IMPACT OF NEONATAL RISK FACTORS ON KINDERGARTEN AND FIRST GRADE PERFORMANCE

JANUARY, 2004

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TECHNICAL REPORT AND WORKS IN PROGRESS SERIES: NUMBER T04-002

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ACKNOWLEDGEMENTS

This report is part of an on-going evaluation on the Parent Appraisal of Children Experiences Instrument (PACE). For complete information on the PACE, see previous PACE publications (Greenberg, Lotyczewski, & Hightower, 2003).

EXECUTIVE SUMMARY

- This evaluation followed 1,058 students who had complete PACE 1.2 and Grade 1 reading comprehension and math Stanford scores.
- The sample was generally at-risk. It was mostly minority (79% Black, Latino or Native American), 63% single parent households, with 42% of households with maternal education lower than high school and 50% of the households receiving Medicaid.
- Children admitted to the neonatal intensive care nursery were rated by their parents as having lower skills in preliteracy and learning domains than demographically comparable peers at entrance into Kindergarten. There was no evidence that admission to the neonatal intensive care nursery was associated with decreased scores in the Spring Grade 1 Stanford reading comprehension and math academic achievement tests.
- We found no evidence that preterm birth was associated with lower parental ratings at entrance in Kindergarten in any domain (preliteracy, learning, motor, social, language and speech). In addition, there was no significant association between preterm birth and Grade 1 Stanford scores.
- We found no evidence that low birth weight, defined as lower than 2500 grams, was associated with lower parental ratings at entrance in Kindergarten or with lower Grade 1 Stanford reading comprehension and math scores, once demographic risk factors are accounted for.

INTRODUCTION

What is the purpose of this study?

Poor neonatal outcomes (e.g. low birth weight, preterm birth and admission to neonatal intensive care nursery) are associated with lower academic performance well into adolescence (Saigal, et al., 2000). At entrance into school, children with poor neonatal outcomes underperformed compared to peers. This gap persists after socio-demographic risk factors have been accounted for (Taylor et al, 1998).

Yet, although the association between poor neonatal outcomes and later problem in elementary school is well established, the association may not be present for important subpopulations. For example, Finnstrom and colleagues (2003) showed that the association between poor neonatal outcomes, particularly very low birth weight, and academic achievement was not detectable for students with normal IQ.

Because Breslau, Johnson and Lucia (2001) determined that most of the academic gap of low birth weight children at age 11 was attributable to cognitive differences at school entry, early identification and intervention of academic and behavioral problems for these children is a sound strategy to minimize the impact of neonatal outcomes on later achievement.

The purpose of this evaluation is to determine if the PACE 1.2 items that measure adverse neonatal outcomes predict lower academic achievement in first grade, or are associated with lower parental ratings in cognitive, motor, language and social domains at school entry.

SAMPLE

The sample consisted of 1,058 students.

Fifty-one percent of the children in this study were female.

Based on previous studies (Montes & Hoffman, 2004), we included the Asian American group with the white non-Hispanic group because of similar performance in academic achievement. Seventy-nine percent were members of an at-risk minority group (Native-American, Black, or Latino).

Fifty percent of households utilized Medicaid services. A majority (63%) of the sample did not live in two-parent households. Almost half (42%) of the mothers reported having less than a high school education.

Measures

What are the outcome measures?

The following measures were used as dependent variables:

- Grade 1 Stanford reading comprehension and math achievement normal curve equivalent scores, administered in the spring.
- Language (4 items), speech (6 items), preliteracy (6 items), learning (2 items), motor (5 items) and social (11 items) subscales of the PACE 1.2 completed by the parent at entrance into Kindergarten.

How were the study variables measured?

- Preterm labor was measured with a single item, "Based on your due date, was this child…preterm (born 3 weeks early or earlier) or full term?"
- Low birth weight was measured with a single item, "At birth, how much did this child weigh?" Parents were given five choices. The low birth weight variable was a dichotomous variable that identified children weighting less than 2500 grams (5 lbs, 8 oz.).
- Admission into the neonatal intensive care nursery was measured with a single item, "As a newborn, was your child ever in the intensive care or special care nursery?"

RESULTS

What is the impact of neonatal risk factors on later achievement?

Table 1 displays the results of two one-way multivariate analyses of variance (MANOVAs). The first MANOVA included the PACE 1.2 subscales as the dependent variables, while the other specified Grade 1 math and reading comprehension achievement test scores as the dependent variables.

Table 1. Effect of study variables before controlling for demographic factors

	Birth Weight			In Intensive Care Nursery?			Birth Status		
	Low Birth Weight	Normal Birth Weight		Yes	No		Pre Term	Full Term	
	Mean (SE) n = 91	Mean (SE) n = 787	p	Mean (SE) n = 124	Mean (SE) n = 754	p	Mean (SE) n = 115	Mean (SE) n = 763	p
PACE 1.2									
Language	3.39 (.08)	3.56 (.05)	< .10	3.44 (.08)	3.51 (.05)	n.s.	3.45 (.06)	3.50 (.07)	n.s.
Motor	3.73 (.05)	3.69 (.03)	n.s.	3.71 (.05)	3.71 (.03)	n.s.	3.67 (.04)	3.75 (.05)	n.s.
Speech	3.33 (.08)	3.46 (.05)	n.s.	3.38 (.08)	3.42 (.05)	n.s.	3.40 (.06)	3.39 (.07)	n.s.
Preliteracy	2.42 (.10)	2.46 (.06)	n.s.	**2.30 (.10)**	**2.59 (.06)**	**< .05**	2.50 (.08)	2.39 (.09)	n.s.
Learning	3.11 (.10)	3.30 (.06)	< .10	**3.06 (.09)**	**3.36 (.06)**	**< .01**	3.19 (.08)	3.23 (.08)	n.s.
Social	2.55 (.04)	2.56 (.02)	n.s.	2.51 (.04)	2.60 (.03)	< .10	2.53 (.03)	2.58 (.04)	n.s.
Grade 1	n = 88	n = 759		n = 120	n = 727		n = 107	n = 740	
Math	**42.57 (2.87)**	**50.88 (1.61)**	**< .05**	44.02 (2.76)	49.43 (1.79)	n.s.	48.76 (2.21)	44.69 (2.43)	n.s.
Reading	45.01 (2.72)	50.90 (1.53)	< .10	46.49 (2.62)	49.41 (1.69)	n.s.	49.54 (2.10)	46.36 (2.31)	n.s.

There was no evidence that low birth weight or premature birth were associated with adverse outcomes in the PACE 1.2 subscales [birth weight: Wilk's lambda = .991, $\underline{F}$ (6, 865) = 1.24, n.s.; pre-term birth: Wilk's lambda = .993, $\underline{F}$ (6, 865) = 1.02, n.s.].

Presence in an intensive care nursery was significantly related to the six PACE 1.2 subscales, Wilk's lambda = .982, F (6, 865) = 2.59, p < .05. Children who had spent time in the neonatal intensive care nursery were rated significantly lower than peers in preliteracy and learning domains by their parents at entrance in Kindergarten.

The second MANOVA included Grade 1 math and reading NCE scores on the Stanford achievement test as the dependent variables. There was no evidence that preterm birth or having spent time in the neonatal intensive care nursery was related to Grade 1 Stanford achievement scores [neonatal intensive care nursery: Wilk's lambda = .997, F (2, 838) = 1.39, n.s., premature birth status: Wilk's lambda = .998, F (2, 838) = .79, n.s.].

Low birth weight status did significantly predict math and reading scores, Wilk's lambda = .992, F (2, 838) = 3.21, p < .05. This effect appears to be due to birth weight's relation to math achievement scores, F (1, 838) = 6.39, p < .05, with a report of low birth weight having lower math scores (M= 42.57) than those children whose parents' reported a normal birth weight (M= 50.88).

Do these results hold after controlling for socio-demographic factors?

Table 2 displays the results of two one-way multivariate analyses of covariance (MANCOVAs) performed in order to determine the effect of the prenatal variables on parental assessment (PACE 1.2 subscales) and achievement outcomes, while controlling for demographic factors. Child's sex, at-risk minority status, mother's education, Medicaid status and two-parent household status were used as covariates.

Table 2. Effect of study variables after controlling for demographic factors

	Birth Weight			In Intensive Care Nursery?			Birth Status		
	Low Birth Weight	Normal Birth Weight		Yes	No		Pre Term	Full Term	
	Mean (SE)[a] n = 91	Mean (SE)[a] n = 787	p	Mean (SE)[a] n = 124	Mean (SE)[a] n = 754	p	Mean (SE)[a] n = 115	Mean (SE)[a] n = 763	p
PACE 1.2									
Language	3.41 (.08)	3.56 (.05)	< .10	3.46 (.08)	3.51 (.05)	n.s.	3.47 (.06)	3.50 (.07)	n.s.
Motor	3.74 (.05)	3.69 (.03)	n.s.	3.72 (.05)	3.71 (.03)	n.s.	3.68 (.04)	3.75 (.04)	n.s.
Speech	3.34 (.08)	3.47 (.05)	n.s.	3.39 (.08)	3.42 (.05)	n.s.	3.42 (.06)	3.39 (.07)	n.s.
Preliteracy	2.48 (.10)	2.46 (.06)	n.s.	**2.32 (.09)**	**2.61 (.06)**	**< .05**	2.53 (.08)	2.41 (.08)	n.s.
Learning	3.13 (.10)	3.30 (.06)	n.s.	**3.07 (.09)**	**3.37 (.06)**	**< .01**	3.21 (.08)	3.23 (.08)	n.s.
Social	2.55 (.04)	2.57 (.02)	n.s.	2.51 (.04)	2.60 (.03)	< .10	2.54 (.03)	2.58 (.04)	n.s.
Grade 1	n = 88	n = 759		n = 120	n = 727		n = 107	n = 740	
Math	45.51 (2.68)	50.35 (1.50)	n.s.	45.41 (2.57)	50.45 (1.66)	< .10	49.56 (2.06)	46.30 (2.26)	n.s.
Reading	47.93 (2.55)	50.65 (1.43)	n.s.	48.23 (2.45)	50.35 (1.59)	n.s.	50.59 (1.96)	47.99 (2.16)	n.s.

Note: [a] All means estimated with sex, at-risk minority status, mother's education, Medicaid status and two-parent household status as covariates.

Presence in an intensive care nursery was still related to the preliteracy and learning PACE 1.2 subscales, even after controlling for demographic factors, Wilk's lambda = .982, F (6, 860) = 2.57, $p < .05$.

Premature birth status remained non-significantly related to PACE subscales when covarying the demographic variables, Wilk's lambda = .993, F (6, 860) = .98, n.s.

The previously significant effect of birth weight on math and reading achievement was no longer significant when including the demographic variables as covariates, Wilk's lambda = .997, F (2, 833) = 1.25, n.s.

DISCUSSION

This preliminary report identified that parents of children who were admitted to neonatal intensive care rated them as having lower school readiness in the preliteracy and learning domains. Although there was no evidence of a gap in our sample by the end of first grade, the gap may emerge later as children are tested in more complex cognitive tasks that require efficient learning strategies.

The lack of associations between parent-report neonatal adverse outcomes and later school performance can be interpreted either as unreliability on parental report or lack of association for this group of children who were tested in the spring of their first grade. It is unknown whether a significant association would have been found had students who were not tested had been included in the analysis. Possible reasons to miss testing include grade retention and participation in some forms of special education.

Finally, a third reason for the lack of significant association may be due with the way questions were worded. In particular, neonatal intensive care admission in and of itself may be far less predictive that spending more prolong periods (more than a week) in intensive care nursery. In this sense, newer versions of the PACE have been modified to separate short-term admission to neonatal care from long-term admission.

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