

Mild Cognitive Impairment in Early Life and Mental Health Problems in Adulthood

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Mental retardation is a complex clinical condition with a heterogeneous etiology.^{1–8} Depending on issues of definition, identification, and sampling,^{1,4,9} estimated prevalence rates of mild mental retardation (IQ of 50–70) vary considerably from 1.7 to 79.3 per 1000, and rates of severe mental retardation (IQ below 50) range from 2.2 to 7.3 per 1000.^{4,9} Individuals with cognitive impairment are known to be a high-risk group for mental health problems.^{8,10–19}

In the Isle of Wight Study, data derived from parental assessments showed that approximately 1 in 3 children and adolescents with IQs below 70 had psychiatric problems, compared with nearly 7% of those with normal cognitive abilities.¹⁹ Similar elevated risks were observed among adults with mental retardation.^{15,18,20} Most of the evidence regarding the co-occurrence of mental retardation with psychiatric disturbance or behavioral problems has come from cross-sectional and clinic- or service-based research^{12,14,18,21}; few population-based studies have addressed this issue prospectively.^{13,16}

Results of several studies have indicated that certain factors might account for increased occurrences of mental health conditions among individuals with mental retardation, including brain dysfunction, psychosocial adversity, family-related stress, and stress related to mental retardation.^{8,16} Of particular pertinence in this study is a line of research about increasing levels of stress observed as children with mental retardation expand their interpersonal relationships beyond family to school and community.²² To develop effective policy interventions that reduce risks of mental health problems among those with mental retardation, it may be crucial to understand whether adult mental health is linked to cognitive ability in the preschool years, a period before children with mental retardation begin to face more complex developmental tasks and environmental demands.

Objectives. We assessed the extent to which borderline mental retardation and mental retardation at preschool ages are related to emotional and behavioral problems in young adulthood. We also explored early risk factors for having mental health problems as a young adult that might be related to preschool differences in cognitive ability.

Methods. We used data from a cohort of births studied in the Johns Hopkins Collaborative Perinatal Study and followed up in the Pathways to Adulthood Study. Preschool cognitive functioning was assessed at 4 years of age. Individual characteristics, psychosocial factors, and mental problems were prospectively evaluated from birth through young adulthood.

Results. Children with subaverage cognitive abilities were more likely to develop mental health problems than their counterparts with IQs above 80. Inadequate family interactions were shown to increase 2- to 4-fold the risk of emotional or behavioral problems among children with borderline mental retardation.

Conclusions. Subaverage cognitive functioning in early life increases later risk of mental health problems. Future research may help to delineate possible impediments faced at different developmental stages and guide changes in supportive services to better address the needs of children with borderline mental retardation. (*Am J Public Health.* 2006;96:1772–1778. doi:10.2105/AJPH.2004.057075)

Emerging research suggests that higher risks of emotional and behavioral problems may not be limited to those with moderate and severe cognitive impairment. For example, using data from the United Kingdom National Child Development Study, Maughan et al. found that mild mental retardation in adolescence was associated with higher malaise scores (obtained from a 24-item affective symptomatology scale) but was not associated with emotional problems or elevated alcohol problem screening scores on the CAGE (Cut down, Annoyed, Guilty, Eyeopener) instrument in young adulthood.¹⁶ It remains unclear whether these connections apply to those with borderline mental retardation. Individuals who are not considered “retarded” but whose cognitive ability is subaverage may experience increased levels of stress because they might have to struggle to meet average standards with respect to role performance and social expectations and might have no access to beneficial and supportive services such as special education for those labeled “mentally retarded.”^{23,24}

We assessed the association between preschool cognitive ability and later occurrence of mental health-related problems, including possible variations in profiles of risk factors for emotional and behavioral problems in young adulthood. Such information may be helpful in designing preventive interventions to reduce school- or community-related difficulties among children with lower than average cognitive ability before they enter elementary school.^{25,26}

METHODS

Study Population

The data for this study were derived from a cohort of births studied in the Johns Hopkins Collaborative Perinatal Study (JHCPS) and the Pathways to Adulthood Study (PAS). These studies’ sampling procedures, data collection, and follow-ups have been described in detail elsewhere (J.P. Lawlor, W.W. Eaton, and J.B. Hardy, unpublished data, 2006).^{27–29} Between 1959 and 1965, the JHCPS recruited 3651 women who visited the prenatal clinic

at Johns Hopkins University Hospital and followed up their 4025 live-born children to track their physical, neurological, cognitive, and socioemotional development and health. These follow-ups took place at the child's birth; at the ages of 4, 8, and 12 months; and at ages 3, 4, 7, and 8 years.

The response rate was 85.3% ($n=3434$) at the end of the JHCPS follow-up (age 7 or 8 years); 187 children died before the JHCPS follow-up at 8 years of age, and 404 did not compete the examination conducted when children were aged 7 or 8 years. The majority of the recruited mothers were African American (77%), had completed very few years of education, and lived within a 10-block radius of the hospital. Data on sociodemographic characteristics such as maternal education, family socioeconomic status, and family composition were collected via mothers' self-reports at or near the child's birth and 7 to 8 years later.

Some 25 years later, in 1992 through 1994, the PAS selected for adulthood assessments a subsample of 2694 offspring born between 1960 and 1965 who had completed the 7-year or 8-year assessments or both (excluding 427 offspring born in 1959 and 313 for other reasons, e.g., pretesting in the pilot study). These offspring, then aged 27 to 33 years, completed an interview that included a history calendar designed to record life events and a standard questionnaire covering (1) personal characteristics; (2) health conditions in childhood, adolescence, and adulthood; and (3) social developmental outcomes (e.g., education, employment).

Mothers were interviewed separately to ascertain socioeconomic status, family composition, life events, personal characteristics, and other developmental outcomes of the offspring. Overall, nearly 65% of the eligible 2694 offspring completed interviews ($n=1758$). Mothers of the offspring who were successfully followed up in adulthood tended to be married and to have a family income above the poverty level at the time of the birth; also, they tended to be older and more educated than mothers of offspring not successfully followed up (J.P. Lawlor, W.W. Eaton, and J.B. Hardy, unpublished data, 2006).²⁷

In comparison with the original baseline sample, a slightly higher percentage of those who completed the follow-up adulthood assessment in 1991 and 1992 had an IQ above 80 at the age of 4 years. Of the 1758 participants who completed the adulthood assessment, 77 were found to lack information on Stanford-Binet Intelligence Scale IQ score at the age of 4 years. IQ information was more likely to be missing among individuals who were not of African American race/ethnicity and whose mothers had not completed high school (data not shown). The present analysis focused on the 1681 participants who had valid data on the preschool test of cognitive ability (Stanford-Binet Intelligence Scale).

Assessment

All of the outcome measures used in the present analysis were derived from the PAS. In that study, a trained interviewer gathered data in standardized face-to-face (70%) or telephone (30%) interviews that were an average of 100 minutes in duration. In an attempt to reduce possible bias, all of the interviewers were unaware of the JHCPS data and could assess only 1 member of any family. Assessments of adults' mental health conditions involved 4 primary areas: treatment for emotional problems, general mental health, tobacco use, and alcohol-related problems.

In assessments of emotional problems, respondents were asked "Have you ever been told by a doctor that you had an emotional problem or nervous condition?" "How old were you when you were first told you had an emotional problem or nervous condition?" and "Do you now have an emotional problem or nervous condition?" The 28-item General Health Questionnaire (GHQ) was included in the PAS to assess respondents' general mental health. GHQ items are rated on a Likert scale with 4 response categories (e.g., not at all, no more than usual, rather more than usual, and much more than usual); a representative item is "Over the past few weeks, have you been feeling nervous and uptight all the time?" In this study, a mental health problem was recorded as present when the GHQ score was 5 or above. On the basis of the 0-0-1-1 scoring method of Goldberg and Hillier,³⁰ an item was scored as "1" when the participant's response fell into 1 of the categories that

indicated worsening symptoms (e.g., "rather more than usual" or "much more than usual").

Current smokers were defined as those with an affirmative response to the question "Do you smoke cigarettes, cigars, or pipe tobacco now?" Extent of cigarette involvement was assessed with the question "On average, how many cigarettes do/did you usually smoke a day?" The question "How many drinks do/did you have on an average day?" was used to evaluate extent of alcohol use, and recent alcohol-related problems were evaluated with 4 binary items from the CAGE instrument. Presence of alcohol-related problems was defined as a positive score on at least 1 CAGE item.^{31,32}

A child psychologist used the Stanford-Binet Intelligence Scale (Form L-M) to assess preschool cognitive ability when children were 4 years old (within 3 months).^{33,34} Participants were then classified, according to total Stanford-Binet IQ score, into 3 subgroups: normal (IQ of 80 or above), borderline mental retardation (IQ between 70 and 80), and definite mental retardation (IQ below 70). In addition, an array of independent variables thought to influence the occurrence of adult mental health conditions are taken into account, with a focus on early-childhood and early-life experiences before young adulthood. For example, we assessed proxies for individual and environmental vulnerabilities, that is, low birthweight (less than 2500 g vs 2500 g or more) and low maternal education at the time of the birth (less than high school vs high school or above).

Three constructs were integrated to assess possible family-related influences: family structure, family stability, and family interaction. In the JHCPS, the child's mother or primary caregiver was asked, when the child was approximately 7.5 years of age, to update information concerning with whom the child lived. Frequency of family moves was cumulated from birth to the age of 17 years, and family instability was defined as 6 or more family moves between those 2 time points. With respect to family interactions, 19 items on a 6-point Likert scale were used to evaluate how frequently parents or other adults in the home might have behaved when they had a disagreement during their offspring's childhood through age 17. Example items included

“How often would they discuss an issue calmly?” “How often would they sulk and/or refuse to talk about?” and “How often would they throw something at you?” An overall score of 25 or above was classified as representing poor family interaction.

Statistical Analysis

Distributions of individual characteristics and psychosocial factors were stratified according to the 3 cognitive ability subgroups. Contingency table analyses were used to assess differences in the distributions of independent variables, with comparisons made between the normal IQ group and the borderline mental retardation and definite mental retardation groups.

Bivariate logistic regressions were used to estimate crude associations linking levels of preschool cognitive ability to the 4 adult mental health measures described earlier (i.e., treatment for emotional problems, poor general mental health, current smoking, and current alcohol-related problems). In analyses of the groups that involved odds ratio estimates, the reference group was the normal IQ group. Student *t* tests were used to estimate IQ-related differences in GHQ score, number of cigarettes smoked per day, and number of drinks consumed on an average day.

To probe possible variations in risk factors for mental health problems, we initially evaluated such risk factors in terms of distal determinants (e.g., race/ethnicity, gender, maternal education level at the time of birth, and birthweight) as well as proximal determinants (e.g., family structure at the age of approximately 7 years, family stability, and family interactions). Next, on the basis of *P* values of less than .1 for crude associations linking risk factors to mental health problems, we constructed multivariate logistic regression models to estimate adjusted associations between potential determinants and the 4 adult mental health measures, stratifying according to preschool cognitive ability. As a result of the small number of participants with IQs below 70 (n=86), comparisons were primarily made between the normal IQ and borderline mental retardation groups. The Stata statistical package was used in carrying out all analyses.³⁵

TABLE 1—Characteristics of Participants, by IQ Group at 4 Years of Age: Pathways to Adulthood Study, 1992–1994 (n = 1681)

	Normal IQ (n = 1417), No. (%)	Borderline Mental Retardation (n = 178), No. (%)	Definite Mental Retardation (n = 86), No. (%)	Overall, No. (%)
Gender				
Male	633 (44.7)	90 (50.6)	47 (54.7)	770 (45.8)
Female	784 (55.3)	88 (49.4)	39 (45.3)	911 (54.2)
Race				
African American	1168 (82.4)	153 (86.0)	74 (86.1)	1395 (83.0)
Other	249 (17.6)	25 (14.0)	12 (13.9)	286 (17.0)
Maternal education (at time of child's birth) ^a				
Less than high school	962 (67.9)	139 (76.4)	69 (80.2)	1167 (69.4)
High school or above	426 (30.1)	37 (20.8)	13 (15.1)	476 (28.3)
Birthweight, g ^a				
≥2500	1238 (87.4)	136 (76.4)	64 (74.4)	1438 (85.5)
<2500	177 (12.5)	42 (23.6)	22 (25.6)	241 (14.3)
Family structure at 7.5 years of age				
Lived with both parents	910 (64.2)	106 (60.0)	48 (55.8)	1064 (63.3)
Other	484 (34.2)	67 (37.6)	35 (40.7)	586 (34.9)
Family instability (ages 0–17 y) ^a				
Less than 6 family moves	1077 (76.0)	113 (63.5)	51 (59.3)	1285 (73.1)
6 or more family moves	340 (24.0)	65 (36.5)	35 (40.7)	473 (26.9)
Family interaction scale score (age 0–17 y)				
<25	1008 (71.1)	119 (66.9)	61 (70.9)	1240 (70.5)
≥25	409 (28.9)	59 (33.1)	25 (29.1)	518 (29.5)
Current emotional problems ^b				
No	1358 (95.8)	160 (89.9)	77 (89.5)	1595 (94.9)
Yes	58 (4.1)	17 (9.6)	9 (10.5)	84 (5.0)
GHQ score ^b				
<5	1088 (76.8)	123 (69.1)	68 (79.1)	1279 (76.1)
≥5	328 (23.2)	55 (30.9)	17 (19.8)	400 (23.8)
Current smoker ^b				
No	768 (54.2)	87 (48.9)	48 (55.8)	903 (53.7)
Yes	649 (45.8)	90 (50.6)	38 (44.2)	777 (46.2)
CAGE (alcohol-related problem) score ^b				
<1	1151 (81.2)	131 (73.6)	67 (77.9)	1349 (80.3)
≥1	263 (18.6)	46 (25.8)	19 (22.1)	348 (19.8)

Note. GHQ = General Health Questionnaire; CAGE = Cut down, Annoyed, Guilty, Eyeopener. See text for group definitions. Some columns do not sum to 100% owing to missing values.

^a*P* < .01 for χ^2 test comparison between normal IQ group and borderline and definite mental retardation groups.

^bAssessed in adulthood.

RESULTS

Among the 1681 respondents, 54% were female, and the majority were African American (83%) (Table 1). Twenty-eight percent of mothers had a high-school education or above at the time of the birth. Approximately 14% of the participants weighed less than

2500 g (i.e., low birthweight) at birth (n=241). One third did not live with both parents when they were 7 years old (n=586), 473 (27%) had moved 6 or more times before reaching early adulthood, and 518 (30%) reported poor family interaction while they were growing up. In comparison with those in the normal IQ group at 4 years of age, those

TABLE 2—Associations Between IQ at 4 Years of Age and Mental Health Problems in Young Adulthood: Pathways to Adulthood Study, 1992–1994

Mental Health or Behavioral Outcome	Normal IQ (n = 1417)	Borderline Mental Retardation (n = 178)	Definite Mental Retardation (n = 86)
Current emotional problems, OR (95% CI)	1.00	2.49 (1.41, 4.38)	2.74 (1.31, 5.73)
GHQ score ≥ 5, OR (95% CI)	1.00	1.48 (1.05, 2.09)	0.83 (0.48, 1.43)
Current smoker, OR (95% CI)	1.00	1.22 (0.90, 1.67)	0.94 (0.60, 1.45)
CAGE (alcohol-related problem) score ≥ 1, OR (95% CI)	1.00	1.53 (1.07, 2.20)	1.24 (0.73, 2.09)
GHQ score, mean (SD)	2.95 (4.37)	3.69 (4.73) ^a	2.90 (4.63)
No. of cigarettes smoked per day, mean (SD)	7.52 (9.25)	9.37 (11.6) ^a	6.66 (7.95) ^b
No. of alcoholic drinks consumed on average day, mean (SD)	2.10 (2.93)	2.60 (3.60) ^a	2.19 (3.56)

Note. OR = odds ratio; CI = confidence interval; GHQ = General Health Questionnaire; CAGE = Cut down, Annoyed, Guilty, Eyeopener. See text for group definitions.

^aStudent *t*-test comparison between normal and borderline groups significant at *P* < .05.

^bStudent *t*-test comparison between borderline and definite mental retardation groups significant at *P* < .05.

the occurrence of emotional and behavioral problems. For example, participants in the borderline mental retardation group were at a 150% increased risk of treatment for emotional problems in adulthood relative to those in the normal IQ group (relative risk [RR] = 2.49). The corresponding risk estimates for poor general mental health and alcohol-related problems were 1.48 (95% confidence interval [CI] = 1.05, 2.09) and 1.53 (95% CI = 1.07, 2.20). Children with IQs below 70 at 4 years of age had a 3-fold risk of treatment for emotional problems in their early 30s (95% CI = 1.31, 5.73). The borderline mental retardation group tended to have higher GHQ scores, to smoke more cigarettes per day, and to drink more alcohol on an average day than the normal IQ group (all *P*s < .05).

Estimated associations of individual characteristics and psychosocial factors with emotional and behavioral problems, stratified according to IQ subgroup, are summarized in Table 3. After simultaneous adjustment for other covariates included in the models, African American ethnicity was inversely associated with treatment for emotional problems

in the borderline and definite mental retardation groups were more likely to have a mother who had not completed high school and were more likely to have had a low birthweight. In general, those in the borderline and definite mental retardation groups had more mental health problems in young

adulthood than their counterparts in the normal IQ group.

Table 2 presents data on mental health conditions at the ages of 27 to 33 years in relation to cognitive functioning at the age 4 of years. Borderline mental retardation was found to be positively associated with

TABLE 3—Associations Between IQ at 4 Years of Age and Mental Health Problems in Young Adulthood: Pathways to Adulthood Study, 1992–1994

Group and Characteristic	Emotional Problems, Adjusted OR (95% CI)	GHQ Score ≥ 5, Adjusted OR (95% CI)	Current Smoker, Adjusted OR (95% CI)	CAGE Score ≥ 1, Adjusted OR (95% CI)
Normal IQ group (n = 1417)				
African American	0.26 (0.15, 0.48)***	0.73 (0.52, 1.03)	0.96 (0.71, 1.28)	0.31 (0.22, 0.44)***
Female	1.82 (1.01, 3.27)*	1.93 (1.48, 2.53)***	0.82 (0.66, 1.02)	0.29 (0.21, 0.39)***
Maternal education less than high school	1.18 (0.59, 2.38)	1.22 (0.91, 1.64)	1.75 (1.37, 2.23)***	1.21 (0.86, 1.70)
Birthweight < 2500 g	0.89 (0.37, 2.16)	1.14 (0.79, 1.69)	0.92 (0.67, 1.29)	1.42 (0.93, 2.17)
Not living with both parents at age 7.5 y	1.91 (1.07, 3.42)*	1.05 (0.79, 1.40)	1.09 (0.86, 1.39)	1.15 (0.82, 1.58)
Family instability (6 or more moves)	1.19 (0.65, 2.20)	1.30 (0.95, 1.76)	1.41 (1.07, 1.85)**	1.22 (0.86, 1.72)
Inadequate family interaction (score of 25 or above)	1.95 (1.11, 3.40)*	2.48 (1.89, 3.25)***	1.39 (1.10, 1.76)**	2.17 (1.60, 2.92)***
Borderline mental retardation group (n = 178)				
African American	0.08 (0.02, 0.37)***	0.49 (0.17, 1.41)	0.67 (0.25, 1.83)	0.19 (0.06, 0.59)**
Female	2.48 (0.66, 9.32)	1.82 (0.90, 3.67)	0.70 (0.37, 1.33)	0.30 (0.13, 0.67)**
Maternal education less than high school	0.20 (0.04, 0.98)*	0.82 (0.33, 2.02)	2.04 (0.89, 4.68)	1.15 (0.40, 3.35)
Birthweight < 2500 g	3.37 (1.00, 11.44)*	0.63 (0.27, 1.47)	0.61 (0.29, 1.29)	2.05 (0.83, 5.07)
Not living with both parents at age 7.5 y	1.75 (0.45, 6.84)	1.86 (0.90, 3.86)	1.57 (0.80, 3.08)	0.72 (0.31, 1.67)
Family instability (6 or more moves)	1.85 (0.49, 7.04)	1.17 (0.55, 2.48)	0.29 (0.35, 1.46)	0.86 (0.36, 2.02)
Inadequate family interaction (score of 25 or above)	4.49 (1.31, 15.41)*	2.58 (1.24, 5.34)**	1.55 (0.77, 3.10)	2.67 (1.19, 6.00)*

Note. GHQ = General Health Questionnaire; CAGE = Cut down, Annoyed, Guilty, Eyeopener; OR = odds ratio; CI = confidence interval. See text for group definitions.

P* < .05; *P* < .01; ****P* < .001.

and alcohol-related problems in the normal IQ and borderline groups (e.g., adjusted RR=0.26 for emotional problems and adjusted RR=0.31 for alcohol-related problems in the normal IQ group). In comparison with male participants, female participants were at twice the risk of reporting treatment for emotional problems (e.g., adjusted RR=1.82 for the normal IQ group) but were at a lower risk of alcohol-related problems (e.g., adjusted RR=0.30 for the borderline mental retardation group).

There were differences in the directions and magnitudes of risk associations for adult mental health conditions related to cognitive ability. For example, lower maternal education level was inversely associated with treatment for emotional problems in the borderline mental retardation group (adjusted RR=0.20; 95% CI=0.04, 0.98), but this was not the case for the normal IQ group (adjusted RR=1.18; 95% CI=0.59, 2.38). Lower birthweight was associated with a 3-fold to 4-fold increased risk of treatment for emotional problems in later life in the borderline mental retardation group but had little effect among those in the normal IQ group.

With respect to family-related factors, frequent family moves seemed to have a greater influence on the normal IQ group in terms of mental health problems, whereas poor family interaction had more of an effect on the borderline mental retardation group. The covariate-adjusted relative risk linking poor family interaction to current emotional problems in the borderline mental retardation group was 4.49 (95% CI=1.31, 15.41), and the corresponding risk estimate was 1.95 in the normal IQ group (95% CI=1.11, 3.40). However, no significant product terms between cognitive ability and risk factors were found, according to conventional standards ($P<.05$), when logistic regression models were analyzed after stratification of the sample into those with normal IQs and those with borderline mental retardation.

We observed a similar pattern of associations among the children with mental retardation. The odds of developing emotional problems by young adulthood were 10 times greater among those with birthweights below 2500 g than among their counterparts with normal birthweights (adjusted RR=10.60;

95% CI=1.86, 60.46), and the participants with mental retardation whose family interactions had been poor during their upbringing had an adjusted relative risk of alcohol-related problems of 3.62 (data not shown).

DISCUSSION

The present study highlights the excess risk of emotional and behavioral problems among young adults with subaverage preschool cognitive abilities. Similar to what has been reported in previous studies,^{16,21} children with preschool IQs below 70 were at a greater risk of developing emotional problems later in life. However, those with borderline mental retardation were at an even higher risk of emotional and behavioral problems. In addition, the associations of individual characteristics and psychosocial factors with mental health problems varied across subgroups defined according to IQ at 4 years of age. Children with borderline mental retardation and definite mental retardation who grew up in disadvantaged family environments were more likely to experience unfavorable mental health outcomes in young adulthood.

There are several limitations, strengths, and methodological issues associated with our study that should be mentioned. First, both borderline mental retardation and definite mental retardation were defined solely on the basis of cognitive ability measures (i.e., Stanford-Binet IQ) rather than being viewed as the product of interactions between individuals and their surrounding environments.¹⁸ Excluding adaptive functioning criteria from assessments of mental retardation may lead to attenuation of risk associations between cognitive impairment and later mental health problems. Another limitation is that some risk factors were assessed in adulthood (e.g., number of family moves and family interaction patterns). This retrospective assessment may have introduced bias because of differential response validities associated with respondents' mental health condition at the time of the adulthood interview.

Our study population consisted of offspring of mothers recruited from a prenatal clinic affiliated with a large urban hospital. These types of clinics typically provide services to women from disadvantaged backgrounds, and

thus our results cannot be generalized to populations with different socioeconomic compositions. It is possible that the observed non-significance of product terms was due, in part, to the collinearity between IQ and personal and psychosocial factors. The stratified analyses suggested possible differences related to mental retardation in risk factors for adulthood mental health conditions; however, the size of the borderline mental retardation group was not large enough to allow a definite conclusion to be reached.

Strengths of this study included the population-based sample and the 27- to 33-year prospective assessment from birth to young adulthood, the use of carefully collected data on cognitive functioning at 4 years, and the breadth of mental health measures assessed in adulthood. The vast majority of previous research investigating excess risks of psychiatric disturbance related to mental retardation has relied on cognitive ability measures administered when children are of school age.^{8,16,36,37} The present study was designed to estimate occurrences of young adulthood emotional and behavioral problems in relation to cognitive functioning in the preschool years, a critical period when interventions and special programs may help individuals of subaverage cognitive ability cope with possible upcoming school-related difficulties and stresses.

To our knowledge, the present study is the first epidemiological investigation to report data on the excess risks of emotional and behavioral problems associated with previous borderline mental retardation. Our findings provide new information on a serious and underaddressed public health problem among children with subaverage cognitive ability who are not considered mentally retarded according to clinical definitions.

The occurrence of mental health problems among children with IQs between 70 and 80 was higher than that among children with IQs below 70, consistent with the observations of Zetlin and Murtaugh,²⁴ among others.³⁸ This borderline group may be capable or sensitive enough to comprehend the age- or role-related expectations of their family, school, and community but may not be capable of reaching these levels, which are oriented toward their peers with average or above-average IQs. The education, family, and social services

made available to those with moderate and severe mental retardation may protect these groups^{24,38} while leaving the borderline group at a greater risk of developing problems.

The associations of low birthweight with cognitive abilities and psychopathology have been examined in a number of studies.³⁹ A number of mechanisms have been posited to explain the observed positive relation between lower birthweight and emotional problems among those with borderline mental retardation and mental retardation. First, lower birthweight is a proxy indicator for underlying neurological abnormalities that might cause cognitive impairment in early childhood as well as emotional problems in young adulthood.⁴⁰ Second, lower birthweight may be an indirect cause of emotional problems, one that functions through elevated experiences of stress stemming from delayed developmental functioning or subaverage cognitive ability.

Although the product terms between family interactions during childhood and adulthood mental health were not statistically significant, the greater risk estimates observed in all cases among those with mental retardation may suggest that children in disadvantaged circumstances are more vulnerable to inadequate family interactions (e.g., emotional abuse). Previous research has consistently shown that quality of environment (e.g., maternal interaction style) has great effects on children's development, regardless of their disability status.⁴¹ However, among children with subaverage cognitive abilities, poor early environment is hypothesized to be particularly detrimental in terms of development and health because it may adversely affect these children's ability to acquire the coping and adjustment skills they need later in life, along with reducing their resilience.^{22,41}

In summary, children who are below average in terms of intellectual ability but do not meet the definition of mental retardation form a substantial subpopulation whose needs should be of concern to those in the field of public health. Future prospective research focusing on this vulnerable population may help to delineate possible impediments faced at different developmental stages and may help to provide clues to pertinent policies, services, and prevention programs. It could be that early interventions designed to

reduce later occurrences of emotional and behavioral problems in children with borderline mental retardation should begin in the preschool years.^{25,42} ■

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Contributors

C.-Y. Chen was responsible for the data analyses and scientific writing. J. Lawlor assisted with data management and preparation. A.K. Duggan and W.W. Eaton assisted in revising drafts of the article. J.B. Hardy contributed to the conceptualization of the original research and supervised the fieldwork.

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Human Participant Protection

This study was approved by the institutional review board of the Johns Hopkins Bloomberg School of Public Health. Verbal informed consent was obtained from mothers and caregivers participating in the Johns Hopkins Collaborative Perinatal Study, and written informed consent was obtained from adult children and their mothers in the Pathways to Adulthood Study.

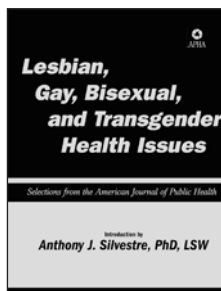
References

- Murphy CC, Boyle C, Schendel D, Decoufle P, Yeargin-Allsopp M. Epidemiology of mental retardation in children. *Ment Retard Dev Disabil Res Rev.* 1998;4:6–13.
- Flint J, Wilkie AOM. The genetics of mental retardation. In: Johnstone EC, ed. *Biological Psychiatry*. Oxford, England: Royal Society of Medicine Press; 1996:453–464.
- Dykens EM, Hodapp RM. Research in mental retardation: toward an etiologic approach. *J Child Psychol Psychiatry.* 2001;42:49–71.
- McLaren J, Bryson SE. Review of recent epidemiological studies of mental retardation: prevalence, associated disorders, and etiology. *Am J Ment Retard.* 1987; 92:243–254.
- Mercer JR. *Labeling the Mentally Retarded: Clinical and Social System Perspectives on Mental Retardation*. Berkeley, Calif: University of California Press; 1973.
- Pennington BF, Bennetto L. Toward a neuropsychology of mental retardation. In: Burack JA, Hodapp RM, Zigler EF, eds. *Handbook of Mental Retardation and*

Development. New York, NY: Cambridge University Press; 1998:80–114.

- Simonoff E, Bolton P, Rutter M. Genetic perspectives on mental retardation. In: Burack JA, Hodapp RM, Zigler EF, eds. *Handbook of Mental Retardation and Development*. New York, NY: Cambridge University Press; 1998:41–79.
- Richardson SA, Koller H. *Twenty-Two Years: Causes and Consequences of Mental Retardation*. Cambridge, Mass: Harvard University Press; 1996.
- Roeleveld N, Zielhuis GA, Gabreels F. The prevalence of mental retardation: a critical review of recent literature. *Dev Med Child Neurol.* 1997;39:125–132.
- Borthwick-Duffy SA. Epidemiology and prevalence of psychopathology in people with mental retardation. *J Consult Clin Psychol.* 1994;62:17–27.
- Dekker MC, Koot HM. DSM-IV disorders in children with borderline to moderate intellectual disability. I: prevalence and impact. *J Am Acad Child Adolesc Psychiatry.* 2003;42:915–922.
- Schonfeld IS, Shaffer D, O'Connor P, Portnoy S. Conduct disorder and cognitive functioning: testing three causal hypotheses. *Child Dev.* 1988;59:993–1007.
- Whalley LJ, Starr JM, Athawes R, Hunter D, Pattie A, Deary IJ. Childhood mental ability and dementia. *Neurology.* 2000;55:1455–1459.
- Dietz KR, Lavigne JV, Arend R, Rosenbaum D. Relation between intelligence and psychopathology among preschoolers. *J Clin Child Psychol.* 1997;26:99–107.
- Kerker BD, Owens PL, Zigler E, Horwitz SM. Mental health disorders among individuals with mental retardation: challenges to accurate prevalence estimates. *Public Health Rep.* 2004;119:409–417.
- Maughan B, Collishaw S, Pickles A. Mild mental retardation: psychosocial functioning in adulthood. *Psychol Med.* 1999;29:351–366.
- Menolascino FJ. Emotional disturbances in mentally retarded children. *Am J Psychiatry.* 1969;126:168–176.
- Reiss S. Prevalence of dual diagnosis in community-based day programs in the Chicago metropolitan area. *Am J Ment Retard.* 1990;94:578–585.
- Rutter M, Graham P. Epidemiology of psychiatric disorder. In: Rutter M, Tizard J, Whitmore P, eds. *Education, Health and Behavior*. London, England: Longman Group; 1970:178–201.
- Crews WD Jr, Bonaventura S, Rowe F. Dual diagnosis: prevalence of psychiatric disorders in a large state residential facility for individuals with mental retardation. *Am J Ment Retard.* 1994;98:724–731.
- Rutter M, Tizard J, Yule W, Graham P, Whitmore K. Research report: Isle of Wight Studies, 1964–1974. *Psychol Med.* 1976;6:313–332.
- Bronfenbrenner U. Developmental ecology through space and time: a future perspective. In: Moen P, Elder GH Jr, Luscher K, eds. *Examining Lives in Context: Perspectives on the Ecology of Human Development*. Washington, DC: American Psychological Association; 1995:619–647.
- Zigler E, Balla D, Hodapp R. On the definition and classification of mental retardation. *Am J Ment Defic.* 1984;89:215–230.
- Zetlin A, Murtaugh M. Whatever happened to those with borderline IQs? *Am J Ment Retard.* 1990; 94:463–469.

25. Ramey LS, Ramey CT. Early experience and early intervention for children "at risk" for developmental delay and mental retardation. *Ment Retard Dev Disabil Res Rev.* 1999;5:1–10.
26. Camp BW, Broman SH, Nichols PL, Leff M. Maternal and neonatal risk factors for mental retardation: defining the 'at-risk' child. *Early Hum Dev.* 1998; 50:159–173.
27. Hardy JB, Astone NM, Brooks-Gunn J, Shapiro S, Miller TL, Hilton SC. Like mother, like child: intergenerational patterns of age at first birth and associations with childhood and adolescent characteristics and adult outcomes in the second generation. *Dev Psychol.* 1998; 34:1220–1232.
28. Hardy JB, Shapiro S, Mellits ED, et al. Self-sufficiency at ages 27 to 33 years: factors present between birth and 18 years that predict educational attainment among children born to inner-city families. *Pediatrics.* 1997;99:80–87.
29. Hardy JB. The Collaborative Perinatal Project: lessons and legacy. *Ann Epidemiol.* 2003;13:303–311.
30. Goldberg DP, Hillier VF. A scaled version of the General Health Questionnaire. *Psychol Med.* 1979;9:139–145.
31. Ewing JA. Detecting alcoholism: the CAGE questionnaire. *JAMA.* 1984;252:1905–1907.
32. Bradley KA, Boyd-Wickizer J, Powell SH, Burman ML. Alcohol screening questionnaires in women: a critical review. *JAMA.* 1998;280:166–171.
33. Terman LM, Merrill MA. *Stanford-Binet Intelligence Scale.* Boston, Mass: Houghton Mifflin Co; 1960.
34. Sattler JM. Analysis of functions of the 1960 Stanford-Binet Intelligence Scale, Form L-M. *J Clin Psychol.* 1965;21:173–179.
35. *Stata, Release 7.0* [computer program]. College Station, Tex: Stata Corp; 2001.
36. Dekker MC, Koot HM, van der Ende J, Verhulst FC. Emotional and behavioral problems in children and adolescents with and without intellectual disability. *J Child Psychol Psychiatry.* 2002;43:1087–1098.
37. Masi G. Psychiatric illness in mentally retarded adolescents: clinical features. *Adolescence.* 1998;33:425–434.
38. Masi G, Marcheschi M, Pfanner P. Adolescents with borderline intellectual functioning: psychopathological risk. *Adolescence.* 1998;33:415–424.
39. Breslau N. Psychiatric sequelae of low birthweight. *Am J Epidemiol.* 1995;17:96–106.
40. Whitaker AH, Van Rossem R, Feldman JF, et al. Psychiatric outcomes in low-birth-weight children at age 6 years: relation to neonatal cranial ultrasound abnormalities. *Arch Gen Psychiatry.* 1997;54:847–856.
41. Greenbaum CW, Auerbach JG. The environment of the child with mental retardation: risk, vulnerability, and resilience. In: Burack JA, Hodapp RM, Zigler EF, eds. *Handbook of Mental Retardation and Development.* New York, NY: Cambridge University Press; 1998: 583–605.
42. Ramey CT, Ramey SL, Lanzi RG. Intelligence and experience. In: Sternberg RJ, Grigorenko EL, eds. *Environmental Effects on Cognitive Abilities.* Mahwah, NJ: Lawrence Erlbaum Associates; 2000:83–115.



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