Supplementary material

Temperature variability and asthma hospitalization in Brazil, 2000-2015: A nationwide case-crossover study

Table S1. Baseline characteristics of 1,816 Brazilian cities, 2000-2015.

Characteristic	Number of cities	Population coverage (%)
Total	1,816	79.0
Region		
North	30	27.0
Northeast	662	78.0
Central west	128	80.7
South	374	83.2
Southeast	622	87.0

Table S2. Consumer price index in Brazil from 2000 to 2015.

Year	Consumer price index compared to previous year (%)	Index	Consumer price index of 2015 compared to current year (%)
2000	107.044	y_{16}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10} \times y_{11} \times y_{12} \times y_{13} \times y_{14} \times y_{15}$
2001	106.840	y_{15}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10} \times y_{11} \times y_{12} \times y_{13} \times y_{14}$
2002	108.450	y_{14}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10} \times y_{11} \times y_{12} \times y_{13}$
2003	114.715	y_{13}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10} \times y_{11} \times y_{12}$
2004	106.597	y_{12}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10} \times y_{11}$
2005	106.870	y_{11}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9 \times y_{10}$
2006	104.184	y_{10}	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8 \times y_9$
2007	103.641	y_9	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7 \times y_8$
2008	105.679	y_8	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6 \times y_7$
2009	104.888	y_7	$y_1 \times y_2 \times y_3 \times y_4 \times y_5 \times y_6$
2010	105.039	y_6	$y_1 \times y_2 \times y_3 \times y_4 \times y_5$
2011	106.636	y_5	$y_1 \times y_2 \times y_3 \times y_4$
2012	105.403	y_4	$y_1 \times y_2 \times y_3$
2013	106.204	y_3	$y_1 \times y_2$
2014	106.329	y_2	y_1
2015	109.030	y_1	100

Table S3. Results of sensitivity analyses for TV using different lag period of mean temperature.

Exposure	Lag period	RR (95%CI)	*P* value	*P* for difference
TV0-1	Lag 0-4 days	1.006 (1.004, 1.007)	< 0.001	0.111
TV0-1	Lag 0-5 days	1.005 (1.003, 1.007)	< 0.001	0.317
TV0-1	Lag 0-6 days	1.004 (1.002, 1.006)	< 0.001	0.756
TV0-1	Lag 0-7 days *	1.004 (1.002, 1.005)	< 0.001	Ref.
TV0-1	Lag 0-8 days	1.003 (1.002, 1.005)	< 0.001	0.944
TV0-1	Lag 0-9 days	1.004 (1.002, 1.005)	< 0.001	0.966
TV0-1	Lag 0-10 days	1.004 (1.002, 1.005)	< 0.001	0.965
TV0-2	Lag 0-4 days	1.008 (1.006, 1.010)	< 0.001	0.318
TV0-2	Lag 0-5 days	1.008 (1.006, 1.010)	< 0.001	0.369
TV0-2	Lag 0-6 days	1.007 (1.005, 1.009)	< 0.001	0.673
TV0-2	Lag 0-7 days *	1.006 (1.004, 1.008)	< 0.001	Ref.
TV0-2	Lag 0-8 days	1.006 (1.004, 1.008)	< 0.001	0.847
TV0-2	Lag 0-9 days	1.006 (1.004, 1.008)	< 0.001	0.687
TV0-2	Lag 0-10 days	1.006 (1.004, 1.008)	< 0.001	0.649
TV0-3	Lag 0-4 days	1.010 (1.007, 1.012)	< 0.001	0.893
TV0-3	Lag 0-5 days	1.009 (1.007, 1.011)	< 0.001	0.752
TV0-3	Lag 0-6 days	1.009 (1.007, 1.012)	< 0.001	0.869
TV0-3	Lag 0-7 days *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-3	Lag 0-8 days	1.009 (1.007, 1.012)	< 0.001	0.974
TV0-3	Lag 0-9 days	1.009 (1.007, 1.011)	< 0.001	0.761
TV0-3	Lag 0-10 days	1.008 (1.006, 1.011)	< 0.001	0.562
TV0-4	Lag 0-4 days	1.012 (1.009, 1.014)	< 0.001	0.219
TV0-4	Lag 0-5 days	1.009 (1.006, 1.012)	< 0.001	0.869
TV0-4	Lag 0-6 days	1.009 (1.006, 1.011)	< 0.001	0.694
TV0-4	Lag 0-7 days *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-4	Lag 0-8 days	1.010 (1.007, 1.012)	< 0.001	0.902
TV0-4	Lag 0-9 days	1.009 (1.007, 1.012)	< 0.001	0.992
TV0-4	Lag 0-10 days	1.009 (1.006, 1.011)	< 0.001	0.807
TV0-5	Lag 0-4 days	1.013 (1.010, 1.016)	< 0.001	0.043
TV0-5	Lag 0-5 days	1.012 (1.009, 1.015)	< 0.001	0.146
TV0-5	Lag 0-6 days	1.010 (1.007, 1.012)	< 0.001	0.788
TV0-5	Lag 0-7 days *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-5	Lag 0-8 days	1.009 (1.006, 1.012)	< 0.001	0.942
TV0-5	Lag 0-9 days	1.009 (1.006, 1.012)	< 0.001	0.945
TV0-5	Lag 0-10 days	1.009 (1.006, 1.012)	< 0.001	0.998
TV0-6	Lag 0-4 days	1.014 (1.011, 1.017)	< 0.001	0.038
TV0-6	Lag 0-5 days	1.013 (1.010, 1.016)	< 0.001	0.063
TV0-6	Lag 0-6 days	1.012 (1.009, 1.015)	< 0.001	0.231
TV0-6	Lag 0-7 days *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-6	Lag 0-8 days	1.009 (1.006, 1.012)	< 0.001	0.798

TV0-6	Lag 0-9 days	1.009 (1.006, 1.012)	< 0.001	0.790
TV0-6	Lag 0-10 days	1.009 (1.006, 1.012)	< 0.001	0.809
TV0-7	Lag 0-4 days	1.014 (1.010, 1.017)	< 0.001	0.149
TV0-7	Lag 0-5 days	1.013 (1.010, 1.016)	< 0.001	0.273
TV0-7	Lag 0-6 days	1.012 (1.009, 1.015)	< 0.001	0.529
TV0-7	Lag 0-7 days *	1.010 (1.007, 1.014)	< 0.001	Ref.
TV0-7	Lag 0-8 days	1.009 (1.006, 1.012)	< 0.001	0.595
TV0-7	Lag 0-9 days	1.009 (1.005, 1.012)	< 0.001	0.426
TV0-7	Lag 0-10 days	1.008 (1.005, 1.012)	< 0.001	0.385

*: primary model. Definition of abbreviations: TV = temperature variability; RR = relative risk; CI = confidence interval; Ref. = reference.

Table S4. Results of sensitivity analyses for TV using different degrees of freedom for mean temperature.

Exposure	df for mean temperature	RR (95%CI)	*P* value	*P* for difference
TV0-1	3 *	1.004 (1.002, 1.005)	< 0.001	Ref.
TV0-1	4	1.003 (1.002, 1.005)	< 0.001	0.933
TV0-1	5	1.003 (1.002, 1.005)	< 0.001	0.941
TV0-1	6	1.003 (1.002, 1.005)	< 0.001	0.928
TV0-2	3 *	1.006 (1.004, 1.008)	< 0.001	Ref.
TV0-2	4	1.006 (1.004, 1.008)	< 0.001	0.946
TV0-2	5	1.006 (1.004, 1.008)	< 0.001	0.951
TV0-2	6	1.006 (1.004, 1.008)	< 0.001	0.941
TV0-3	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-3	4	1.009 (1.007, 1.012)	< 0.001	0.954
TV0-3	5	1.009 (1.007, 1.012)	< 0.001	0.953
TV0-3	6	1.009 (1.007, 1.012)	< 0.001	0.946
TV0-4	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-4	4	1.009 (1.007, 1.012)	< 0.001	0.945
TV0-4	5	1.009 (1.007, 1.012)	< 0.001	0.940
TV0-4	6	1.009 (1.007, 1.012)	< 0.001	0.934
TV0-5	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-5	4	1.009 (1.006, 1.012)	< 0.001	0.940
TV0-5	5	1.009 (1.006, 1.012)	< 0.001	0.934
TV0-5	6	1.009 (1.006, 1.012)	< 0.001	0.929
TV0-6	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-6	4	1.009 (1.006, 1.012)	< 0.001	0.947
TV0-6	5	1.009 (1.006, 1.012)	< 0.001	0.939
TV0-6	6	1.009 (1.006, 1.012)	< 0.001	0.935
TV0-7	3 *	1.010 (1.007, 1.014)	< 0.001	Ref.
TV0-7	4	1.010 (1.007, 1.013)	< 0.001	0.961
TV0-7	5	1.010 (1.007, 1.013)	< 0.001	0.952
TV0-7	6	1.010 (1.007, 1.013)	< 0.001	0.949

*: primary model. Definition of abbreviations: TV = temperature variability; df = degrees of freedom; RR = relative risk; CI = confidence interval; Ref. = reference.

Table S5. Results of sensitivity analyses for TV using different df for lag days of mean temperature.

Exposure	df for lag days	RR (95%CI)	*P* value	*P* for difference
TV0-1	3 *	1.004 (1.002, 1.005)	< 0.001	Ref.
TV0-1	4	1.004 (1.002, 1.006)	< 0.001	0.664
TV0-1	5	1.004 (1.003, 1.006)	< 0.001	0.549
TV0-1	6	1.004 (1.003, 1.006)	< 0.001	0.539
TV0-2	3 *	1.006 (1.004, 1.008)	< 0.001	Ref.
TV0-2	4	1.007 (1.005, 1.009)	< 0.001	0.799
TV0-2	5	1.007 (1.004, 1.009)	< 0.001	0.875
TV0-2	6	1.007 (1.005, 1.009)	< 0.001	0.824
TV0-3	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-3	4	1.009 (1.006, 1.011)	< 0.001	0.682
TV0-3	5	1.009 (1.006, 1.011)	< 0.001	0.664
TV0-3	6	1.009 (1.006, 1.011)	< 0.001	0.581
TV0-4	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-4	4	1.009 (1.006, 1.011)	< 0.001	0.680
TV0-4	5	1.009 (1.006, 1.011)	< 0.001	0.741
TV0-4	6	1.009 (1.006, 1.011)	< 0.001	0.797
TV0-5	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-5	4	1.009 (1.006, 1.012)	< 0.001	0.963
TV0-5	5	1.009 (1.006, 1.012)	< 0.001	0.979
TV0-5	6	1.009 (1.006, 1.012)	< 0.001	0.945
TV0-6	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-6	4	1.010 (1.007, 1.013)	< 0.001	0.859
TV0-6	5	1.010 (1.007, 1.013)	< 0.001	0.892
TV0-6	6	1.010 (1.007, 1.013)	< 0.001	0.924
TV0-7	3 *	1.010 (1.007, 1.014)	< 0.001	Ref.
TV0-7	4	1.010 (1.007, 1.014)	< 0.001	0.944
TV0-7	5	1.010 (1.007, 1.014)	< 0.001	0.965
TV0-7	6	1.010 (1.007, 1.014)	< 0.001	0.994

*: primary model. Definition of abbreviations: TV = temperature variability; df = degrees of freedom; RR = relative risk; CI = confidence interval; Ref. = reference.

Table S6. Results of sensitivity analyses for TV using different degrees of freedom for relative humidity.

Exposure	df for mean temperature	RR (95%CI)	*P* value	*P* for difference
TV0-1	3 *	1.004 (1.002, 1.005)	< 0.001	Ref.
TV0-1	4	1.003 (1.002, 1.005)	< 0.001	0.968
TV0-1	5	1.003 (1.002, 1.005)	< 0.001	0.942
TV0-1	6	1.003 (1.002, 1.005)	< 0.001	0.921
TV0-2	3 *	1.006 (1.004, 1.008)	< 0.001	Ref.
TV0-2	4	1.006 (1.004, 1.008)	< 0.001	0.986
TV0-2	5	1.006 (1.004, 1.008)	< 0.001	0.962
TV0-2	6	1.006 (1.004, 1.008)	< 0.001	0.941
TV0-3	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-3	4	1.009 (1.007, 1.012)	< 0.001	1.000
TV0-3	5	1.009 (1.007, 1.012)	< 0.001	0.993
TV0-3	6	1.009 (1.007, 1.012)	< 0.001	0.982
TV0-4	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-4	4	1.009 (1.007, 1.012)	< 0.001	0.982
TV0-4	5	1.009 (1.007, 1.012)	< 0.001	0.977
TV0-4	6	1.009 (1.007, 1.012)	< 0.001	0.981
TV0-5	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-5	4	1.009 (1.006, 1.012)	< 0.001	0.965
TV0-5	5	1.009 (1.006, 1.012)	< 0.001	0.959
TV0-5	6	1.009 (1.006, 1.012)	< 0.001	0.961
TV0-6	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-6	4	1.010 (1.007, 1.013)	< 0.001	0.961
TV0-6	5	1.010 (1.007, 1.013)	< 0.001	0.960
TV0-6	6	1.010 (1.007, 1.013)	< 0.001	0.962
TV0-7	3 *	1.010 (1.007, 1.014)	< 0.001	Ref.
TV0-7	4	1.010 (1.007, 1.014)	< 0.001	0.962
TV0-7	5	1.010 (1.007, 1.014)	< 0.001	0.963
TV0-7	6	1.010 (1.007, 1.014)	< 0.001	0.966

*: primary model. Definition of abbreviations: TV = temperature variability; df = degrees of freedom; RR = relative risk; CI = confidence interval; Ref. = reference.

Table S7. Results of sensitivity analyses for TV using different degrees of freedom for lag days of relative humidity.

Exposure	df for lag days	RR (95%CI)	*P* value	*P* for difference
TV0-1	3 *	1.004 (1.002, 1.005)	< 0.001	Ref.
TV0-1	4	1.005 (1.003, 1.007)	< 0.001	0.329
TV0-1	5	1.005 (1.003, 1.007)	< 0.001	0.280
TV0-1	6	1.005 (1.003, 1.007)	< 0.001	0.269
TV0-2	3 *	1.006 (1.004, 1.008)	< 0.001	Ref.
TV0-2	4	1.006 (1.004, 1.009)	< 0.001	0.955
TV0-2	5	1.006 (1.004, 1.008)	< 0.001	0.947
TV0-2	6	1.006 (1.004, 1.008)	< 0.001	0.941
TV0-3	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-3	4	1.009 (1.006, 1.011)	< 0.001	0.609
TV0-3	5	1.009 (1.006, 1.011)	< 0.001	0.695
TV0-3	6	1.009 (1.006, 1.011)	< 0.001	0.660
TV0-4	3 *	1.009 (1.007, 1.012)	< 0.001	Ref.
TV0-4	4	1.009 (1.006, 1.011)	< 0.001	0.813
TV0-4	5	1.009 (1.007, 1.012)	< 0.001	0.909
TV0-4	6	1.009 (1.007, 1.012)	< 0.001	0.955
TV0-5	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-5	4	1.009 (1.007, 1.012)	< 0.001	0.835
TV0-5	5	1.009 (1.007, 1.012)	< 0.001	0.855
TV0-5	6	1.009 (1.007, 1.012)	< 0.001	0.834
TV0-6	3 *	1.009 (1.006, 1.012)	< 0.001	Ref.
TV0-6	4	1.010 (1.007, 1.013)	< 0.001	0.783
TV0-6	5	1.010 (1.007, 1.013)	< 0.001	0.820
TV0-6	6	1.010 (1.007, 1.013)	< 0.001	0.860
TV0-7	3 *	1.010 (1.007, 1.014)	< 0.001	Ref.
TV0-7	4	1.010 (1.007, 1.014)	< 0.001	0.999
TV0-7	5	1.010 (1.007, 1.014)	< 0.001	1.000
TV0-7	6	1.010 (1.007, 1.014)	< 0.001	0.991

*: primary model. Definition of abbreviations: TV = temperature variability; df = degrees of freedom; RR = relative risk; CI = confidence interval; Ref. = reference.