0006	0.043	ns***	*ns*	ns
Sitting without assistance	r_s	**-0.2627**	**-0.1483**	**-0.1272**	*-0.0699*	*-0.0514*	*0.0303*
	p	<0.0001	0.0041	0.016	ns	*ns*	ns
Standing without assistance	r_s	**-0.4238**	**-0.2071**	*-0.0550*	*-0.0765*	*-0.0187*	*0.0337*
	p	<0.0001	0.0001	ns	ns	*ns*	ns
Walking alone	r_s	**-0.5865**	**-0.2908**	**-0.1728**	**-0.1824**	**-0.1269**	*-0.0118*
	p	<0.0001	<0.0001	0.0010	0.0003	0.014	ns
Walking upstairs	r_s	**-0.2158**	**-0.2030**	-0.0941	*-0.0310*	*-0.0721*	*0.0019*
	p	<0.0001	0.0001	ns	ns	ns	ns
Bladder control	r_s	**-0.1168**	**-0.1791**	**-0.1595**	*-0.0713*	*-0.0857*	*-0.0915*
	p	0.022	0.0005	0.0023	ns	ns	ns
Bowel control	r_s	**-0.1865**	**-0.2907**	**-0.2467**	**-0.1662**	**-0.1471**	**-0.1447**
	p	0.0002	<0.0001	<0.0001	0.0011	0.0041	0.0048
Speaking first meaningful words	r_s	*-0.0488*	**-0.1461**	**-0.1671**	**-0.1476**	**-0.2498**	**-0.1793**
	p	ns	0.0048	0.0015	0.0040	<0.0001	0.0005

* - Spearman rank correlation rate
** - statistical significance
*** ns - non-significant

completed toilet training. Correlation arose when the time of achieving a particular milestone was closer to time of managing the BSID-II test. The highest correlation (r=-0.586) was found between the month of walking alone and score on the motor scale of the BSID-II at the 12th month, however it weakened to -0.173 in 36th month of life. Despite that small coefficient the result remain significant, like most of the other associations between recalled milestones and BSID-II scores (table IV).

The age of speaking the first words reported by mothers correlated significantly with the score on the mental scale of the BSID-II at all age levels. It also correlated with the score on the motor scale at the 24th and 36th month. Meanwhile, such skills as walking unassisted and bowel control were associated not only with score on motor scale but also with the mental one.

There were no differences in correlation of milestone assessment according to child gender, birth weight, duration of pregnancy, mother's age, educational level and whether mother takes all-day care of child (not presented).

DISCUSSION

The evaluation of children's developmental progress is an important part of routine pediatric care. The experiences of the first 3 years of life exert a powerful influence on subsequent development (6). Major literature reviews concluded that high quality early intervention could influence the development of children with impressive effects (7).

Recognizing the efficacy of early intervention and the accompanying need for earlier identification of problems, pediatricians should offer developmental screening for all children. Many formal standardized assessments of development are expensive and time-consuming, and pediatricians frequently report the use of developmental milestones in monitoring young children's development. Parents are potentially rich source of information about their child's emerging abilities and have the capacity to provide accurate information about a child's development (8). Investigations into the consistency of existing parent reports have shown significant correlations (r = 0.33-0.79) between parental and professional estimates of development in children born at or near term (9). Slightly stronger correlations (r=0.41-0.91) have been found in similar studies with samples of preterm or low birth weight children (10).

Despite the fact that the observed inverse correlations of maternal reports of children's developmental milestones and BSID-II (from r = -0.180 to r = -0.546) were statistically significant, the relationship was found to be weaker than that found in other studies. The less strong correlation may be the result of the time lag between achieving skills and applying the closed BSID-II, and is perhaps also caused by using each milestone separately to assess correlation coefficients. Another reason might be the rather varied period of time between achieving most of the considered skills and their reporting by mothers.. The methods used in the study demonstrated that most milestones correlated weakly or very weakly not only with the closed BSID-II score but also with scores of the tests performed one and two years later or earlier, though the correlation is less significant for distant BSID-II outcomes.

Considering the fact, that correlation was analyzed between complicated test of children development and

single milestones, which is only a small part of that multivariate tool, we cannot expect high coefficients of association. Therefore obtained correlations were small but statistically significant.

The variability of correlation between the milestones may be explained by recall bias: mothers may remember the onset of one milestone better than another (11). For instance, mothers had no doubts reporting the time of attainment of walking alone but needed more time to decide about the onset of another outcome of development. The fact of the strongest correlation being between walking alone and BSID-II scores confirmed the great importance of this skill for overall development. Despite each milestone alone correlated less significantly with BSID-II scores as compared with formal standardized assessments used in other studies, this research provided additional empirical evidence for the use of mother reports as a reliable tool for assessing the development of young children.

Few previous studies have addressed the links between developmental milestones and BSID-II scores. Previous studies have tended to be drawn from specific population such as group with low birth weight, low IQ or physical disabilities, while the current sample is drawn from the general population (12, 13). This is probably the reason for less significant correlation between developmental milestones and the BSID-II scores obtained in our study. The most important advantage in comparison with previous studies is that parental report concerned not only current status, but also a child's previous development. Reliable parent report about a child's early development is very important, and is sometimes the only source of information on the rate of development over time, so that current results can be interpreted together with what is known about the child's background.

CONCLUSION

Our study demonstrated that maternal reports of developmental milestones of children under 3 years old are sufficiently reliable to be used in clinical judgment.

Acknowledgements
This is a part of ongoing comparative longitudinal study on the health impact of prenatal exposure of infants and children to outdoor/indoor air pollution, which is being conductedin the New York City and Kraków. The study received funding from an RO1 grant entitled "Vulnerability of the Fetus/Infants to PAH, $PM_{2.5}$ and ETS" (RO1 ES10165 NIEHS; 02/01/00 - 01/31/04) and from NIEHS (5 RO1 ES010165-0451), the Lundin Foundation, and the Gladys T. and Roland Harriman Foundation. Principal Investigator: Prof. F.P. Perera

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Received: 26.03.2013
Accepted for publication: 5.07.2013

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