The impact of extreme temperatures on birth outcomes in the Netherlands: a nationwide population-based study

Supplementary Files

Contents

Supplementary file 1: Full numerical results for the main analysis.

Table S1. Effect of in utero temperature exposure on birth outcomes. [a]

Temperature bin	LBW [b]	SGA [b]	PTB [b]
< - 4 °C	1.001 (0.997, 1.004)	0.999 (0.997, 1.002)	1.002 (0.999, 1.005)
-4 – 0 °C	0.997 (0.996, 0.999)	0.998 (0.997, 1.000)	0.998 (0.996, 1.000)
0 – 4 °C	0.997 (0.996, 0.999)	0.999 (0.998, 1.001)	0.997 (0.996, 0.998)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.998 (0.997, 0.999)
12 – 16 °C	1.001 (1.000, 1.002)	1.001 (1.000, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.004 (1.003, 1.005)	1.001 (1.000, 1.001)	1.004 (1.003, 1.005)
> 20 °C	1.007 (1.005, 1.009)	1.004 (1.003, 1.005)	1.006 (1.005, 1.007)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Supplementary file 2: Results by gestational trimester.

Table S2. Effect of in utero temperature exposure on birth outcomes by gestational trimester, odds ratios (95% CI).[a]			
Trimester 1			
Temperature bin	**LBW** [b]	**SGA** [b]	**PTB** [b]
< - 4 °C	0.998 (0.993, 1.003)	0.999 (0.996, 1.002)	0.997 (0.992, 1.002)
-4 – 0 °C	0.993 (0.991, 0.996)	0.999 (0.997, 1.000)	0.995 (0.992, 0.997)
0 – 4 °C	0.999 (0.997, 1.000)	0.999 (0.998, 1.000)	0.999 (0.998, 1.000)
4 – 8 °C	0.994 (0.992, 0.995)	0.999 (0.998, 1.000)	0.994 (0.992, 0.995)
12 – 16 °C	0.996 (0.994, 0.998)	1.000 (0.999, 1.001)	0.996 (0.995, 0.998)
16 – 20 °C	1.001 (1.000, 1.003)	1.000 (0.999, 1.001)	1.001 (0.999, 1.002)
> 20 °C	1.001 (0.999, 1.004)	1.003 (1.002, 1.004)	1.001 (0.999, 1.003)
Trimester 2			
< - 4 °C	1.006 (1.001, 1.011)	0.999 (0.996, 1.003)	1.003 (1.001, 1.005)
-4 – 0 °C	0.995 (0.993, 0.997)	0.999 (0.998, 1.001)	1.000 (0.998, 1.002)
0 – 4 °C	0.999 (0.998, 1.001)	1.000 (0.999, 1.001)	1.000 (0.998, 1.002)
4 – 8 °C	0.996 (0.995, 0.998)	0.999 (0.998, 1.000)	1.001 (0.999, 1.002)
12 – 16 °C	1.000 (0.999, 1.002)	1.001 (1.000, 1.002)	0.999 (0.997, 1.001)
16 – 20 °C	1.004 (1.002, 1.006)	1.001 (1.000, 1.002)	1.003 (1.002, 1.005)
> 20 °C	1.007 (1.006, 1.009)	1.004 (1.003, 1.006)	1.003 (1.002, 1.005)
Trimester 3			
< - 4 °C	1.002 (0.997, 1.006)	1.001 (0.997, 1.004)	0.992 (0.988, 0.996)
-4 – 0 °C	1.000 (0.998, 1.002)	0.997 (0.996, 0.999)	0.999 (0.997, 1.001)
0 – 4 °C	1.002 (0.999, 1.003)	1.000 (0.999, 1.001)	0.998 (0.997, 0.999)
4 – 8 °C	1.000 (0.998, 1.001)	0.999 (0.997, 1.000)	0.997 (0.996, 0.998)
12 – 16 °C	0.999 (0.997, 1.001)	1.000 (0.999, 1.001)	0.997 (0.995, 0.998)
16 – 20 °C	1.004 (1.002, 1.006)	1.001 (1.000, 1.002)	1.001 (1.000, 1.002)
> 20 °C	1.004 (1.003, 1.006)	1.004 (1.002, 1.005)	1.005 (1.003, 1.007)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.
a The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. b For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. c For continuous outcomes estimates correspond to beta coefficients (95% CI) from linear regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Supplementary file 3: Differential effect of temperature exposure across socioeconomic status groups.

Table S3. Effect of in utero temperature exposure on birth outcomes by household income groups. [a]

High			
Temperature bin	**LBW** [b]	**SGA** [b]	**PTB** [b]
< - 4 °C	0.993 (0.988, 0.997)	0.989 (0.986, 0.992)	0.997 (0.993, 1.001)
-4 – 0 °C	0.997 (0.995, 0.998)	0.998 (0.997, 1.000)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.000)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (1.000, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.005)	1.000 (1.000, 1.001)	1.004 (1.003, 1.005)
> 20 °C	1.001 (1.000, 1.003)	0.998 (0.997, 0.999)	1.005 (1.004, 1.007)
Medium			
< - 4 °C	0.998 (0.994, 1.002)	0.997 (0.995, 0.999)	1.001 (0.998, 1.004)
-4 – 0 °C	0.997 (0.995, 0.998)	0.998 (0.997, 0.999)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.000)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.005)	1.000 (0.999, 1.001)	1.004 (1.003, 1.005)
> 20 °C	1.004 (1.003, 1.006)	1.002 (1.001, 1.003)	1.005 (1.004, 1.007)
Low			
< - 4 °C	1.016 (1.011, 1.021)	1.016 (1.012, 1.019)	1.009 (1.004, 1.013)
-4 – 0 °C	0.997 (0.995, 0.998)	0.998 (0.997, 0.999)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.005)	1.000 (0.999, 1.001)	1.004 (1.003, 1.005)
> 20 °C	1.014 (1.012, 1.015)	1.013 (1.012, 1.014)	1.010 (1.008, 1.011)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. [c] For continuous outcomes estimates correspond to beta coefficients (95% CI) from linear regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S4. Effect of in utero temperature exposure on birth outcomes by neighbourhood socioeconomic status groups. [a]			
High			
Temperature bin	**LBW** [b]	**SGA** [b]	**PTB** [b]
< - 4 °C	0.994 (0.989, 0.999)	0.994 (0.991, 0.997)	1.000 (0.996, 1.005)
-4 – 0 °C	0.997 (0.996, 0.999)	0.999 (0.998, 1.000)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.998 (0.997, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.004)	1.001 (1.000, 1.002)	1.003 (1.002, 1.004)
> 20 °C	1.001 (1.000, 1.003)	0.999 (0.998, 1.000)	1.004 (1.002, 1.005)
Medium			
< - 4 °C	0.997 (0.994, 1.001)	0.996 (0.994, 0.999)	1.000 (0.997, 1.004)
-4 – 0 °C	0.997 (0.996, 0.999)	0.999 (0.998, 1.000)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.998 (0.997, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.004)	1.001 (1.000, 1.002)	1.003 (1.002, 1.004)
> 20 °C	1.004 (1.002, 1.005)	1.001 (1.000, 1.002)	1.005 (1.004, 1.006)
Low			
< - 4 °C	1.008 (1.004, 1.012)	1.009 (1.006, 1.012)	1.004 (1.000, 1.008)
-4 – 0 °C	0.997 (0.996, 0.999)	0.999 (0.998, 1.000)	0.998 (0.996, 0.999)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.998 (0.997, 0.998)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.003 (1.002, 1.004)	1.001 (1.000, 1.001)	1.003 (1.002, 1.004)
> 20 °C	1.011 (1.010, 1.013)	1.008 (1.008, 1.009)	1.009 (1.007, 1.010)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S5. Effect of in utero temperature exposure on birth outcomes by mother's education groups.[a]				
		High		
Temperature bin	**LBW** [b]	**SGA** [b]	**PTB** [b]	**Birthweight** [c]
< - 4 °C	1.003 (0.997, 1.008)	0.997 (0.994, 1.000)	1.002 (0.998, 1.006)	-0.94 (-1.70, -0.18)
-4 – 0 °C	0.997 (0.995, 0.999)	0.998 (0.996, 1.000)	0.997 (0.996, 0.999)	0.62 (0.44, 0.81)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	0.01 (-0.10, 0.11)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)	0.58 (0.45, 0.70)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	-0.2 (-0.31, -0.09)
16 – 20 °C	1.003 (1.002, 1.004)	1.000 (0.999, 1.001)	1.004 (1.003, 1.004)	-0.58 (-0.7, -0.47)
> 20 °C	1.006 (1.004, 1.008)	1.003 (1.002, 1.004)	1.005 (1.003, 1.007)	-1.08 (-1.35, -0.81)
		Medium		
< - 4 °C	1.000 (0.996, 1.004)	1.002 (0.999, 1.004)	1.002 (0.998, 1.005)	-0.97 (-1.43, -0.50)
-4 – 0 °C	0.997 (0.995, 0.999)	0.998 (0.996, 1.000)	0.997 (0.996, 0.999)	0.62 (0.44, 0.81)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	0.01 (-0.10, 0.11)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)	0.58 (0.45, 0.70)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	-0.20 (-0.31, -0.09)
16 – 20 °C	1.003 (1.002, 1.004)	1.000 (0.999, 1.001)	1.004 (1.003, 1.004)	-0.58 (-0.70, -0.47)
> 20 °C	1.006 (1.005, 1.008)	1.004 (1.003, 1.004)	1.005 (1.003, 1.006)	-1.29 (-1.46, -1.12)
		Low		
< - 4 °C	1.000 (0.995, 1.004)	1.004 (1.000, 1.008)	1.002 (0.996, 1.007)	-0.39 (-0.88, 0.10)
-4 – 0 °C	0.997 (0.995, 0.999)	0.998 (0.996, 1.000)	0.997 (0.996, 0.999)	0.62 (0.44, 0.81)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	0.01 (-0.1, 0.11)
4 – 8 °C	0.997 (0.996, 0.998)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)	0.58 (0.45, 0.7)
12 – 16 °C	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)	-0.20 (-0.31, -0.09)
16 – 20 °C	1.003 (1.002, 1.004)	1.000 (0.999, 1.001)	1.004 (1.003, 1.004)	-0.58 (-0.70, -0.47)
> 20 °C	1.007 (1.005, 1.008)	1.003 (1.002, 1.005)	1.007 (1.005, 1.008)	-1.30 (-1.48, -1.12)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Supplementary file 4: Sensitivity analyses.

Table S6. Effect of in utero temperature exposure on birth outcomes additionally adjusted for distance to monitoring station. [a]

Temperature bin	LBW [b]	SGA [b]	PTB [b]
< - 4 °C	1.001 (0.997, 1.004)	0.999 (0.997, 1.002)	1.002 (0.999, 1.005)
-4 – 0 °C	0.998 (0.996, 0.999)	0.999 (0.997, 1.001)	0.998 (0.997, 1.000)
0 – 4 °C	1.000 (0.998, 1.001)	1.000 (0.999, 1.001)	0.999 (0.998, 1.000)
4 – 8 °C	0.997 (0.996, 0.999)	0.999 (0.998, 1.000)	0.998 (0.997, 0.999)
12 – 16 °C	1.001 (1.000, 1.002)	1.001 (1.000, 1.001)	1.001 (1.000, 1.002)
16 – 20 °C	1.004 (1.003, 1.005)	1.001 (1.000, 1.001)	1.004 (1.003, 1.005)
> 20 °C	1.007 (1.005, 1.008)	1.004 (1.003, 1.005)	1.006 (1.005, 1.007)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S7. Effect of temperature negative control (placebo) exposure on birth outcomes. [a]

Temperature bin	LBW [b]	SGA [b]	PTB [b]
< - 4 °C	0.996 (0.993, 1.000)	1.000 (0.998, 1.003)	0.996 (0.993, 0.999)
-4 – 0 °C	0.996 (0.993, 1.000)	0.999 (0.998, 1.000)	0.996 (0.994, 0.997)
0 – 4 °C	0.998 (0.996, 1.001)	1.000 (0.999, 1.001)	0.998 (0.997, 0.999)
4 – 8 °C	0.998 (0.996, 1.001)	0.999 (0.998, 1.000)	0.997 (0.996, 0.998)
12 – 16 °C	0.999 (0.998, 1.000)	1.000 (0.999, 1.001)	0.998 (0.997, 0.999)
16 – 20 °C	0.997 (0.994, 1.000)	0.999 (0.998, 1.000)	0.995 (0.994, 0.996)
> 20 °C	1.000 (0.998, 1.001)	1.000 (0.999, 1.001)	0.997 (0.994, 1.000)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of placebo exposure (9 months after birth) to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S8. Effect of in utero temperature exposure on birth outcomes using minimum temperature to specify exposure bins. [a]

Temperature bin	LBW [b]	SGA [b]	PTB [b]
< - 4 °C	1.001 (1.000, 1.003)	1.001 (1.000, 1.002)	1.001 (1.000, 1.002)
-4 – 0 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
0 – 4 °C	0.998 (0.997, 0.999)	0.998 (0.996, 1.001)	0.999 (0.998, 1.000)
4 – 8 °C	1.001 (1.000, 1.002)	1.000 (0.998, 1.001)	0.998 (0.996, 1.000)
12 – 16 °C	1.002 (1.001, 1.002)	1.000 (0.999, 1.001)	1.002 (1.001, 1.003)
> 16 °C	1.003 (1.002, 1.005)	1.003 (1.002, 1.004)	1.002 (1.001, 1.003)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a minimum temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S9. Effect of in utero temperature exposure on birth outcomes using maximum temperature to specify exposure bins. [a]

Temperature bin	LBW [b]	SGA [b]	PTB [b]
< - 4 °C	0.998 (0.988, 1.007)	0.992 (0.986, 0.998)	1.003 (0.995, 1.012)
-4 – 0 °C	1.003 (1.001, 1.006)	1.001 (0.999, 1.003)	1.003 (1.001, 1.006)
0 – 4 °C	1.000 (0.999, 1.001)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.998 (0.996, 1.001)	0.998 (0.996, 1.001)	0.998 (0.997, 0.999)
12 – 16 °C	1.000 (0.998, 1.001)	0.998 (0.996, 1.001)	1.000 (0.999, 1.001)
16 – 20 °C	1.000 (0.999, 1.001)	1.000 (0.998, 1.002)	1.000 (0.999, 1.001)
20 – 24 °C	1.001 (1.000, 1.002)	1.001 (1.000, 1.002)	1.000 (0.999, 1.001)
24 – 28 °C	1.007 (1.005, 1.009)	1.005 (1.004, 1.006)	1.006 (1.005, 1.008)
> 28 °C	1.009 (1.007, 1.012)	1.003 (1.002, 1.005)	1.009 (1.007, 1.011)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a maximum temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Table S10. Effect of in utero temperature exposure on birth outcomes by foetal sex. [a]			
Male			
Temperature bin	**LBW** [b]	**SGA** [b]	**PTB** [b]
< - 4 °C	1.001 (0.996, 1.006)	1.000 (0.997, 1.004)	1.003 (0.998, 1.007)
-4 – 0 °C	0.997 (0.994, 0.999)	0.999 (0.997, 1.001)	0.999 (0.997, 1.000)
0 – 4 °C	1.000 (0.999, 1.002)	0.999 (0.998, 1.000)	1.002 (1.001, 1.003)
4 – 8 °C	0.997 (0.995, 0.998)	0.999 (0.998, 1.000)	0.999 (0.997, 1.000)
12 – 16 °C	1.001 (1.000, 1.003)	1.000 (0.999, 1.001)	1.002 (1.001, 1.003)
16 – 20 °C	1.005 (1.004, 1.007)	1.000 (0.999, 1.001)	1.006 (1.005, 1.007)
> 20 °C	1.009 (1.007, 1.011)	1.003 (1.002, 1.005)	1.007 (1.006, 1.009)
Female			
< - 4 °C	1.001 (0.996, 1.005)	0.998 (0.995, 1.002)	1.001 (0.997, 1.006)
-4 – 0 °C	0.998 (0.996, 1.001)	0.998 (0.996, 1.000)	0.998 (0.996, 1.000)
0 – 4 °C	1.000 (0.999, 1.002)	1.000 (0.999, 1.001)	1.001 (1.000, 1.002)
4 – 8 °C	0.998 (0.996, 0.999)	0.999 (0.998, 1.000)	0.997 (0.996, 0.999)
12 – 16 °C	1.000 (0.999, 1.002)	1.001 (1.000, 1.002)	0.999 (0.998, 1.001)
16 – 20 °C	1.002 (1.001, 1.004)	1.001 (1.000, 1.002)	1.001 (1.000, 1.003)
> 20 °C	1.005 (1.003, 1.007)	1.005 (1.004, 1.006)	1.004 (1.002, 1.006)

LBW, low birthweight; SGA, small for gestational age; PTB, preterm birth.

[a] The effect of in utero exposure to one additional day falling in certain temperature bin on birth outcomes relative to a day with a mean temperature of 8 – 12 °C. [b] For binary outcomes, estimates correspond to Odds Ratios (95% CI) from logistic regression models. All models include province × month fixed effects, province × year-time-trend, and year fixed effects. Environmental controls include mean precipitation, wind speed, sunshine duration, and relative humidity during the gestational period. Other covariates included were maternal age in categories, parity, fetal sex, household income, mother's migration background and education.

Supplementary File 5: Model Specification

The baseline model specification for the main analysis is as follows:

$$Y = \sum_{k=1}^{8} \beta_k TEMP^k + \alpha X + \phi C + \delta\, p \cdot w + \zeta p \cdot trend + \eta j + \varepsilon$$

Where the outcome *Y* is the outcome of interest. The birth outcomes in this paper are low birthweight, small for gestational age, and preterm birth (see description in main text). The key variables of interest $TEMP^k$ are the number of days in the temperature bin *k* (from 1 to 8, see description in main text) during the full gestational period, i.e., counting 280 days forward from the estimated day of conception. We set the bin 8 – 12 °C (containing the historical average temperature in the Netherlands) as the reference range for all models. To address potential survivor bias, we account for a vector X which contains a set of demographic variables, including foetal sex, parity, mother's migration background, maternal age, household income, and educational level. We also control for a vector of rich weather conditions *C*, involving average precipitation, sunshine duration, and wind speed measured at the full gestational period level. Finally, we control for region specific seasonality by including a province (*p*) × week-of-the-year (*w*) term, and province level time trends (e.g., driven by economic growth) by including a province × linear year-time-trend ($trend$) term, and year (*j)* fixed effects (dummies). All variables in the interaction terms were also included as main effects. ε is the error term.