

**Supplementary Table S1: Relationship between covariates and maternal serum vitamin D among controls, and covariates and specific learning disorder diagnosis in case and control subjects.**

|                                                 | Covariates and vitamin D (nmol/L) among controls |                                 |                            |                                | Covariates and specific learning disorder |                     |                                |
|-------------------------------------------------|--------------------------------------------------|---------------------------------|----------------------------|--------------------------------|-------------------------------------------|---------------------|--------------------------------|
|                                                 | Deficient<br><30<br>N=541                        | Insufficient<br>30-<50<br>N=685 | Sufficient<br>>50<br>N=381 |                                | Cases<br>N=1,607                          | Controls<br>N=1,607 |                                |
| Categorical variables                           | Frequency (%)                                    | Frequency (%)                   | Frequency (%)              | x <sup>2</sup> test<br>P-value | Frequency (%)                             | Frequency (%)       | x <sup>2</sup> test<br>P-value |
| <b>Maternal smoking</b>                         |                                                  |                                 |                            |                                |                                           |                     |                                |
| No                                              | 416 (79.1)                                       | 564 (83.9)                      | 327 (87.0)                 | 0.006                          | 1,194 (76.5)                              | 1,307 (83.0)        | <0.001                         |
| Yes                                             | 110 (20.9)                                       | 108 (16.1)                      | 49 (13.0)                  |                                | 366 (23.5)                                | 267 (17.0)          |                                |
| <b>Previous births</b>                          |                                                  |                                 |                            |                                |                                           |                     |                                |
| 0                                               | 226 (41.9)                                       | 268 (39.2)                      | 146 (38.6)                 | 0.53                           | 598 (37.3)                                | 640 (40.0)          | 0.12                           |
| ≥ 1                                             | 314 (58.1)                                       | 416 (60.8)                      | 232 (61.4)                 |                                | 1,006 (62.7)                              | 962 (60.0)          |                                |
| <b>Maternal psychiatric history<sup>a</sup></b> |                                                  |                                 |                            |                                |                                           |                     |                                |
| No                                              | 473 (87.4)                                       | 604 (88.2)                      | 339 (89.0)                 | 0.77                           | 1,272 (79.2)                              | 1,416 (88.1)        | <0.001                         |
| Yes                                             | 68 (12.6)                                        | 81 (11.8)                       | 42 (11.0)                  |                                | 335 (20.8)                                | 191 (11.9)          |                                |

|                                                        |            |            |            |      |               |              |        |
|--------------------------------------------------------|------------|------------|------------|------|---------------|--------------|--------|
| <b>Paternal psychiatric history<sup>b</sup></b>        |            |            |            |      |               |              |        |
| No                                                     | 461 (86.0) | 600 (88.4) | 336 (88.2) | 0.42 | 1,259 (79.9)  | 1,397 (87.5) | <0.001 |
| Yes                                                    | 75 (14.0)  | 79 (11.6)  | 45 (11.8)  |      | 316 (20.1)    | 199 (12.5)   |        |
| <b>Maternal SES</b>                                    |            |            |            |      |               |              |        |
| Upper white collar                                     | 66 (12.9)  | 115 (17.4) | 55 (15.0)  | 0.03 | 129 (8.5)     | 236 (15.3)   | <0.001 |
| Lower white collar                                     | 228 (44.7) | 319 (48.2) | 189 (51.6) |      | 664 (43.6)    | 736 (47.9)   |        |
| Blue collar                                            | 123 (24.1) | 124 (18.7) | 61 (16.7)  |      | 417 (27.4)    | 308 (20.0)   |        |
| Others                                                 | 93 (18.2)  | 104 (15.7) | 61 (16.7)  |      | 313 (20.6)    | 258 (16.8)   |        |
| <b>History of maternal substance abuse<sup>c</sup></b> |            |            |            |      |               |              |        |
| No                                                     | 534 (98.7) | 668 (97.5) | 375 (98.4) | 0.28 | 1,534 (95.5)  | 1,577 (98.1) | <0.001 |
| Yes                                                    | 7 (1.3)    | 17 (2.5)   | 6 (1.6)    |      | 73 (4.5)      | 30 (1.9)     |        |
| <b>Maternal immigration status</b>                     |            |            |            |      |               |              |        |
| No                                                     | 529 (97.8) | 678 (99.0) | 375 (98.4) | 0.24 | 1,607 (100.0) | 1,582 (98.4) | <0.001 |
| Yes                                                    | 12 (2.2)   | 7 (1.0)    | 6 (1.6)    |      | 0 (0.0)       | 25 (1.6)     |        |
| <b>Weight for gestational age</b>                      |            |            |            |      |               |              |        |
| <-2 SD                                                 | 24 (4.5)   | 19 (2.8)   | 5 (1.3)    | 0.07 | 100 (6.3)     | 48 (3.0)     | <0.001 |
| -2 SD to +2 SD                                         | 497 (92.4) | 642 (93.9) | 355 (94.2) |      | 1,439 (90.1)  | 1,494 (93.4) |        |

|                                       |                                 |            |            |                           |                  |                  |                           |
|---------------------------------------|---------------------------------|------------|------------|---------------------------|------------------|------------------|---------------------------|
| >+2 SD                                | 17 (3.2)                        | 23 (3.4)   | 17 (4.5)   |                           | 58 (3.6)         | 57 ( 3.6)        |                           |
| <b>Gestational age</b>                |                                 |            |            |                           |                  |                  |                           |
| <37 weeks                             | 21 (3.9)                        | 27 (4.0)   | 14 (3.7)   | 0.98                      | 113 (7.1)        | 62 (3.9)         | <0.001                    |
| ≥37 weeks                             | 519 (96.1)                      | 657 (96.0) | 363 (96.3) |                           | 1,485 (92.9)     | 1,539 (96.1)     |                           |
| <b>Season of blood draw</b>           |                                 |            |            |                           |                  |                  |                           |
| Spring                                | 226 (41.8)                      | 182 (26.6) | 39 (10.2)  | <0.001                    | 442 (27.5)       | 447 (27.8)       | 0.94                      |
| Summer                                | 28 (5.2)                        | 152 (22.2) | 187 (49.1) |                           | 357 (22.2)       | 367 (22.8)       |                           |
| Autumn                                | 83 (15.3)                       | 175 (25.6) | 115 (30.2) |                           | 385 (24.0)       | 373 (23.2)       |                           |
| Winter                                | 204 (37.7)                      | 176 (25.7) | 40 (10.5)  |                           | 423 (26.3)       | 420 (26.1)       |                           |
| <b>Apgar Score</b>                    |                                 |            |            |                           |                  |                  |                           |
| 0–6                                   | 25 (4.7)                        | 22 (3.2)   | 14 (3.7)   | 0.43                      | 80 (5.0)         | 61 (3.8)         | 0.10                      |
| 7–10                                  | 512 (95.3)                      | 662 (96.8) | 363 (96.3) |                           | 1,512 (95.0)     | 1,537 (96.2)     |                           |
| <b>Continuous variables</b>           | <b>Least squares means (SD)</b> |            |            | <b>F-test<br/>P-value</b> | <b>Mean (SD)</b> | <b>Mean (SD)</b> | <b>T-test<br/>P-value</b> |
| <b>Maternal age (years)</b>           | 28.7 (5.1)                      | 29.6 (5.1) | 29.6 (5.1) | 0.003                     | 28.8 (5.7)       | 29.3 (5.1)       | 0.005                     |
| <b>Gestational week of blood draw</b> | 10.7 (3.1)                      | 10.5 (3.1) | 10.5 (3.1) | 0.31                      | 11.0 (3.1)       | 10.6 (3.5)       | <0.001                    |

<sup>a</sup> ICD-8 (291-308), ICD-9 (291-316) or ICD-10 (F10-99, excluding maternal substance abuse diagnosis, <sup>b</sup> ICD-8 (291-308), ICD-9 (291-316) or ICD-10 (F10-99); <sup>c</sup> ICD-8 (291, 303, 304), ICD-9 (291, 292, 303,304,305) or ICD-10 (F10-19). Abbreviations: SES, socioeconomic status. SD, standard deviation.

Missing data: Maternal smoking 80 subjects; Maternal SES 153 subjects; Previous births 8 subjects; Paternal psychiatric history 43 subjects; Gestational age 15 subjects; Weight for gestational age 18 subjects; Apgar score 24 subjects.