**Supplement 1** – EXPOSURE VARIABLE: Maternal depressive symptoms

Items assessing maternal depressive symptoms over the past 7 days (5 months – 5 years): short version of the Center for Epidemiologic Studies Depression scale (CES-D) – self-reported

The frequency of each symptom was rated on a scale ranging from 0-3: 0 – ‘Rarely or none of the time (< 1 day)’; 1 – ‘Some or a little of the time (1-2 days)’; 2 – ‘Occasionally or a moderate amount of time (3-4 days)’; 3 – ‘Most or all of the time (5-7 days)’.

1. I did not feel like eating: my appetite was poor

2. I felt that I could not shake off the blues even with help from my family or friends

3. I had trouble keeping my mind on what I was doing

4. I felt depressed

5. I felt that everything I did was an effort

6. I felt hopeful about the future

7. My sleep was restless

8. I was happy

9. I felt lonely

10. I enjoyed life

11. I had crying spells

12. I felt that people disliked me

Note. Total scores were converted to scores varying between 0 and 10. Mean scores (created using items 2, 4, 5, 8, and 9) over the 4 assessment periods were used in the analyses.

**Supplement 2** – OUTCOME VARIABLES: Offspring academic outcomes (math, reading, writing)

Every Québec student must write government examinations (created by the Ministry of Education) at the end of grade 6 (age 12 years) to be admissible to high school. The results of the tests were made accessible and corrected by **BLINDED**. Using the terms and guidelines established by the Ministry, the **BLINDED** centralized correction was supervised by 4 people and conducted by a team consisting mostly of **BLINDED**. Inter-judge reliability assessments were also conducted (**BLINDED**). Reading examination corrections relied on 3 evaluation criteria: (1) extraction of pertinent explicit and implicit information (75% of grade), (2) text interpretation (8% of grade), and (3) pertinent reactions to literary and informational texts (17% of grade). Each response was judged as being satisfactory, acceptable, or unsatisfactory (3, 2, or 0 points, respectively) and summed to a total of 36 points. Writing examination correction relied on 5 evaluation criteria: (1) relevance and adequacy of ideas, (2) appropriate organization of the text, (3) syntax and punctuation, (4) vocabulary, and (5) spelling. Each criterion was rated on an A-to-E scale according to the Ministry of Education, Recreation and Sports (MERS) evaluation grid, where A = 20 points, B = 16 points, C = 12 points, D = 8 points, and E = 4 points. An overall score of 100 can then be calculated by adding the points obtained in each test. Finally, mathematic examination correction relied on 2 skills. The mathematic problem-solving questions (30%) relied on 3 evaluation criteria: (1) task comprehension, (2) mobilizing concepts and processes, and (3) solution explanation. The mathematical concept and process reasoning (70%) depended on 3 evaluation criteria: (1) analyze and make informed choices, (2) apply solution, and (3) justify. Each evaluation criterion was rated on an A-to-E scale outlined in the Ministry of Education’s evaluation grid. The grades in each academic achievement examination ranged as follows: reading comprehension (6– 100), writing (32–100), and mathematics (22–100). The scores are percentages.

References

**BLINDED**

**Supplement 3** – MEDIATOR VARIABLES: Peer victimization, cognitive, behavioral, and emotional school engagement

Items assessing peer victimization (6 – 10 years) – child-reported

The frequency of each perceived victimization behavior was rated on a scale ranging from never (coded as 0) to ‘Once or twice’ (coded as 1) to ‘more often’ (coded as 2).

“Has it ever occurred that a child from your school…

1. Has called you names or said mean things to you?

2. Has said mean things behind your back to other children?

3. Has prevented you from playing in his/her group when you wanted to?

4. Has pushed, hit, or kicked you?

5. Is always on your back (teases you all the time)?

6. Takes your personal things without asking for your permission and without giving them back to you?

7. Breaks something that belongs to you on purpose?

Items assessing peer victimization over the last 12 months (6 years) – parent-reported

The frequency of each perceived victimization behavior was rated on a scale ranging from 1-3: 1 – ‘Never or not true’; 2 – ‘Sometimes or somewhat true’; 3 – ‘Often or very true’.

“How often would you say that [INSERT NAME OF TARGET CHILD] …

1. Has been called names by other children?

2. Was hit or pushed by other children?

3. Reacted in an aggressive manner when teased?

Items assessing peer victimization over the last 6 months (6 – 10 years) – teacher-reported

The frequency of each perceived victimization behavior was rated on a scale ranging from 1-3: 1 – ‘Never or not true’; 2 – ‘Sometimes or somewhat true’; 3 – ‘Often or very true’. “In your opinion, [INSERT NAME OF TARGET CHILD] …

1. Has been laughed at by other children

2. Has been hit or jostled by other children

3. Has been called names by other children

Items assessing cognitive school engagement over the past 12 months (6 years) – teacher-reported

The frequency of each behavior was rated on a scale ranging from 1-5: 1 – ‘Never’; 2 – ‘Rarely’; 3 – ‘Sometimes’; 4 – ‘Often’; 5 – ‘Always’.

1. Is curious about the world
2. Is willing to play with a new toy
3. Is willing to play a new game
4. Shows a keen interest in playing with or reading a new book

Items assessing cognitive school engagement over the past 12 months (7 – 10 years) – teacher-reported

The frequency of each behavior was rated on a scale ranging from 1-5: 1 – ‘Never’; 2 – ‘Rarely’; 3 – ‘Sometimes’; 4 – ‘Often’; 5 – ‘Always’.

1. Challenges the teacher in a positive way
2. Shows creativity
3. Is capable of resolving problems
4. Puts a lot of effort into work
5. Participates in class
6. Asks questions when he/she does not understand

Items assessing behavioral school engagement over the past 12 months (6 – 10 years) – teacher-reported

The frequency of each behavior was rated on a scale ranging from 1-5: 1 – ‘Never’; 2 – ‘Rarely’; 3 – ‘Sometimes’; 4 – ‘Often’; 5 – ‘Always’.

1. Listens attentively
2. Follows instructions
3. Finishes assignments on time
4. Works autonomously
5. Works cleanly and carefully

**The following items were only included in the attitude towards learning score at age 6 years**

1. Is capable of resolving daily problems on his/her own
2. Is capable of following instructions with only one step
3. Is capable of following class routines without being reminded
4. Is capable of adapting to changes in the schedule

Items assessing emotional school engagement over the past 12 months (6 – 10 years) – child-reported

Responses to each item were rated on a scale ranging from 1-5: 1-‘Strongly disagree’; 2-‘Disagree’; 3-‘Uncertain’; 4-‘Agree’; 5-‘Strongly agree’.

1. I am proud to be studying at this school
2. I am happy to be studying at this school
3. I feel safe at my school
4. Most mornings, I feel like going to school
5. I like my school

**Table S1**. Sample characteristicsa

|  |  |  |  |
| --- | --- | --- | --- |
|  | Analysis samplen=1173b | Range | Child’s age at assessment |
| Participant |  |  |  |
|  *Boys, %* | 47.7 | 0/1 | 5 months |
|  *Caucasian ethnicity, %* | 84.0 | 0/1 | 5 months |
|  *Lollipop Test Score, median (IQR)* | 60.00 (7.0) | 11-69 | 5 years |
|  *Aggression, median (IQR)* | .83 (1.7) | 0-19 | 1.5 years |
|  *Depressive and anxiety symptoms, median (IQR)* | .00 (1.0) | 0-10 | 1.5 years |
|  *Hyperactivity, mean (SD)* | 3.46 (2.1) | 0-10 | 1.5 years |
|  *Inattention, median (IQR)* | 1.67 (3.3) | 0-10 | 1.5 years |
|  *Peer victimization, median (IQR)* | 1.11 (1.4) | 0-10 | 3.5-5 years |
| Mother |  |  |  |
|  *≤ 21 years at child’s birth, %* | 5.5 | 0/1 | 5 months |
|  *Depressive symptoms, median (IQR)* | 1.06 (1.3) | 0-10 | 5 months-5 years |
|  *Anxiety, median (IQR)* | 0.88 (1.4) | 0-8 | 4 years |
|  *Youth antisocial behavior, median (IQR)* | 1.00 (1.0) | 0-5 | 5 months |
|  *IQ, median (IQR)* | 8.57 (0.7) | 4-10 | 5 months |
|  *Stimulation, mean (SD)* | 4.83 (2.4) | 0-10 | 5 months |
|  *Verbalization, mean (SD)* | 6.76 (1.6) | 0-10 | 5 months |
| Family |  |  |  |
|  *SES, mean (SD)* | .13 (1.0) | -3-3 | 5 months |
|  *Family dysfunction, median (IQR)* | 1.39 (1.9) | 0-10 | 5 months |
|  *Single-parent family, %* | 5.6 | 0/1 | 5 months |

a Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2010), ©Gouvernement du Québec, Institut de la Statistique du Québec

b Means and standard deviations are reported for normally distributed continuous variables and medians and inter-quartile ranges are reported for non-normally distributed continuous variables.

**Table S2**. Weight-adjusted Pearson correlation matrix for study variables, n=1173a

**A. Boys, n=559**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. Maternal depressive symptoms (5mo – 5y)  |  |  |  |  |  |  |  |  |
| ***Offspring outcomes (12y)*** |  |  |  |  |  |  |  |  |
| 2. Math | -.12\* |  |  |  |  |  |  |  |
| 3. Reading | -.03 | .61\* |  |  |  |  |  |  |
| 4. Writing | -.08 | .45\* | .48\* |  |  |  |  |  |
| ***Potential mediators (6-10y)*** |  |  |  |  |  |  |  |  |
| 5. Peer victimization | .08 | -.16\* | -.07 | -.03 |  |  |  |  |
| 6. Cognitive engagement | -.12\* | .43\* | .42\* | .41\* | -.21\* |  |  |  |
| 7. Behavioral engagement | -.12\* | .48\* | .41\* | .36\* | -.32\* | .74\* |  |  |
| 8. Emotional engagement | -.02 | -.02 | .03 | .08 | -.12 | .16\* | .22\* |  |
| ***Covariates (5mo-5y)*** |  |  |  |  |  |  |  |  |
| 9. Lollipop test score | -.02 | .23\* | .11\* | .35\* | -.04 | .35\* | .32\* | .05 |
| 1. Mother <21 at birth | -.03b | -.31b\* | -.32b\* | -.34b\* | -.10b | -.22b\* | -.19b\* | .22b\* |
| 11. Maternal anxiety | .40\* | -.03 | .04 | .05 | -.02 | -.00 | -.04 | -.05 |
| 12. Maternal youth antisocial behavior | .16\* | -.01 | -.04 | -.14\* | -.04 | -.16\* | -.15\* | -.08 |
| 13. Maternal IQ | -.05 | .07 | .07 | .06 | -.10 | .10\* | .03 | -.04 |
| 14. Mother-child interactions (stimulation) | -.19\* | .13\* | .15\* | .07 | .01 | .12\* | .14\* | .03 |
| 15. Mother-child interactions (verbalization) | -.13\* | .02 | .08 | .09\* | -.03 | .11\* | .07 | .13\* |
| 16. Family SES | -.23\* | .28\* | .24\* | .44\* | .06 | .25\* | .25\* | .13\* |
| 17. Family dysfunction | .37\* | .01 | -.03 | .05 | .07 | -.04 | -.04 | -.10\* |
| 18. Single-parent family | .24b\* | -.31b\* | -.29b\* | -.28b\* | -.04b | -.23b\* | -.29b\* | .11b |
| 19. Aggression  | .14\* | -.02 | .05 | -.02 | -.01 | -.10\* | -.08 | -.00 |
| 2. DASc | .20\* | .03 | .03 | .10\* | -.06 | .02 | -.00 | .01 |
| 21. Hyperactivity  | .19\* | .00 | -.01 | -.07 | -.03 | -.06 | -.07 | .07 |
| 22. Inattention  | .14\* | .03 | -.07 | -.08 | -.05 | -.03 | -.03 | -.02 |
| 23. Peer victimization | .24\* | -.05 | -.01 | .01 | .15\* | -.10\* | -.12\* | .01 |

**B. Girls, n=614**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. Maternal depressive symptoms (5mo – 5y)  |  |  |  |  |  |  |  |  |
| ***Offspring outcomes (12y)*** |  |  |  |  |  |  |  |  |
| 2. Math | -.11\* |  |  |  |  |  |  |  |
| 3. Reading | -.13\* | .58\* |  |  |  |  |  |  |
| 4. Writing | -.18\* | .57\* | .60\* |  |  |  |  |  |
| ***Potential mediators (6-10y)*** |  |  |  |  |  |  |  |  |
| 5. Peer victimization | .10\* | -.21\* | -.16\* | -.26\* |  |  |  |  |
| 6. Cognitive engagement | -.25\* | .49\* | .44\* | .48\* | -.19\* |  |  |  |
| 7. Behavioral engagement | -.17\* | .52\* | .45\* | .49\* | -.29\* | .74\* |  |  |
| 8. Emotional engagement | .06 | .00 | -.11\* | .05 | -.07 | .14\* | .04 |  |
| ***Covariates (5mo-5y)*** |  |  |  |  |  |  |  |  |
| 9. Lollipop test score | .10\* | .05 | .01 | .25\* | -.09 | .17\* | .10\* | .58\* |
| 1. Mother <21y at birth | .21b\* | -.19b\* | -.16b\* | -.13b | .05b | -.16b\* | -.19b\* | .06b |
| 11. Maternal anxiety | .45\* | -.07 | -.09\* | -.14\* | .03 | -.15\* | -.11\* | -.11\* |
| 12. Maternal youth antisocial behavior | .16\* | -.09\* | -.04 | -.04 | .02 | -.09\* | -.12\* | .09\* |
| 13. Maternal IQ | -.12\* | .14\* | .25\* | .21\* | -.06 | .14\* | .06 | .05 |
| 14. Mother-child interactions (stimulation) | -.04 | .09\* | .12\* | .17\* | -.02 | .08 | .11\* | .06 |
| 15. Mother-child interactions (verbalization) | -.01 | .06 | .13\* | .14\* | .05 | .09\* | .07 | .11\* |
| 16. Family SES | -.22\* | .33\* | .33\* | .37\* | -.11\* | .31\* | .25\* | .08 |
| 17. Family dysfunction | .30\* | -.12\* | -.01 | -.08 | .02 | -.07 | -.02 | -.15\* |
| 18. Single-parent family | -.32b\* | -.26b\* | -.27b\* | -.22b\* | -.03b | -.18b\* | -.14b | .08b |
| 19. Aggression  | -.02 | -.06 | -.05 | -.11\* | .05 | -.01 | -.02 | .05 |
| 2. DASc | .27\* | .07 | .05 | .08 | -.17\* | -.02 | .09\* | -.10\* |
| 21. Hyperactivity  | .12\* | .05 | .08 | -.05 | -.00 | .02 | .04 | -.14\* |
| 22. Inattention  | .07 | .08 | .06 | .06 | -.04 | -.01 | .06 | -.21\* |
| 23. Peer victimization | .21\* | -.16\* | -.09\* | -.09\* | -.13\* | -.21\* | -.13\* | -.05 |

a Polyserial correlations. Note that weights cannot be applied to polyserial correlations in SAS 9.4, therefore these correlations are from the unweighted sample

b Depressive and anxiety symptoms

c Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2010), ©Gouvernement du Québec, Institut de la Statistique du Québec

\*Significant at p≤.05

**Table S3**. Comparison of baseline sample characteristics between analysis sample (n=1173) and those without government exam scores (n=947)a

|  |  |  |  |
| --- | --- | --- | --- |
|  | Analysis sample n=1173 | Participants without exam data n=947 | p-value |
| Participant |  |  |  |
|  *Boys, %* | 47.7 | 55.0 | .001 |
|  *Lollipop Test Score, median (IQR)* | 60.00 (7.0) | 57.00 (11.5) | <.0001 |
|  *Aggression, median (IQR)* | 0.83 (1.7) | 0.83 (1.7) | .755 |
|  *Depressive and anxiety symptoms, median (IQR)* | 0.00 (1.0) | 0.00 (1.0) | .089 |
|  *Hyperactivity, mean (SD)* | 3.46 (2.1) | 3.50 (2.2) | .684 |
|  *Inattention, median (IQR)* | 1.67 (3.3) | 1.67 (3.3) | .376 |
|  *Peer victimization, median (IQR)* | 1.11 (1.4) | 1.11 (1.4) | .112 |
| Mother |  |  |  |
|  *<21 years at child’s birth, %* | 5.5 | 6.0 | .575 |
|  *Depressive symptoms, median (IQR)* | 1.06 (1.3) | 1.16 (1.5) | .005 |
|  *Anxiety, median (IQR)* | 0.88 (1.4) | 0.88 (1.6) | .747 |
|  *Youth antisocial behavior, median (IQR)* | 1.00 (1.0) | 1.00 (1.0) | .290 |
|  *IQ, median (IQR)* | 8.57 (0.7) | 7.86 (1.4) | <.0001 |
|  *Stimulation, mean (SD)* | 4.83 (2.4) | 4.59 (2.3) | .032 |
|  *Verbalization, mean (SD)* | 6.76 (1.6) | 6.54 (1.7) | .004 |
| Family |  |  |  |
|  *SES, mean (SD)* | 0.13 (1.0) | -0.16 (1.0) | <.0001 |
|  *Family dysfunction, median (IQR)* | 1.39 (1.9) | 1.39 (2.2) | .025 |
|  *Single-parent family, %* | 5.6 | 11.2 | <.0001 |

Categorical variables were compared using chi-square tests and t-tests were used for continuous variables.

a Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2010), ©Gouvernement du Québec, Institut de la Statistique du Québec

**Figure S1** Mediation models of the unadjusted associations (standardized $β$[95% confidence intervals]) between exposure to maternal depressive symptoms in early childhood and children’s academic performance at 12 yearsa

\*p<0.05

p≥0.05

\*p$\leq $.05

 p>.05

BOYS

Maternal depressive symptoms

(5 months – 5 years)

 Mathematics score

(12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

-.01

[-.13;.12]

-.05 [-.19;.09]

.18\*

[.02;.35]

.37\*

[.20;.54]

-.12\*

[-.23;-.02]

.08

[-.05;.22]

-.12

[-.25;.01]

-.12

[-.25;.00]

.-02

[-.14;.09]

**A – Mathematics**

GIRLS

Maternal depressive symptoms

(5 months – 5 years)

 Mathematics score

(12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

-.04

[-.14;.06]

.02 [-.09;.13]

.26\*

[.10;.42]

.31\*

[.17;.45]

-.05

[-.13;.02]

.10

[-.08;.28]

-.17\*

[-.32;-.02]

-.24\*

[-.37;-.11]

.06

[-.16;.28]

**B – Reading**

Maternal depressive symptoms

(5 months – 5 years)

 Reading score

 (12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

.05

[-.01;.18]

.01 [-.13;.14]

.26\*

[.09;.42]

.27\*

[.09;.44]

-.07

[-.20;.06]

.09

[-.05;.22]

-.12

[-.25;.01]

-.12

[-.25;.00]

.02

[-.14;.09]

BOYS

GIRLS

Maternal depressive symptoms

(5 months – 5 years)

 Reading score

 (12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

-.04

[-.14;.06]

-.02 [-.14;.09]

.27\*

[.13;.41]

.24\*

[.09;.40]

-.13\*

[-.22;.-05]

.10

[.01;.28]

-.17\*

[-.32;-.02]

-.24\*

[-.37;-.11]

.06

[-.16;.28]

**C – Writing**

Maternal depressive symptoms

(5 months – 5 years)

 Writing score

 (12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

.15\*

[.03;.26]

-.04 [-.14;.05]

.31\*

[.16;.46]

.18\*

[.02;.34]

.00

[-.11;.11]

.09

[-.05;.22]

-.13

[-.25;.00]

-.13\*

[-.25;-.-00]

-.02

[-.14;.09]

GIRLS

Maternal depressive symptoms

(5 months – 5 years)

 Writing score

 (12 years)

Behavioral engagement

(6-10 years)

Emotional engagement

(6-10 years)

Peer victimization

(6-10 years)

Cognitive engagement

(6-10 years)

-.12\*

[-.21;-.02]

-.10 [-.23;.03]

.24\*

[.10;.38]

.27\*

[.12;.42]

.02

[-.11;.16]

.10

[-.09;.28]

-.17\*

[-.32;-.02]

-.24\*

[-.37;-.11]

.06

[-.16;.28]

BOYS

a Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2010), ©Gouvernement du Québec (Government of Québec), Institut de la Statistique du Québec (Québec Institute of Statistics)

**Table S4.** Unadjusted indirect and direct effects (standardized $β$[95% confidence intervals]) of maternal depressive symptoms on children’s academic performanceb

|  |  |  |  |
| --- | --- | --- | --- |
|  | Boys |  | Girls |
|  | Mathematics |
| Total effect | -.11 [-.27;.05] |  | -.10 [-.22;.01] |
| Direct effect | -.05 [-.18;.09] |  | .02 [-.08;.14] |
| Indirect effect |  |  |  |
|  via Peer victimization | -.00 [-.03;.04] |  | -.00 [-.02;.01] |
|  via Cognitive engagement | -.02 [-.06;.00] |  | -.06\* [-.12;-.02] |
|  via Behavioral engagement | -.05 [-.11;.00] |  | -.05\* [-.11;-.01] |
|  via Emotional engagement  | .00 [-.01;.02] |  | -.00 [-.02;.01] |
|  | Reading |
| Total effect | -.05 [-.20;.10] |  | -.14\* [-.26;.-02] |
| Direct effect | .01 [-.13;.14] |  | -.01 [-.13;.10] |
| Indirect effect |  |  |  |
|  via Peer victimization | .00 [-.04;.04] |  | -.00 [-.02;.01] |
|  via Cognitive engagement | -.03 [-.08;.00] |  | -.06\* [-.12;-.02] |
|  via Behavioral engagement | -.03 [-.08;.00] |  | -.04\* [-.09;-.00] |
|  via Emotional engagement  | .00 [-.01;.02] |  | -.01 [-.04;.02] |
|  | Writing |
| Total effect | -.09 [-.21;.03] |  | -.19\* [-.34;-.04] |
| Direct effect | -.01 [-.16;.04] |  | -.01 [-.03;.01] |
| Indirect effect |  |  |  |
|  via Peer victimization | .01 [-.01;.04] |  | -.01 [-.04;.01] |
|  via Cognitive engagement | -.04\* [-.09;.-00] |  | -.06\* [-.11;-.02] |
|  via Behavioral engagement | -.02 [-.06;.00] |  | -.05\* [-.10;-.00] |
|  via Emotional engagement  | .00 [-.01;.01] |  | -.00 [-.02;.03] |

\*p$\leq $.05

bData were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2010), ©Gouvernement du Québec (Government of Québec), Institut de la Statistique du Québec (Québec Institute of Statistics)