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Supplemental Material

Ambient Temperature and Stillbirth: A Multicenter Retrospective Cohort Study

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Table S1: Distribution of Temperature During Different Pregnancy Windows in the Consortium on Safe Labor, 2002-2008.

Exposure window	Stillbirth		No stillbirth	
	n	%	n	%
Chronic exposure[a]				
Preconception				
Cold	122	12.3	22,266	10.0
Mild	781	78.7	177,857	80.0
Hot	89	9.0	22,260	10.0
Trimester 1				
Cold	9	9.8	22,299	10.0
Mild	820	82.7	177,814	80.0
Hot	75	7.6	22,270	10.0
Whole pregnancy				
Cold	247	24.9	22,095	9.9
Mild	507	51.1	178,194	80.1
Hot	238	24.0	22,094	9.9
Acute exposure[b]	Mean[c]	(min,max)	Mean[d]	(min,max)
Warm season (May-Sept)	21.2	5.3, 29.9	20.8	2.8, 30.3[c]
Cold season (Oct-Apr)	9.0	-14.3, 28.1	8.9	-12.9, 29.5[c]

[a]The distribution is presented as frequency (percent). Cold, mild and hot were defined as <10th, 10-90th, and >90th percentile of the distribution of temperature by site.
[b]The distribution is presented as mean (min, max) expressed in C°. Estimates are based on 987 first stillbirths.
[c]Data based on case period, which was the week preceding stillbirth delivery.
[d]Data based on control periods, which are two weeks before and after stillbirth delivery.

Table S2. Distribution of Absolute Temperature by Site and Pregnancy Windows in the Consortium on Safe Labor, 2002-2008.

Site	Pregnancy windows[a]	Average daily temperature distribution (°C)				
		Min	P10	P50	P90	Max
1-Baystate Medical Center, Massachusetts	Preconception	-6.7	-2.6	10.2	19.3	20.5
	Trimester 1	-6.3	-3.1	8.9	19.1	20.3
	Trimester 2	-7.0	-3.0	7.8	18.8	21.2
	Whole pregnancy	-2.3	4.6	8.1	12.3	17.4
2-Cedars-Sinai Medical Center, California	Preconception	12.6	13.5	18.2	22.1	24.2
	Trimester 1	12.8	13.4	17.6	22.1	24.0
	Trimester 2	12.8	13.5	16.8	22.0	24.1
	Whole pregnancy	13.6	16.1	17.4	19.1	22.3
3-Christiana Care Health System, Delaware	Preconception	0.8	3.3	14.3	24.2	25.0
	Trimester 1	0.9	3.3	12.1	24.1	24.8
	Trimester 2	0.8	3.9	13.9	24.0	25.6
	Whole pregnancy	5.5	10.6	13.7	17.4	22.2
4-Indiana University - Clarian Health, Indiana	Preconception	-0.5	1.7	13.7	22.0	23.1
	Trimester 1	-0.4	1.4	9.5	21.7	22.8
	Trimester 2	-1.6	1.6	11.5	22.0	23.2
	Whole pregnancy	3.2	8.8	11.5	15.3	20.6
5-Intermountain HealthCare, Utah	Preconception	-4.2	-0.4	11.1	19.7	22.2
	Trimester 1	-4.5	-1.4	8.7	19.5	22.1
	Trimester 2	-4.7	-1.5	6.8	19.1	24.4
	Whole pregnancy	-0.5	5.1	8.5	12.2	19.1
6-Maimonides Medical Center, New York	Preconception	-2.3	1.3	13.8	23.3	24.3
	Trimester 1	-0.8	1.5	12.9	23.1	24.0
	Trimester 2	-1.6	1.6	11.7	22.7	24.4
	Whole pregnancy	3.3	8.9	12.0	16.1	21.6
7-MedStar Health, Maryland	Preconception	0.1	3.2	14.4	23.1	24.5
	Trimester 1	1.1	3.6	14.1	22.9	24.2
	Trimester 2	0.3	3.7	12.6	22.7	25.0
	Whole pregnancy	5.0	10.0	13.0	16.7	21.8
8-MetroHealth Medical Center, Ohio	Preconception	-1.7	0.0	10.4	20.3	21.5
	Trimester 1	-1.2	0.1	9.2	19.9	21.3
	Trimester 2	-2.4	0.1	9.9	19.7	21.3
	Whole pregnancy	1.9	6.7	9.9	13.5	18.7
9-Summa Health System, Ohio	Preconception	-3.1	0.3	12.0	19.9	21.4
	Trimester 1	-2.8	-0.3	10.2	19.7	21.2
	Trimester 2	-2.7	-0.3	8.7	19.6	21.7
	Whole pregnancy	1.4	6.5	9.3	13.3	18.4
10-University of Illinois at Chicago, Illinois	Preconception	-3.3	-0.4	8.7	19.2	21.6
	Trimester 1	-3.0	-0.9	7.2	18.7	21.4
	Trimester 2	-4.7	-1.0	7.5	18.7	22.0
	Whole pregnancy	-0.3	5.0	8.6	12.0	18.3
11-University of Miami, Florida	Preconception	20.4	21.2	25.0	28.5	29.0
	Trimester 1	20.5	21.3	25.0	28.5	29.0
	Trimester 2	20.4	21.4	25.3	28.5	29.0
	Whole pregnancy	21.9	23.8	25.1	26.4	28.2

12-University of Texas, Texas	Preconception	12.9	14.8	22.6	27.9	28.7
	Trimester 1	12.9	14.6	21.7	27.8	28.6
	Trimester 2	12.5	14.8	21.9	27.7	28.8
	Whole pregnancy	15.3	19.2	21.3	24.1	27.4

Abbreviations: C, Celsius; P, percentile

[a]Preconception: 91 days prior to estimated last menstrual period (eLMP), first trimester: eLMP-13 weeks, whole pregnancy: eLMP-date of delivery.

Table S3. Chronic Associations Between Extreme Ambient Temperatures and Stillbirth by Type of Stillbirth in the Consortium on Safe Labor, 2002-2008 (cohort analysis).

Pregnancy windows	Intrapartum (n=96)		Antepartum (n=896)	
	OR[a]	95% CI	OR[a]	95% CI
Hot				
Preconception	0.63	0.28, 1.43	1.01	0.79, 1.29
Trimester 1	0.77	0.32, 1.84	0.81	0.62, 1.06
Trimester 2[b]	-	-	1.04	0.80, 1.35
Whole Pregnancy	4.75	2.38, 9.46	3.80	3.16, 4.57
Cold				
Preconception	1.16	0.58, 2.34	1.16	0.93, 1.45
Trimester 1	1.41	0.71, 2.80	0.85	0.66, 1.08
Trimester 2[b]	-	-	0.86	0.64, 1.17
Whole Pregnancy	5.78	3.53, 9.46	4.83	3.97, 5.86

Abbreviations: OR, odds ratio; CI, confidence interval

[a] Adjusted for clustering resulting from multiple singleton deliveries within the same mother and potential confounders including site, infant sex, maternal age, race, marital status, parity, prepregnancy BMI, hypertensive disorders of pregnancy, insurance status, humidity, particulate matter with diameter <2.5 microns, ozone, and season of conception.

[b] Analyses were based on pregnancies that completed the 2nd trimester (631 antepartum stillbirths). Intrapartum stillbirth analyses did not converge due to low number of cases (n=33).

Table S4. Sensitivity Analysis Results of Chronic Associations Between Extreme Ambient Temperatures and Stillbirth Among Singleton Births in the Consortium on Safe Labor, 2002-2008 (Matched Case-control Analysis).

Pregnancy windows	OR[a]	95% CI
Hot		
Preconception	0.86	0.66 ,1.14
Trimester 1	0.78	0.59 ,1.04
Trimester 2	1.24	0.97, 1.59
Whole Pregnancy[b]	4.29	3.22 ,5.72
Cold		
Preconception	1.14	0.88 ,1.47
Trimester 1	0.97	0.75 ,1.25
Trimester 2	1.02	0.78, 1.32
Whole Pregnancy[b]	2.96	2.21 ,3.96

[a]ORs were obtained using conditional logistic regression adjusted for all covariates except study site and air pollutants.

[b]At a given gestational age, whole pregnancy exposure was truncated among controls to match that of the case.

Table S5. Acute Association Between Ambient Temperature During the Week Prior and Stillbirth Among Cases by Type of Stillbirth in the Consortium on Safe Labor, 2002-2008 (Case-crossover analysis).

	Season of delivery	n	OR[a]		AR[b]		AR[c]	
			Estimate	95% CI	Estimate	95% CI	Estimate	95%CI
Intrapartum	Cold (Oct-Apr)	50	1.02	0.96,1.08	1.1	-2.8,5.1	0.8	-2.0,3.7
	Warm (May-Sept)	45	1.05	0.95,1.17	3.2	-3.2,10.4	2.3	-2.3,7.5
Antepartum	Cold (Oct-Apr)	490	1.00	0.98,1.02	0.1	-1.2,1.4	0.1	-0.9,1.0
	Warm (May-Sept)	402	1.06	1.03,1.10	3.8	1.8,5.9	2.7	1.3,4.3

Abbreviations: OR, odds ratio; CI, confidence interval; AR, attributable risk

[a]The ORs for case-crossover models are obtained from conditional logistic regression with robust standard errors where only cases were selected and they act as their own controls. Estimates are for one degree Celsius increase in ambient temperature adjusted for relative humidity and time invariant confounders.

[b]Calculated using US background rate as I_u; risk is expressed as per 10,000 births

[c]Calculated using study specific background rate during specific season as I_u; risk is expressed as per 10,000 births

Table S6. Population Attributable Fraction (PAF) Associated With Chronic Exposure to Extreme Ambient Temperature by Type of Stillbirth in the Consortium on Safe Labor, 2002-2008.

	Whole pregnancy temperature	PAF[a]	95% CI	Total cases	Excess cases[b]	95% CI
Antepartum	Cold	0.19	0.18,0.20	219	42.4	40.0, 44.4
	Hot	0.18	0.16 ,0.19	215	38.0	35.3, 40.3
	Cold	0.24	0.21,0.26	28	6.8	5.9, 7.3
Intrapartum	Hot	0.19	0.14,0.21	23	4.4	3.2, 4.9

Abbreviations: PAF, population attributable fraction; CI, confidence interval

[a]PAF was calculated using the formula:PAF= pd[(OR-1)/OR], expressed as a proportion.

[b]Expressed as per 100,000 births