Prenatal Exposure to Nitrate from Drinking Water and Markers of Fetal Growth Restriction: A Population-Based Study of Nearly One Million Danish-Born Children

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**Table S1.** Characteristics of the study population by low birthweight, 1991-2011.

| Characteristic                                      | Normal weight (≥ 2,500 g) | Low birthweight (< 2,500 g) |
|-----------------------------------------------------|---------------------------|-----------------------------|
| Total population, n (%)                             | 842,320 (100)             | 10,028 (100)                |
| Pregnancy average NO₂ (mg/L), mean ± SD            | 4.7 ± 7.6                 | 4.9 ± 7.7                   |
| Gestational age (weeks), mean ± SD                 | 40 ± 1                    | 38 ± 1                      |
| Maternal age (years), mean ± SD                    | 30 ± 5                    | 29 ± 5                      |
| Maternal income (DKK), mean ± SD                   | 229,100 ± 114,200         | 211,700 ± 108,800           |
| Paternal age (years), mean ± SD                    | 32 ± 5                    | 32 ± 6                      |
| Paternal income (DKK), mean ± SD                   | 331,000 ± 211,200         | 299,000 ± 178,000           |
| Maternal height (cm), mean ± SD                    | 169 ± 16                  | 166 ± 8                     |
| Maternal pre-pregnancy weight (kg), mean ± SD      | 70 ± 23                   | 65 ± 15                     |
| Sex, n (%)                                          |                           |                             |
| Female                                              | 410,705 (49)              | 5,856 (58)                  |
| Male                                                | 431,615 (51)              | 4,172 (42)                  |
| Gravidity, n (%)                                    |                           |                             |
| 1                                                   | 368,281 (44)              | 5,691 (57)                  |
| 2                                                   | 328,443 (39)              | 2,777 (28)                  |
| ≥ 3                                                 | 145,596 (17)              | 1,560 (16)                  |
| Maternal smoking, n (%)                             |                           |                             |
| No                                                  | 657,508 (78)              | 5,047 (50)                  |
| Yes                                                 | 184,812 (22)              | 4,981 (50)                  |
| Maternal education, n (%)                           |                           |                             |
| Compulsory                                          | 194,700 (23)              | 3,828 (38)                  |
| Secondary                                           | 404,032 (48)              | 4,288 (43)                  |
| Post-secondary                                      | 243,588 (29)              | 1,912 (19)                  |
| Maternal employment status, n (%)                   |                           |                             |
| Employed                                            | 688,628 (82)              | 7,419 (74)                  |
| Unemployed                                           | 52,969 (6)                | 969 (10)                    |
| Not seeking work                                    | 100,723 (12)              | 1,640 (16)                  |
| Paternal education, n (%)                            |                           |                             |
| Compulsory                                          | 182,765 (22)              | 3,290 (33)                  |
| Secondary                                           | 438,140 (52)              | 4,959 (49)                  |
| Post-secondary                                      | 212,136 (25)              | 1,588 (16)                  |
| Missing                                             | 9,279 (1)                 | 191 (2)                     |
| Paternal employment status, n (%)                   |                           |                             |
| Employed                                            | 760,694 (90)              | 8,512 (85)                  |
| Unemployed                                           | 33,551 (4)                | 664 (7)                     |
| Not seeking work                                    | 45,325 (5)                | 816 (8)                     |
| Missing                                             | 2,750 (0)                 | 36 (0)                      |
| Urbanicity of maternal address at birth, n (%)      |                           |                             |
| Rural areas                                         | 272,270 (32)              | 3,390 (34)                  |
| Provincial town                                      | 241,417 (29)              | 3,083 (31)                  |
| Provincial city                                      | 106,839 (13)              | 1,124 (11)                  |
| Suburb of capital                                    | 102,658 (12)              | 1,142 (11)                  |
| Capital                                             | 119,136 (14)              | 1,289 (13)                  |
| Region of maternal address at birth, n (%)          |                           |                             |
| North Jutland                                       | 88,919 (11)               | 1,114 (11)                  |
| Middle Jutland                                      | 208,230 (25)              | 2,245 (22)                  |
| Southern Jutland                                    | 175,993 (21)              | 2,238 (22)                  |
| Capital area                                         | 253,167 (30)              | 2,840 (28)                  |
Zealand 116,011 (14) 1,591 (16)

**Year of birth, n (%)**

| Year          | Total     | Cases |
|---------------|-----------|-------|
| 1991 - 1995   | 207,774   | 2,980 |
| 1996 - 2000   | 205,373   | 2,522 |
| 2001 - 2005   | 197,992   | 2,141 |
| 2006 - 2012   | 231,181   | 2,385 |

**Season of birth, n (%)**

| Season          | Total     | Cases |
|-----------------|-----------|-------|
| January - March | 203,904   | 2,573 |
| April - June    | 211,581   | 2,382 |
| July - September| 227,136   | 2,639 |
| October - December | 199,699 | 2,434 |

**Water supply, n (%)**

| Supply       | Total     | Cases |
|--------------|-----------|-------|
| Public       | 838,345   | 9,971 |
| Private      | 2,989     | 42    |
| Unknown      | 986       | 15    |

**Caesarean delivery, n (%)**

| Delivery | Total     | Cases |
|----------|-----------|-------|
| No       | 494,210   | 4,294 |
| Yes      | 97,663    | 2,187 |

Note: All X² tests for difference between strata were significant at \( p \leq 0.001 \) except for the water supply \( p = 0.36 \) and continuous nitrate \( p = 0.007 \).

- The study population: full-term singleton live births in Denmark with a birthweight measurement born January 1, 1991 to December 31, 2011 to Danish-born parents who have at least eight address-linked \( NO_3 \) measurements and with non-missing covariates in the base model
- As reported two years prior to birth and standardized to 2009 values
- Maternal height and weight were assessed two years prior to birth and available from 2003 onward only, which reduces the sample size to 3,038 cases and 294,715 non-cases of LBW
- For children born in the period before 1997 smoking was recorded at the first visit with the midwife with no specifications as to the timing. For children born from 1997 onward smoking is during pregnancy.
- As reported two years before birth
- Municipalities in Denmark where the largest town has < 10,000 inhabitants
- Municipalities having a town with between 10,000 and 100,000 inhabitants
- Municipalities having a town with > 100,000 inhabitants
- Available from 1997 onward only, which reduces the sample size to 6,481 cases and 591,873 non-cases of LBW
Table S2. Difference in the mean birthweight (grams) for NO$_3^-$ concentrations in household drinking water restricted to babies born to mothers who were on public water throughout their pregnancy, and restricted to babies born to mothers whose nitrate levels were never reported above the EU standard of 50 mg/L.

| NO$_3^-$ (mg/L) | Base model $n = 852,348$ | Only public $n = 848,316$ | Never above 50 mg/L $n = 845,699$ |
|-----------------|-------------------------|--------------------------|---------------------------------|
|                 | $n$ | $\Delta$ (95% CI) | $p$-value | $n$ | $\Delta$ (95% CI) | $p$-value | $n$ | $\Delta$ (95% CI) | $p$-value |
| Categorical     |     |                 |             |     |                 |             |     |                 |             |
| $\leq 1$        | 186,182 | Ref (0) | 185,339 | Ref (0) | 185,661 | Ref (0) |
| $> 1 - \leq 2$  | 182,870 | -3.6 (-6.8, -0.5) | 0.02 | 182,322 | -3.5 (-6.7, -0.3) | 0.03 | 182,333 | -3.5 (-6.7, -0.3) | 0.03 |
| $> 2 - \leq 5$  | 299,468 | -7.4 (-10.8, -4.1) | <0.001 | 298,381 | -7.4 (-10.7, -4.0) | <0.001 | 298,401 | -7.4 (-10.7, -4.0) | <0.001 |
| $> 5 - \leq 25$ | 150,019 | -8.1 (-11.6, -4.6) | <0.001 | 148,999 | -7.9 (-11.5, -4.4) | <0.001 | 149,130 | -8.0 (-11.6, -4.5) | <0.001 |
| $> 25$          | 33,809 | -7.0 (-13.3, -0.7) | 0.03 | 33,275 | -7.0 (-13.4, -0.7) | 0.03 | 30,174 | -6.6 (-13.2, 0.03) | 0.05 |
| trend           |     | <0.001 |             |     | <0.001 |             |     | <0.001 |             |
| Continuous$^a$  | 852,348 | -9.7 (-14.6, -4.8) | <0.001 | 848,316 | -9.5 (-14.4, -4.5) | <0.001 | 845,699 | -9.8 (-14.8, -4.8) | <0.001 |

Note: EU = European Union. CI = Confidence interval. Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity. $^a$ The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and $\beta$ (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.
Table S3. Difference in mean body length at birth (millimeters) restricted to babies born to mothers who were on public water throughout their pregnancy, and restricted to babies born to mothers whose nitrate levels were never reported above the EU standard of 50 mg/L.

| NO₃⁻ (mg/L) | Categorical | Continuous<sup>a</sup> |
|-------------|--------------|------------------------|
| n = 848,106 | n = 844,095  | n = 841,494            |

|                     | Base model | Only public | Never above 50 mg/L |
|---------------------|------------|-------------|---------------------|
|                     | n         | Δ (95% CI) | p-value             | n         | Δ (95% CI) | p-value | n         | Δ (95% CI) | p-value |
| ≤ 1                 | 185,379   | Ref (0)    | 0.24                | 184,539   | Ref (0)    | 0.26    | 184,860   | Ref (0)    | 0.26    |
| > 1 – ≤ 2           | 182,001   | -0.1 (-0.2, 0.1) | 0.24 | 181,456   | -0.1 (-0.2, 0.1) | 0.26 | 181,467   | -0.1 (-0.2, 0.1) | 0.26 |
| > 2 – ≤ 5           | 297,885   | -0.2 (-0.3, -0.02) | 0.03 | 296,803   | -0.2 (-0.3, -0.01) | 0.04 | 296,824   | -0.2 (-0.3, -0.01) | 0.03 |
| > 5 – ≤ 25          | 149,114   | -0.4 (-0.5, -0.2) | <0.001 | 148,102   | -0.4 (-0.5, -0.2) | <0.001 | 148,234   | -0.4 (-0.5, -0.2) | <0.001 |
| > 25                | 33,727    | -0.2 (-0.5, 0.1) | 0.27 | 33,195    | -0.2 (-0.5, 0.1) | 0.22 | 30,109    | -0.2 (-0.5, 0.1) | 0.21 |
| trend               | <0.001    | 0.01        | <0.001              | <0.001    | 0.01        | <0.001              | <0.001    | 0.01 |

Note: EU = European Union. CI = Confidence interval. Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

<sup>a</sup> The continuous NO₃⁻ exposure variable was log transformed, ln(x+1) and β (95% CI) shown for exposures x = 25.0 mg/L NO₃⁻ compared to 0 mg/L.
Table S4. Difference in mean head circumference (millimeters) restricted to babies born to mothers who were on public water throughout their pregnancy, and restricted to babies born to mothers whose nitrate levels were never reported above the EU standard of 50 mg/L.

| NO$_3^-$ (mg/L) | Base model$^a$ $n = 588,981$ | Only public $n = 586,128$ | Never above 50 mg/L $n = 584,807$ |
|-----------------|-------------------------------|-----------------------------|----------------------------------|
|                 | $n$ | $\Delta$ (95% CI) | p-value | $n$ | $\Delta$ (95% CI) | p-value | $n$ | $\Delta$ (95% CI) | p-value |
| Categorical     |     |                      |       |     |                      |       |     |                      |       |
| $\leq 1$        | 140,486 | Ref (0)  | 0.79 | 139,828 | Ref (0)  | 0.81 | 140,085 | Ref (0)  | 0.80 |
| $> 1 - \leq 2$  | 126,561 | 0.02 (-0.1, 0.2) | 0.79 | 126,186 | 0.02 (-0.1, 0.2) | 0.81 | 126,198 | 0.02 (-0.1, 0.2) | 0.80 |
| $> 2 - \leq 5$  | 218,398 | -0.2 (-0.4, -0.1) | 0.001 | 217,601 | -0.2 (-0.4, -0.1) | 0.001 | 217,625 | -0.2 (-0.4, -0.1) | 0.001 |
| $> 5 - \leq 25$ | 81,085  | 0.1 (-0.1, 0.2) | 0.52 | 80,451  | 0.1 (-0.1, 0.2) | 0.57 | 80,588  | 0.1 (-0.1, 0.2) | 0.55 |
| $> 25$          | 22,451  | 0.1 (-0.2, 0.3) | 0.62 | 22,062  | 0.1 (-0.2, 0.4) | 0.62 | 20,311  | 0.1 (-0.2, 0.4) | 0.46 |
| trend           | 0.52  |                      |       | 0.47  |                      |       | 0.55  |                      |       |
| Continuous$^b$  | 588,981 | 0.04 (-0.2, 0.3) | 0.69 | 586,128 | 0.04 (-0.2, 0.3) | 0.74 | 584,807 | 0.1 (-0.2, 0.3) | 0.60 |

Note: EU = European Union. CI = Confidence interval. Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

$^a$ Data were available only for births ≥1997.

$^b$ The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and $\beta$ (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.
Table S5. Adjusted odds ratios (aOR) for the association between term low birthweight and household NO$_3^-$ concentration, restricted to babies born to mothers who were on public water throughout their pregnancy, and restricted to babies born to mothers whose nitrate levels were never reported above the EU standard of 50 mg/L.

| NO$_3^-$ (mg/L) | Base model \( n = 852,348 \) | Only public \( n = 848,316 \) | Never above 50 mg/L \( n = 845,699 \) |
|-----------------|-------------------------------|-------------------------------|-------------------------------------|
|                 | \( n \) | aOR (95% CI) | \( p \)-value | \( n \) | aOR (95% CI) | \( p \)-value | \( n \) | aOR (95% CI) | \( p \)-value |
| Categorical     |     |     |     |     |     |     |     |     |     |
| ≤ 1             | 186,182 | Ref (1) | 0.52 | 185,339 | Ref (1) | 0.47 | 185,661 | Ref (1) | 0.47 |
| > 1 – ≤ 2       | 182,870 | 0.98 (0.92, 1.05) | 0.52 | 182,322 | 0.98 (0.91, 1.04) | 0.47 | 182,333 | 0.98 (0.91, 1.04) | 0.47 |
| > 2 – ≤ 5       | 299,468 | 1.01 (0.94, 1.08) | 0.86 | 298,381 | 1.01 (0.94, 1.08) | 0.84 | 298,401 | 1.01 (0.94, 1.07) | 0.87 |
| > 5 – ≤ 25      | 150,019 | 1.02 (0.95, 1.09) | 0.55 | 148,999 | 1.02 (0.95, 1.09) | 0.55 | 149,130 | 1.02 (0.96, 1.09) | 0.51 |
| > 25            | 33,809  | 0.99 (0.88, 1.12) | 0.91 | 33,275  | 0.99 (0.87, 1.11) | 0.81 | 30,174  | 0.98 (0.86, 1.12) | 0.78 |
| trend           |     | 0.51 | 0.51 |     | 0.51 | 0.52 |     | 0.51 | 0.50 |
| Continuous$^a$  | 852,348 | 1.02 (0.93, 1.11) | 0.73 | 848,316 | 1.02 (0.93, 1.11) | 0.75 | 845,699 | 1.02 (0.93, 1.12) | 0.74 |

Notes: EU = European Union. CI = Confidence interval. Models were fitted using logistic regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

$^a$ The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and aOR (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.
Table S6. Difference in the mean birthweight (g) and body length at birth (mm) and odds of low birthweight for NO$_3^-$ concentrations in household drinking water to babies born during the full cohort (1991-2011) and restricted to the later, lower exposure years (1997-2011).

| NO$_3^-$ (mg/L) | Birthweight (g) base model | Birthweight (g) restricted model |
|----------------|---------------------------|---------------------------------|
|                | n     | $\Delta$ (95% CI) | p-value | n     | $\Delta$ (95% CI) | p-value |
| Categorical    |       |                   |         |       |                   |         |
| $\leq 1$       | 186,182 | Ref (0)           |         | 142,697 | Ref (0)           |         |
| $> 1$ – $\leq 2$ | 182,870 | -3.6 (-6.8, -0.5) | 0.02    | 128,846 | -2.8 (-6.6, 0.9)  | 0.14    |
| $> 2$ – $\leq 5$ | 299,468 | -7.4 (-10.8, -4.1) | <0.001  | 221,761 | -9.3 (-13.3, -5.3) | <0.001  |
| $> 5$ – $\leq 25$ | 150,019 | -8.1 (-11.6, -4.6) | <0.001  | 82,449 | -7.5 (-11.9, -3.1) | 0.001   |
| $> 25$         | 33,809 | -7.0 (-13.3, -0.7) | 0.03    | 22,616 | -6.5 (-14.4, 1.4) | 0.11    |
| trend          |       |                   |         |       |                   |         |
| Continuous$^{a,b}$ | 852,348 | -9.7 (-14.6, -4.8) | <0.001  | 598,369 | -9.6 (-15.8, -3.4) | 0.002   |

| NO$_3^-$ (mg/L) | Body length (mm) base model | Body length (mm) restricted model |
|----------------|---------------------------|---------------------------------|
|                | n     | $\Delta$ (95% CI) | p-value | n     | $\Delta$ (95% CI) | p-value |
| Categorical    |       |                   |         |       |                   |         |
| $\leq 1$       | 185,379 | Ref (0)           |         | 142,156 | Ref (0)           |         |
| $> 1$ – $\leq 2$ | 182,001 | -0.1 (-0.2, 0.1) | 0.24    | 128,301 | -0.2 (-0.4, -0.02) | 0.03    |
| $> 2$ – $\leq 5$ | 297,885 | -0.2 (-0.3, -0.02) | 0.03    | 220,776 | -0.4 (-0.6, -0.2) | <0.001  |
| $> 5$ – $\leq 25$ | 149,114 | -0.4 (-0.5, -0.2) | <0.001  | 82,033 | -0.4 (-0.6, -0.2) | <0.001  |
| $> 25$         | 33,727 | -0.2 (-0.5, 0.1) | 0.27    | 22,583 | -0.2 (-0.5, 0.2) | 0.41    |
| trend          |       |                   |         |       |                   |         |
| Continuous$^{a,b}$ | 848,106 | -0.3 (-0.5, -0.1) | 0.01    | 595,849 | -0.4 (-0.6, -0.1) | 0.02    |

| NO$_3^-$ (mg/L) | Low birthweight base model | Low birthweight restricted model |
|----------------|---------------------------|---------------------------------|
|                | n     | aOR (95% CI) | p-value | n     | aOR (95% CI) | p-value |
| Categorical    |       |              |         |       |              |         |
| $\leq 1$       | 186,182 | Ref (1)      |         | 142,697 | Ref (1)      |         |
| $> 1$ – $\leq 2$ | 182,870 | 0.98 (0.92, 1.05) | 0.52    | 128,846 | 1.00 (0.93, 1.09) | 0.94    |
| $> 2$ – $\leq 5$ | 299,468 | 1.01 (0.94, 1.08) | 0.86    | 221,761 | 1.07 (0.98, 1.16) | 0.12    |
| $> 5$ – $\leq 25$ | 150,019 | 1.02 (0.95, 1.09) | 0.55    | 82,449 | 1.03 (0.94, 1.12) | 0.55    |
| $> 25$         | 33,809 | 0.99 (0.88, 1.12) | 0.91    | 22,616 | 0.99 (0.84, 1.15) | 0.85    |
| trend          |       |              |         |       |              |         |
| Continuous$^{a,b,c}$ | 852,348 | 1.02 (0.93, 1.11) | 0.73    | 598,369 | 1.02 (0.90, 1.15) | 0.77    |

Note: CI = Confidence interval. Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

*a.* Total $n$ is the same as the continuous model $n$

*b.* The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and $\beta$ (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.

*c.* The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and aOR (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.
### Table S7. Difference in the mean birthweight (g), birth length (mm), head circumference (mm), and odds ratios (OR) for low birthweight using categorical and continuous variables for NO$_3$ concentrations in household drinking water, restricting to those with a recorded value for maternal pre-pregnancy height and weight.

| NO$_3$ (mg/L) | n       | Birthweight (g) restricted base model$^{a,b}$ | Birthlength (mm) restricted base model$^{b,d}$ | Headcircumference (mm) restricted base model$^{b,c,e}$ | Low birthweight restricted base model$^{a,b}$ | Low birthweight restricted base model$^{a,b}$ + height and weight |
|---------------|---------|-----------------------------------------------|-----------------------------------------------|-------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------|
|               |         | $\Delta$ (95% CI) | p-value | $\Delta$ (95% CI) | p-value | $\Delta$ (95% CI) | p-value | $\Delta$ (95% CI) | p-value | aOR (95% CI) | p-value | aOR (95% CI) | p-value |
| Categorical   |         |                                  |        |                                  |        |                                  |        |                                  |        |        |        |        |        |
| ≤ 1           | 71,885  | Ref (0)                            | 0.57   | Ref (0)                            | 0.73   | Ref (0)                            | 0.04   | Ref (0)                            | 0.89   | 0.2   | 0.2   | 0.3   | 0.03 |
| > 1 - 2       | 70,245  | -1.5 (-6.7, 3.7)                  | 0.05   | -3.7 (-9.2, 1.8)                  | 0.19   | 0.1 (-0.2, 0.3)                   | 0.49   | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |
| > 2 - 5       | 114,043 | -5.6 (-11.3, 0.03)                | 0.38   | -2.3 (-9.0, 4.4)                  | 0.50   | -0.3 (-0.6, -0.03)                | 0.03   | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |
| > 5 - 25      | 31,091  | -3.1 (-10.1, 3.8)                 | 0.38   | 0.1 (-0.1, 0.4)                   | 0.22   | 0.2 (-0.1, 0.4)                   | 0.22   | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |
| > 25          | 10,489  | 1.7 (-9.9, 13.3)                  | 0.77   | 0.2 (-0.2, 0.6)                   | 0.31   | 0.2 (-0.2, 0.6)                   | 0.31   | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |
| trend         |         | 0.25                              |        | 0.81                              |        | 0.81                              |        | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |
| Continuous$^c$| 297,753 | -3.4 (-12.7, 6.0)                 | 0.48   | -2.7 (-11.8, 6.4)                 | 0.56   | 0.04                              | 0.03   | Ref (0)                            | 0.11   | 0.03  | 0.03  | 0.3   | 0.03 |

Note: CI = Confidence interval. Models were fitted using logistic regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

$^a$ n = 293,882

$^b$ Restricting the base model to those with pre-pregnancy height and weight measurements for comparable estimates between models

$^c$ The continuous NO$_3$ exposure variable was log transformed, ln(x+1) and aOR (95% CI) shown for exposures x = 25.0 mg/L NO$_3$ compared to 0 mg/L

$^d$ n = 296,425

$^e$ n = 293,882

$^f$ Data were available only for births ≥1997
Table S8. Difference in the mean birthweight (g), birth length (mm), and head circumference (mm) using categorical and continuous variables for NO$_3^-$ concentrations in household drinking water, adding one additional potential confounder to the base model.

|          | Categorical NO$_3^-$ estimation (mg/L) | Continuous at 25 mg/L NO$_3^-$ |
|----------|---------------------------------------|--------------------------------|
|          | n | ≤ 1 | > 1 ≤ 2 | > 2 ≤ 5 | > 5 ≤ 25 | > 25 | p for trend | Δ (95% CI) |
| Birthweight (g) base model$^a$ | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 |
| + gestational age | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 |
| + Cesarean section | 598,354 | 598,354 | 598,354 | 598,354 | 598,354 | 598,354 | 598,354 | 598,354 | 598,354 |
| + season of birth | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 |
| + paternal age | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 | 852,348 |
| + paternal income | 851,913 | 851,913 | 851,913 | 851,913 | 851,913 | 851,913 | 851,913 | 851,913 | 851,913 |
| + paternal education | 842,878 | 842,878 | 842,878 | 842,878 | 842,878 | 842,878 | 842,878 | 842,878 | 842,878 |
| + paternal employment status | 849,562 | 849,562 | 849,562 | 849,562 | 849,562 | 849,562 | 849,562 | 849,562 | 849,562 |

|          | Categorical NO$_3^-$ estimation (mg/L) | Continuous at 25 mg/L NO$_3^-$ |
|----------|---------------------------------------|--------------------------------|
|          | n | ≤ 1 | > 1 ≤ 2 | > 2 ≤ 5 | > 5 ≤ 25 | > 25 | p for trend | Δ (95% CI) |
| Body length (mm) base model$^b$ | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 |
| + gestational age | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 |
| + Cesarean section | 595,834 | 595,834 | 595,834 | 595,834 | 595,834 | 595,834 | 595,834 | 595,834 | 595,834 |
| + season of birth | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 |
| + paternal age | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 | 848,106 |
| + paternal income | 847,673 | 847,673 | 847,673 | 847,673 | 847,673 | 847,673 | 847,673 | 847,673 | 847,673 |
| + paternal education | 838,683 | 838,683 | 838,683 | 838,683 | 838,683 | 838,683 | 838,683 | 838,683 | 838,683 |
| + paternal employment status | 845,336 | 845,336 | 845,336 | 845,336 | 845,336 | 845,336 | 845,336 | 845,336 | 845,336 |

|          | Categorical NO$_3^-$ estimation (mg/L) | Continuous at 25 mg/L NO$_3^-$ |
|----------|---------------------------------------|--------------------------------|
|          | n | ≤ 1 | > 1 ≤ 2 | > 2 ≤ 5 | > 5 ≤ 25 | > 25 | p for trend | Δ (95% CI) |
| Head circumference (mm) base model$^c$ | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 |
| + gestational age | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 |
| + Cesarean section | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 |
| + season of birth | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 |
| + paternal age | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 | 588,981 |
| + paternal income | 588,628 | 588,628 | 588,628 | 588,628 | 588,628 | 588,628 | 588,628 | 588,628 | 588,628 |
| + paternal education | 583,104 | 583,104 | 583,104 | 583,104 | 583,104 | 583,104 | 583,104 | 583,104 | 583,104 |
| + paternal employment status | 586,987 | 586,987 | 586,987 | 586,987 | 586,987 | 586,987 | 586,987 | 586,987 | 586,987 |

Note: Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother. The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and β (95% CI) shown for exposures x = 5.0 mg/L NO$_3^-$ compared to 0 mg/L.

$^a$ Base model: Controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, paternal employment status, region, and urbanicity.
Table S9. Adjusted odds ratios for the association between term low birthweight and household NO$_3^-$ concentrations, adding one additional potential confounder to the base model.

|                                | n         | ≤ 1  | > 1 – ≤ 2 | > 2 – ≤ 5 | > 5 – ≤ 25 | > 25 | OR (95% CI) | p for trend | Continuous at 25 mg/L NO$_3^-$ | Δ (95% CI) |
|--------------------------------|-----------|------|-----------|-----------|------------|-------|-------------|------------|---------------------------------|------------|
| Low birthweight base model  $^a$ | 852,348   | Ref  | 0.98 (0.92, 1.05) | 1.01 (0.94, 1.08) | 1.02 (0.95, 1.09) | 0.99 (0.88, 1.12) | 0.51 | 1.02 (0.93, 1.11) |
| + gestational age               | 852,348   | Ref  | 0.99 (0.92, 1.06) | 1.02 (0.95, 1.09) | 1.02 (0.95, 1.09) | 0.99 (0.87, 1.12) | 0.56 | 1.01 (0.92, 1.11) |
| + Cesarean section              | 598,354   | Ref  | 1.00 (0.93, 1.09) | 1.07 (0.99, 1.16) | 1.02 (0.94, 1.12) | 1.00 (0.85, 1.16) | 0.41 | 1.02 (0.90, 1.15) |
| + season of birth               | 852,348   | Ref  | 0.98 (0.92, 1.05) | 1.01 (0.94, 1.08) | 1.02 (0.95, 1.09) | 0.99 (0.88, 1.12) | 0.52 | 1.02 (0.93, 1.11) |
| + paternal age                  | 852,348   | Ref  | 0.98 (0.92, 1.05) | 1.01 (0.94, 1.08) | 1.02 (0.95, 1.09) | 0.99 (0.88, 1.12) | 0.51 | 1.02 (0.93, 1.11) |
| + paternal income               | 851,913   | Ref  | 0.98 (0.92, 1.04) | 1.00 (0.94, 1.07) | 1.02 (0.95, 1.09) | 0.99 (0.88, 1.12) | 0.56 | 1.01 (0.93, 1.11) |
| + paternal education            | 842,878   | Ref  | 0.99 (0.92, 1.05) | 1.00 (0.94, 1.07) | 1.02 (0.95, 1.09) | 1.00 (0.89, 1.13) | 0.54 | 1.02 (0.93, 1.11) |
| + paternal employment status    | 849,562   | Ref  | 0.98 (0.92, 1.04) | 1.00 (0.94, 1.07) | 1.02 (0.95, 1.09) | 0.99 (0.88, 1.12) | 0.57 | 1.01 (0.93, 1.11) |

Note: Models were fitted using linear regression with generalized estimating equations in order to control for the non-independence of births from the same mother. The continuous NO$_3^-$ exposure variable was log transformed, ln(x+1) and OR (95% CI) shown for exposures x = 25.0 mg/L NO$_3^-$ compared to 0 mg/L.

$^a$: Base model: Controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.
Table S10. Difference in the mean birthweight (g), birth length (mm), head circumference (mm), and low birthweight for NO$_3^-$ concentrations in household drinking water in two different exposure categorical schemes (five and four categories).

| NO$_3^-$ (mg/L) | Categorical | Birthweight base model$^a$ | Birthweight collapsed model$^a$ | NO$_3^-$ (mg/L) | Categorical | Birth length base model$^b$ | Birth length collapsed model$^b$ | NO$_3^-$ (mg/L) | Categorical | Head circumference base model$^{c,d}$ | Head circumference collapsed model$^{c,d}$ | NO$_3^-$ (mg/L) | Categorical | Low birthweight base model$^a$ | Low birthweight collapsed model$^a$ |
|-----------------|-------------|--------------------------|-------------------------------|-----------------|-------------|---------------------------|-------------------------------|-----------------|-------------|-----------------------------------|---------------------------------|-----------------|-------------|------------------|-----------------|
|                 |             | n                        | ∆ (95% CI)                   | p-value         |             | n                        | ∆ (95% CI)                   | p-value         |             | n                        | ∆ (95% CI)                   | p-value         |             | n                        | ∆ (95% CI)                   | p-value         |
|                 |             | 186,182                  | -3.6 (-6.8, -0.5)            | 0.02            |             | 186,182                  | -3.6 (-6.8, -0.5)            | 0.02            |             | 140,486                  | 0.02 (-0.2, 0.1)          | 0.24            |             | 186,182                  | 0.02 (-0.2, 0.1)          | 0.24            |
|                 |             | 186,182                  | -7.4 (-10.8, -4.1)           | <0.001          |             | 186,182                  | -7.4 (-10.8, -4.1)           | <0.001          |             | 140,486                  | -0.2 (-0.3, -0.02)         | 0.03            |             | 186,182                  | -0.2 (-0.3, -0.02)         | 0.03            |
|                 |             | 150,019                  | -8.1 (-11.6, -4.6)           | <0.001          |             | 150,019                  | -8.1 (-11.6, -4.6)           | <0.001          |             | 140,486                  | -0.4 (-0.5, -0.2)          | <0.001          |             | 140,486                  | -0.4 (-0.5, -0.2)          | <0.001          |
|                 |             | 33,809                   | -7.0 (-13.3, -0.7)           | 0.03            |             | 33,809                   | -7.0 (-13.3, -0.7)           | 0.03            |             | 81,085                   | 0.1 (-0.1, 0.2)           | 0.52            |             | 299,468                  | 0.1 (-0.1, 0.2)           | 0.52            |
| trend           |             |                         | <0.001                      |                 |             |                         | <0.001                      |                 |             | 22,451                   | 0.1 (-0.2, 0.3)           | 0.62            |             | 22,451                   | 0.1 (-0.2, 0.3)           | 0.62            |

Note: CI = Confidence interval. Models were fitted using linear and logistic regression with generalized estimating equations in order to control for the non-independence of births from the same mother and were controlled for maternal age, calendar year, sex, gravidity, maternal smoking, maternal education, maternal income, maternal employment status, region, and urbanicity.

a. n = 852,548
b. n = 848,106
c. n = 588,981
d. Data were available only for births ≥1997