**School Quality Trajectories and Later-Life Physical and Mental Health***

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**EXTENDED ABSTRACT**

Although the association between education and health is well documented [1], pinpointing the specific inputs to the schooling process which most affect student outcomes is an area of active research. An emerging body of research suggests higher quality schools may be associated with increased earnings and academic achievement [2, 3]. Furthermore, some research suggests school quality effects may be particularly strong for socially disadvantaged groups such as women or those with lower ability [4, 5]. Much less is known about health outcomes. School quality has been reportedly associated with concurrent health outcomes (i.e. adolescent health behaviors); higher quality middle and high schools have lower student rates of smoking and obesity [6, 7]. However, research findings on the long-term health impact of school quality in primary and secondary schools have been mixed. One study found quality of primary schools was not associated with high blood pressure, current smoking, alcohol intake, or obesity in adulthood [8]. By contrast, a separate study using variation in schooling quality generated by the comprehensive schooling reforms in England and Wales and data from the 1958 National Child Development Study (NCDS) found that standard measures of poor quality of secondary schooling such as pupil expulsion rate were associated with poorer self-rated health in adulthood [9].

Previous research on this topic assessed school quality as a cross-sectional measure from one time-point. Using a cross-sectional measure to operationalize school quality assumes we know the critical period (e.g. primary school or secondary school). Measuring school quality at a single point in time may also introduce substantial measurement error if school quality is fundamentally a dynamic exposure. While the quality of primary and secondary schools may be especially important because it encompasses the years covered by compulsory schooling, it may vary substantially year to year. To better understand whether school quality is associated with physical and mental health in later age, we use measures capturing the trajectories of school quality in the primary and secondary schools. We hypothesize that respondents who experienced high schooling quality consistently throughout their primary and secondary schools will have larger health gains than respondents who experienced low schooling quality. We expect schooling quality to have the largest impact among women because research substitution theory suggests socially disadvantaged groups may benefit more from increases in educational capital [10]. Furthermore, these effects may differ along the distribution of depressive symptoms and BMI, respectively reflecting the extent social factors may differentially affect underlying biological risk.

**Methods**

*Sample.* We use the Wisconsin Longitudinal Study (WLS) dataset, a longitudinal study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957. Extensive social, demographic, and economic information were collected from the original respondents or their

parents in 1957, 1964, 1975, 1992, and 2003-2004. Some information on mental and physical health are available when respondents were approximately 50 years old and as they approach retirement age. The sample for the current analyses was restricted to a subset of 1640 WLS respondents who previously provided information on their primary and secondary schools to allow a linkage with historical school quality indicators.

*Exposures.* In a previous paper, Halpern-Manners et al. (2009) used group-based trajectory modeling to assign individuals based on their primary and secondary school characteristics to categorically distinct longitudinal school quality trajectories. These measures were based on three components of school quality: per pupil expenditures, teachers' schooling and pupil-teacher ratio in the district where each respondent attended school from Kindergarten through 12$^{th}$ grade [11]. Expenditures and teachers' schooling trajectories differed in primary schools but largely converged by high school years (e.g. low-increasing, flat, and high). Student-teacher ratio trajectories were more dynamic with levels differing throughout the school years and several trajectories crossing at different points in time. For each of these categorical variables the group with the most school resources was used as the reference (e.g. high teacher's schooling, high expenditures, and low-flat student-teacher ratio).

*Outcomes.* BMI was calculated based on self-reported weight and height in 1993 and 1994. Respondents' depressive symptoms were assessed with the Center for Epidemiologic Studies-Depression Scale (CESD) in 1993 and 2004. CESD is a commonly used self-reported measure designed to assess depressive experience in the general population [12, 13]. WLS used the 20-item CESD scale with scores ranging from 0 to 60, with higher scores indicating greater frequency of depressive experiences. Sample CESD items include negatively worded statements such as "I felt sad" and "I thought my life had been a failure" and positively-worded statements such as "I felt happy" and "I enjoyed life". We considered continuous BMI and CESD in linear regression models and dichotomized BMI (obese or not, defined as BMI greater than 29.9 kg/m$^2$) and a dichotomized indicator of elevated depressive symptoms (defined as CESD of 16 or greater) in logistic regression models. Continuous outcomes were natural log-transformed.

*Other covariates.* Potential confounders included age (estimated as difference between year of birth and 1993 and 2003, respectively), self-reported health as a child recalled in 2003-04 (Excellent/ Very good, Good, Fair/Poor), family household income reported in 1957 (log transformed family continuous outcome) and mother's education (less than 12 years vs. at least 12 years), mental ability measured in 11$^{th}$ grade reported in 1957, presence of siblings in the family (Y/N) and rural vs. urban residence in 1957 (urban population used is that population residing in incorporated places of 2,500

population or more). Additional covariates used in sensitivity or stratification analyses included educational attainment by 1975 (i.e., bachelor's degree or higher by approximately age 35).

*Analyses.* Primary analyses used linear models of depressive symptoms and BMI and logistic regression models for elevated depressive symptomatology and obesity. Each indicator of school quality was entered in a separate model. We pooled outcomes for 1993 and 2004 to increase statistical power and corrected standard errors for correlation between the repeated measures on the same individual. All models were adjusted for core covariates listed above. Conceptually, we hypothesized that schooling quality may impact later adult health by increasing socioeconomic advantage in early adulthood (Figure 1). For that reason, we examined whether the effect estimates were attenuated by adjustment for educational attainment by 1975 (i.e. bachelor's degree or higher by the age of 35 for most respondents). Models were gender-stratified because previous research suggested educational quality may be more beneficial to women (i.e. resource substitution theory). Finally, we repeated primary models using quantile regression and depressive symptoms and BMI to examine whether the effects of school quality differed along the outcome distribution. Confidence intervals for quantile regression models were created by bootstrapping each model 500 times. All analysis was conducted in Stata 12.0.

**Preliminary results**

Over half of the 1640 sample respondents experienced schooling trajectories with consistently high levels of teachers' schooling (Table 1). Average childhood socioeconomic status was higher for respondents who were categorized in higher "quality" schooling trajectories regardless of the measure. For example, the mean family income was 43,000 for those with schooling trajectories with consistently low teachers' schooling compared to 51,000 for those with medium teachers' schooling and 72,000 for those with consistently high teachers' schooling (Table 1). Similarly, a higher percentage of respondents in the lower quality schooling trajectories had a mother with less than 12 years of education was higher. Groups with lower schooling quality generally had higher prevalence of depression and this trend was more pronounced among females. Conversely, the prevalence of overweight/obesity was generally high for all groups (Figure 2).

No association between schooling quality and obesity or mean BMI was found for females or males (Table 2A-2B). For depressive symptoms, we found interesting gender-specific patterns. There was no association between schooling quality and average depressive symptoms or odds of elevated depressive symptoms among males (Table 3A). Among females, trajectories characterized as consistently lower school resources were associated with more depressive symptoms. Females whose student-teacher ratio trajectory started high and then declined had 30% increase in depressive

symptoms compared to those in the medium student-ratio trajectory. The quantile regression results suggest the association between schooling quality and CESD symptomology is larger at the lower end of the outcome distribution (i.e., low levels of depressive symptoms; Table 3B).

Including educational attainment (Bachelor's degree by 1975 vs. None) attenuated the regression coefficient associated with lower schooling quality trajectory and depressive symptoms/depression somewhat but did not change the statistical significance. To account for possible interaction between schooling quality and educational attainment, we further stratified according to whether or not the respondent had a bachelor's degree by 1975. We found that respondents in the high-declining vs. low-flat student-teacher ratio trajectory were significantly more likely to have depressive symptoms among females without a bachelor's degree by 1975 (b=0.33, 95% CI=0.03, 0.63, Table 4). Among women with a bachelor's degree by 1975, the association was also positive but not statistically significant (b=0.11, 95% CI=-0.33, 0.54).

**Summary**

Emerging research suggests that early childhood schooling quality can have long-lasting effects on socioeconomic outcomes [3-5, 14], though much less is known about health outcomes. School quality has been identified in a qualitative study as a domain associated with physical and mental health in mid- and later life [15]. While a previous study found no associations between primary school and adult health outcomes [8], to date, no study has examined the association between school quality and long-term health outcomes using measures that reflect schooling quality throughout the course of an individual's compulsory schooling career. Our findings do not support a previous study suggest improvements in school quality, measured as the student-teacher ratio, average teachers' wage, and length of the school year as associated with decreased obesity in later life [16]. We find no evidence that early schooling quality was associated with BMI or overweight status. Further, school quality was not associated with depressive symptoms among men. However, schooling quality as captured by trajectories of expenditures in primary and secondary school and trajectories of teachers' schooling was associated with depression and the distribution of depressive symptoms among females. While previous research suggest low levels of education is strongly associated with depression, especially among women [10] but no prior study has examined the role of school quality and depression.

Gender differences in the effect of education may be explained by two different theories: resource multiplication and resource substitution [10]. Resource substitution theory assumes that education is more beneficial to socially disadvantaged subpopulations because it can serve as a substitute for other resources that are not present. In contrast, resource multiplication assumes education is more beneficial to subpopulations that are already advantaged because the absence of

one resource reduces the value of other resources. Our results provide some support for the resource substitution theory. Moreover, our findings that the effects of school quality were generally found at the lower end of the distribution of depressive symptoms suggesting less of a biological/ clinical mechanism and more of a social mechanism addressing general malaise.

The various measures of school resources used in this study may be tapping into different dimensions of school quality. Student teacher ratio is a measure of class size which, by extension, may proxy the amount of individualized attention students are receiving. Expenditures and teachers' schooling are often used as proxy measures of school quality but they may also reflect finer area-level distinctions not necessarily associated with school quality. For example, schools in poor urban metropolitan areas often have high expenditures per student, yet the "quality" of schooling is not high.

Our study had some limitations including generalizability. However, our study also had several advantages. We included measures of childhood health status and IQ measured in adolescent, potential confounders in the association between schooling and later-life health that is often not available. In addition our measures of schooling quality were objective measures of school resources reflecting the kindergarten through high school years.

Multiple pathways link education to health including higher socioeconomic status and a higher capacity to for processing health-related information[17]. Despite the research focus on school quantity, such mechanisms linking education and health may be influenced by other, more policy-modifiable aspects of education. Complementary to previous research on degree credentials and years of schooling, our results suggest increasing school quality may have mental health benefits especially for socially disadvantaged groups.

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**Table 1. Selected sociodemographic characteristics for study sample according to school quality, WLS**

| | | Teacher's schooling | | | Student-teacher ratio | | | | | Expenditures per student | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Low | Medium | High | Low-flat | Medium | Low-declining | Sharp-declining | High-declining | Low | Medium | High |
| *N* | 1640 | 222 | 456 | 962 | 132 | 893 | 103 | 143 | 369 | 824 | 590 | 226 |
| Male (%) | 46 | 50 | 44 | 46 | 52 | 46 | 40 | 45 | 45 | 46 | 46 | 46 |
| Health as a child: | | | | | | | | | | | | |
| Poor/fair/good (%) | 17 | 15 | 19 | 17 | 17 | 18 | 18 | 17 | 16 | 18 | 17 | 19 |
| Has a sibling (%) | 93 | 95 | 93 | 92 | 95 | 92 | 93 | 91 | 93 | 93 | 92 | 93 |
| Mean income in thousands | 62 | 43 | 51 | 72 | 53 | 65 | 47 | 50 | 66 | 52 | 72 | 71 |
| (IQR) | (37) | (28) | (32) | (34) | (37) | (33) | (39) | (27) | (39) | (35) | (35) | (40) |
| Mother's education: | | | | | | | | | | | | |
| < 12 yrs (%) | 47 | 59 | 48 | 43 | 58 | 45 | 53 | 45 | 45 | 50 | 46 | 40 |
| Mean IQ | 101 | 98 | 102 | 102 | 104 | 101 | 100 | 101 | 100 | 100 | 102 | 103 |
| (IQR) | (20) | (19) | (19) | (19) | (25) | (19) | (20) | (17) | (22) | (20) | (20) | (18) |
| Rural (%) | 38 | 93 | 63 | 13 | 58 | 31 | 84 | 67 | 22 | 59 | 10 | 31 |
| BA by 1975 (%) | 23 | 14 | 24 | 24 | 31 | 23 | 20 | 16 | 22 | 20 | 25 | 28 |
| Obese in 1993 (%) | 24 | 25 | 23 | 24 | 24 | 24 | 26 | 32 | 21 | 29 | 24 | 23 |
| Elevated CESD in 1993 (% | 10 | 9 | 9 | 11 | 5 | 10 | 10 | 11 | 9 | 10 | 7 | 11 |
| Obese in 2003 (%) | 33 | 33 | 33 | 33 | 35 | 32 | 30 | 43 | 31 | 37 | 34 | 32 |
| Elevated CESD in 2003 (% | 6 | 7 | 6 | 6 | 5 | 6 | 8 | 8 | 8 | 10 | 5 | 6 |

**Table 2A. Associations of school quality with BMI and overweight status among males, WLS**

| | OLS/Mean (BMI) | P25 (BMI) | P50 (BMI) | P75 (BMI) | OR (Obese) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | 0.03 | 0.04 | 0.02 | 0.04 | 1.43 |
| | [-0.1, 0.07] | [-0.01, 0.08] | [-0.03, 0.07] | [-0.02, 0.09] | [0.80, 2.56] |
| Medium | 0.02 | 0.02 | 0.01 | 0.01 | 1.29 |
| | [-0.01, 0.05] | [-0.02, 0.06] | [-0.02, 0.05] | [-0.03, 0.05] | [0.84, 1.96] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | 0.00 | 0.00 | 0.01 | -0.01 | 0.96 |
| | [-0.03, 0.04] | [-0.04, 0.05] | [-0.03, 0.06] | [-0.06, 0.05] | [0.57, 1.61] |
| Medium | 0.00 | 0.00 | 0.01 | 0.00 | 0.93 |
| | [-0.04, 0.04] | [-0.04, 0.05] | [-0.03, 0.05] | [-0.05, 0.05] | [0.56, 1.56] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | -0.03 | -0.04 | -0.03 | -0.04 | 0.61 |
| | [-0.07, 0.01] | [-0.08, 0.01] | [-0.08, 0.03] | [-0.10, 0.01] | [0.35, 1.07] |
| Low-declining | -0.02 | 0.00 | -0.02 | -0.05 | 0.69 |
| | [-0.07, 0.04] | [-0.08, 0.07] | [-0.09, 0.05] | [-0.12, 0.03] | [0.28, 1.66] |
| Sharp-declining | 0.02 | 0.00 | 0.05 | 0.01 | 1.55 |
| | [-0.03, 0.08] | [-0.07, 0.08] | [-0.03, 0.12] | [-0.06, 0.08] | [0.76, 3.19] |
| High-declining | -0.04 | -0.04 | -0.04 | -0.07 | 0.48 |
| | [-0.08, 0.00] | [-0.08, 0.00] | [-0.10, 0.01] | [-0.13, -0.02] | [0.26, 0.90] |
| *N* | 1170 | 1170 | 1170 | 1170 | 1170 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.

**Table 2B. Associations of school quality with BMI and overweight status among females, WLS**

| | OLS/Mean (BMI) | P25 (BMI) | P50 (BMI) | P75 (BMI) | OR (Obese) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | -0.01 | -0.04 | 0.01 | 0.02 | 1,11 |
| | [-0.06, 0.04] | [-0.10, 0.01] | [-0.07, 0.10] | [-0.06, 0.09] | [0.62, 1.98] |
| Medium | -0.02 | -0.04 | 0 | -0.01 | 0.91 |
| | [-0.05, 0.01] | [-0.08, 0.00] | [-0.05, 0.04] | [-0.07, 0.04] | [0.60, 1.37] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | -0.03 | -0.04 | -0.04 | -0.04 | 0.91 |
| | [-0.07, 0.01] | [-0.09, 0.02] | [-0.09, 0.01] | [-0.10, 0.03] | [0.57, 1.45] |
| Medium | 0 | 0 | 0 | -0.02 | 0.97 |
| | [-0.05, 0.04] | [-0.06, 0.06] | [-0.05, 0.05] | [-0.08, 0.05] | [0.60, 1.59] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | 0.04 | 0.04 | 0.02 | 0.04 | 1.66 |
| | [-0.01, 0.09] | [-0.02, 0.11] | [-0.05, 0.10] | [-0.03, 0.12] | [0.89, 3.15] |
| Low-declining | 0.05 | 0.05 | 0.05 | 0.05 | 1.46 |
| | [-0.02, 0.12] | [-0.04, 0.13] | [-0.04, 0.13] | [-0.05, 0.15] | [0.66, 3.23] |
| Sharp-declining | 0.03 | 0 | 0.03 | 0.05 | 1.61 |
| | [-0.04, 0.10] | [-0.08, 0.08] | [-0.06, 0.13] | [-0.04, 0.14] | [0.73, 3.58] |
| High-declining | 0.05 | 0.04 | 0.04 | 0.06 | 1.91 |
| | [0.00, 0.11] | [-0.03, 0.11] | [-0.04, 0.11] | [-0.03, 0.14] | [0.95, 3.83] |
| *N* | 1321 | 1321 | 1321 | 1321 | 1321 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.

**Table 3A. Associations of school quality with depressive symptoms among males, WLS**

| | OLS/Mean (CESD) | P25 (CESD) | P50 (CESD) | P75 (CESD) | OR (Max score) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | 0.09 | 0.14 | 0.11 | -0.03 | 0.69 |
| | [-0.13, 0.30] | [-0.28, 0.56] | [-0.16, 0.38] | [-0.27, 0.20] | [0.19, 2.51] |
| Medium | 0.07 | 0.17 | 0.04 | -0.01 | 1.04 |
| | [-0.09, 0.22] | [-0.07, 0.40] | [-0.15, 0.22] | [-0.21, 0.19] | [0.50, 2.17] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | -0.07 | 0.29 | -0.13 | -0.17 | 0.66 |
| | [-0.26, 0.13] | [-0.12, 0.69] | [-0.35, 0.08] | [-0.39, 0.06] | [0.29, 1.53] |
| Medium | -0.08 | 0.26 | -0.13 | -0.17 | 0.8 |
| | [-0.28, 0.11] | [-0.15, 0.67] | [-0.35, 0.08] | [-0.42, 0.08] | [0.35, 1.82] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | 0.08 | 0.2 | 0.06 | 0.14 | 1.27 |
| | [-0.13, 0.30] | [-0.20, 0.59] | [-0.18, 0.30] | [-0.14, 0.41] | [0.28, 5.86] |
| Low-declining | 0.03 | 0.12 | 0 | 0.1 | 2.74 |
| | [-0.30, 0.37] | [-0.50, 0.74] | [-0.37, 0.37] | [-0.28, 0.38] | [0.49, 15.47] |
| Sharp-declining | 0.12 | 0.36 | 0.04 | 0.06 | 2.01 |
| | [-0.14, 0.38] | [-0.13, 0.85] | [-0.30, 0.38] | [-0.26, 0.38] | [0.37, 10.80] |
| High-declining | 0 | 0.11 | -0.05 | 0.08 | 1.72 |
| | [-0.24, 0.24] | [-0.35, 0.57] | [-0.32, 0.21] | [-0.23, 0.39] | [0.35, 8.38] |
| *N* | 1121 | 1121 | 1121 | 1121 | 1121 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.

**Table 3B. Associations of school quality with depressive symptoms among females, WLS**

| | OLS/Mean (CESD) | P25 (CESD) | P50 (CESD) | P75 (CESD) | OR (Max score) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | 0.02 | -0.01 | 0.07 | 0.06 | 1.39 |
| | [-0.19, 0.24] | [-0.32, 0.31] | [-0.18, 0.33] | [-0.21, 0.33] | [0.61, 3.16] |
| Medium | -0.03 | -0.01 | -0.03 | -0.04 | 0.71 |
| | [-0.17, 0.10] | [-0.21, 0.20] | [-0.18, 0.13] | [-0.20, 0.12] | [0.36, 1.38] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | -0.10 | -0.13 | -0.12 | -0.02 | 1.06 |
| | [-0.24, 0.05] | [-0.39, 0.13] | [-0.25, 0.02] | [-0.20, 0.17] | [0.57, 1.97] |
| Medium | -0.24 | -0.28 | -0.25 | -0.11 | 0.75 |
| | [-0.39, -0.09] | [-0.57,0.01] | [-0.39, -0.10] | [-0.31, 0.08] | [0.38, 1.48] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | 0.22 | 0.42 | 0.21 | 0.03 | 1.35 |
| | [-0.01, 0.45] | [0.11, 0.72] | [-0.18, 0.60] | [-0.18, 0.24] | [0.59, 3.08] |
| Low-declining | 0.12 | 0.47 | 0.08 | -0.12 | 1.28 |
| | [-0.18, 0.42] | [0.02, 0.92] | [-0.35, 0.51] | [-0.42, 0.19] | [0.40, 4.16] |
| Sharp-declining | 0.03 | 0.16 | 0.01 | -0.08 | 1.18 |
| | [-0.26, 0.31] | [-0.30, 0.63] | [-0.41, 0.44] | [-0.37, 0.21] | [0.42, 3.28] |
| High-declining | 0.26 | 0.42 | 0.23 | 0.13 | 1.44 |
| | [0.01, 0.51] | [0.09, 0.75] | [-0.16, 0.62] | [-0.10, 0.37] | [0.58, 3.57] |
| *N* | 1262 | 1262 | 1262 | 1262 | 1262 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.

**Table 4A. Associations of school quality with depressive symptoms, females with a college degree**

| | OLS/Mean (CESD) | P25 (CESD) | P50 (CESD) | P75 (CESD) | OR (Depression) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | 0.00 | -0.02 | 0.18 | 0.14 | 0.37 |
| | [-0.38, 0.38] | [-0.88, 0.84] | [-0.45, 0.81] | [-0.47, 0.76] | [0.02, 7.97] |
| Medium | 0.02 | -0.04 | 0.16 | 0.08 | 0.30 |
| | [-0.25, 0.29] | [-0.47, 0.38] | [-0.12, 0.44] | [-0.21, 0.37] | [0.08, 1.13] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | -0.22 | -0.26 | -0.07 | -0.09 | 0.24 |
| | [-0.49, 0.05] | [-0.64, 0.11] | [-0.35, 0.21] | [-0.41, 0.24] | [0.06, 0.96] |
| Medium | -0.30 | -0.50 | -0.26 | 0.00 | 0.75 |
| | [-0.57, -0.03] | [-0.90, -0.10] | [-0.54, 0.03] | [-0.37, 0.36] | [0.24, 2.32] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | 0.10 | 0.37 | -0.06 | -0.17 | 0.10 |
| | [-0.28, 0.49] | [-0.17, 0.90] | [-0.66, 0.54] | [-0.58, 0.24] | [-0.28, 0.49] |
| Low-declining | 0.06 | 0.10 | -0.19 | 0.08 | 0.06 |
| | [-0.48, 0.60] | [-0.87, 1.07] | [-1.01, 0.63] | [-0.44, 0.60] | [-0.48, 0.60] |
| Sharp-declining | -0.16 | 0.05 | -0.41 | 0.02 | -0.16 |
| | [-0.72, 0.39] | [-0.89, 0.98] | [-1.22, 0.39] | [-0.59, 0.64] | [-0.72, 0.39] |
| High-declining | 0.11 | 0.32 | -0.08 | 0.00 | 0.11 |
| | [-0.33, 0.54] | [-0.22, 0.86] | [-0.74, 0.58] | [-0.48, 0.47] | [-0.33, 0.54] |
| *N* | 261 | 261 | 261 | 261 | 225 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.

**Table 4B. Associations of school quality with depressive symptoms, females without a college degree**

| | OLS/Mean (CESD) | P25 (CESD) | P50 (CESD) | P75 (CESD) | OR (Depression) |
|---|---|---|---|---|---|
| *Teacher's schooling (high as ref. cat.)* | | | | | |
| Low-increasing | 0.00 | 0.00 | -0.02 | 0.10 | 1.60 |
| | [-0.24, 0.24] | [-0.38, 0.38] | [-0.24, 0.21] | [-0.16, 0.37] | [0.64, 4.01] |
| Medium | -0.04 | -0.01 | -0.04 | -0.03 | 0.86 |
| | [-0.20, 0.12] | [-0.25, 0.24] | [-0.18, 0.10] | [-0.18, 0.12] | [0.41, 1.81] |
| *Expenditures (high as ref. cat.)* | | | | | |
| Low | -0.07 | -0.08 | -0.09 | 0.05 | 1.42 |
| | [-0.24, 0.09] | [-0.36, 0.19] | [-0.25, 0.07] | [-0.13, 0.23] | [0.65, 3.10] |
| Medium | -0.22 | -0.27 | -0.19 | -0.09 | 0.79 |
| | [-0.39, -0.04] | [-0.56, 0.02] | [-0.36, -0.01] | [-0.29, 0.12] | [0.33, 1.90] |
| *Student-teacher ratio (low-flat as ref. cat.)* | | | | | |
| Medium | 0.28 | 0.42 | 0.27 | 0.07 | 1.84 |
| | [0.00, 0.56] | [0.03 - 0.82] | [-0.12, 0.66] | [-0.12, 0.26] | [0.62, 5.46] |
| Low-declining | 0.18 | 0.42 | 0.14 | 0.02 | 2.13 |
| | [-0.18, 0.54] | [-0.07, 0.92] | [-0.29, 0.57] | [-0.34, 0.39] | [0.55, 8.22] |
| Sharp-declining | 0.10 | 0.31 | 0.10 | -0.09 | 1.89 |
| | [-0.23, 0.44] | [-0.18, 0.80] | [-0.31, 0.52] | [-0.39, 0.22] | [0.56, 6.41] |
| High-declining | 0.33 | 0.47 | 0.30 | 0.17 | 1.84 |
| | [0.03, 0.63] | [0.05, 0.89] | [-0.09, 0.69] | [-0.04, 0.39] | [0.57, 5.90] |
| *N* | 1001 | 1001 | 1001 | 1001 | 1001 |

Note: All models adjusted for age, health as a child, family income in 1957, mother's education, IQ measured in adolescence, residence in a rural area in 1957, and whether respondent had a sibling. Confidence intervals for linear and logistic regression models accounted for clustering by individual because BMI and CESD were measured in 1993 and 2003. Confidence intervals for quantile regression models were calculated by bootstrapping 500 times and accounted for clustering by individual. Continuous outcomes were natural-log transformed in the linear and quantile regression models.