1   **Supplemental Materials**

2

3   **Table S1.** Summary statistics of $PM_{2.5}$ and meteorological variables across 530 counties.

Variable	Mean ± SD	Minimum	Maximum
$PM_{2.5}$ ($\mu g/m^3$)	9.29 ± 5.39	0.05	155.16
Temperature (°F)	56.37 ± 18.50	-37.30	104.74
Relative humidity (%)	65.24 ± 16.24	0	100

4

5   **Table S2.** The relative risk (RR, 95%CI) for an all-cause, cardiovascular, and respiratory related early and late-readmission following

6   all-cause and cause-specific discharges. RR is expressed per 10 μg/m^3 increase in $PM_{2.5}$. Models presented include the main model

7   presented in the paper (model 1) where $PM_{2.5}$ is considered as a linear variable and a model that considers $PM_{2.5}$ as a non-linear

8   variable (model 2).

Readmission model	Discharge cause	Readmission cause	Model 1 PM linear RR (95%CI)	Model 2 PM non-linear RR (95%CI)
Early-readmission (1-7d)	All Causes	All Causes	1.016 (1.006, 1.026)	1.089 (1.016, 1.168)
Early-readmission (1-7d)	All Causes	All Cardiovascular	1.009 (0.996, 1.023)	0.984 (0.892, 1.085)
Early-readmission (1-7d)	All Causes	Dysrhythmia*	1.048 (1.023, 1.074)	0.898 (0.754, 1.070)
Early-readmission (1-7d)	All Causes	Heart failure	1.037 (1.014, 1.060)	1.065 (0.906, 1.252)
Early-readmission (1-7d)	All Causes	Hypertension	1.007 (0.990, 1.025)	1.011 (0.895, 1.141)
Early-readmission (1-7d)	All Causes	Ischemic heart disease	0.970 (0.929, 1.012)	0.910 (0.678, 1.222)
Early-readmission (1-7d)	All Causes	Myocardial infarction	0.955 (0.906, 1.007)	0.940 (0.651, 1.358)
Early-readmission (1-7d)	All Causes	Peripheral arterial disease	0.900 (0.748, 1.083)	0.389 (0.121, 1.254)
Early-readmission (1-7d)	All Causes	All Respiratory	1.026 (1.011, 1.040)	1.082 (0.977, 1.199)
Early-readmission (1-7d)	All Causes	Asthma	1.102 (0.992, 1.226)	0.464 (0.240, 0.900)
Early-readmission (1-7d)	All Causes	COPD	1.040 (1.002, 1.081)	1.021 (0.763, 1.366)
Early-readmission (1-7d)	All Causes	Other*	1.027 (1.012, 1.042)	1.093 (0.981, 1.218)
Early-readmission (1-7d)	All Causes	Pneumonia	1.065 (1.035, 1.096)	1.263 (1.012, 1.576)
Early-readmission (1-7d)	All Causes	Pulmonary embolism	1.047 (0.930, 1.179)	0.911 (0.371, 2.233)
Early-readmission (1-7d)	All Cardiovascular	All Causes	1.018 (1.004, 1.032)	1.034 (0.933, 1.145)
Early-readmission (1-7d)	All Cardiovascular	All Cardiovascular	1.006 (0.989, 1.024)	0.938 (0.823, 1.070)
Early-readmission (1-7d)	All Cardiovascular	Dysrhythmia*	1.043 (1.012, 1.076)	1.006 (0.793, 1.278)
Early-readmission (1-7d)	All Cardiovascular	Heart failure	1.027 (0.999, 1.056)	0.994 (0.810, 1.221)
Early-readmission (1-7d)	All Cardiovascular	Hypertension	1.006 (0.985, 1.028)	0.911 (0.776, 1.069)
Early-readmission (1-7d)	All Cardiovascular	Ischemic heart disease	1.014 (0.963, 1.069)	0.888 (0.603, 1.309)
Early-readmission (1-7d)	All Cardiovascular	Myocardial infarction	0.987 (0.924, 1.054)	0.901 (0.557, 1.459)
Early-readmission (1-7d)	All Cardiovascular	Peripheral arterial disease	0.924 (0.693, 1.230)	0.195 (0.044, 0.875)

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Early-readmission (1-7d)	All Cardiovascular	All Respiratory	1.025 (1.006, 1.045)	1.015 (0.882, 1.169)
Early-readmission (1-7d)	All Cardiovascular	Asthma	1.086 (0.948, 1.243)	0.335 (0.144, 0.781)
Early-readmission (1-7d)	All Cardiovascular	COPD	1.035 (0.985, 1.087)	0.877 (0.604, 1.275)
Early-readmission (1-7d)	All Cardiovascular	Other*	1.025 (1.005, 1.045)	1.067 (0.919, 1.238)
Early-readmission (1-7d)	All Cardiovascular	Pneumonia	1.075 (1.035, 1.117)	1.124 (0.831, 1.521)
Early-readmission (1-7d)	All Cardiovascular	Pulmonary embolism	1.134 (0.986, 1.303)	1.879 (0.544, 6.491)
Early-readmission (1-7d)	All Respiratory	All Causes	1.018 (1.004, 1.032)	1.041 (0.939, 1.154)
Early-readmission (1-7d)	All Respiratory	All Cardiovascular	1.007 (0.988, 1.026)	1.011 (0.880, 1.161)
Early-readmission (1-7d)	All Respiratory	Dysrhythmia*	1.045 (1.011, 1.080)	0.936 (0.731, 1.198)
Early-readmission (1-7d)	All Respiratory	Heart failure	1.017 (0.988, 1.047)	0.989 (0.802, 1.220)
Early-readmission (1-7d)	All Respiratory	Hypertension	1.014 (0.990, 1.038)	1.056 (0.885, 1.260)
Early-readmission (1-7d)	All Respiratory	Ischemic heart disease	0.971 (0.918, 1.028)	0.783 (0.534, 1.149)
Early-readmission (1-7d)	All Respiratory	Myocardial infarction	0.938 (0.872, 1.009)	0.682 (0.422, 1.102)
Early-readmission (1-7d)	All Respiratory	Peripheral arterial disease	0.857 (0.603, 1.219)	0.189 (0.035, 1.004)
Early-readmission (1-7d)	All Respiratory	All Respiratory	1.025 (1.006, 1.044)	1.087 (0.947, 1.248)
Early-readmission (1-7d)	All Respiratory	Asthma	1.074 (0.938, 1.230)	0.407 (0.180, 0.920)
Early-readmission (1-7d)	All Respiratory	COPD	1.041 (0.993, 1.092)	0.856 (0.600, 1.223)
Early-readmission (1-7d)	All Respiratory	Other*	1.028 (1.008, 1.048)	1.114 (0.963, 1.289)
Early-readmission (1-7d)	All Respiratory	Pneumonia	1.049 (1.011, 1.089)	1.185 (0.890, 1.578)
Early-readmission (1-7d)	All Respiratory	Pulmonary embolism	1.075 (0.913, 1.265)	0.921 (0.265, 3.202)
Late-readmission (8-30d)	All Causes	All Causes	1.013 (1.006, 1.020)	1.024 (0.974, 1.077)
Late-readmission (8-30d)	All Causes	All Cardiovascular	1.017 (1.007, 1.027)	1.071 (0.995, 1.153)
Late-readmission (8-30d)	All Causes	Dysrhythmia*	1.031 (1.013, 1.050)	1.103 (0.961, 1.266)
Late-readmission (8-30d)	All Causes	Heart failure	1.041 (1.025, 1.058)	1.027 (0.915, 1.154)
Late-readmission (8-30d)	All Causes	Hypertension	1.010 (0.998, 1.023)	1.036 (0.947, 1.135)
Late-readmission (8-30d)	All Causes	Ischemic heart disease	1.008 (0.975, 1.042)	0.858 (0.676, 1.089)
Late-readmission (8-30d)	All Causes	Myocardial infarction	0.974 (0.933, 1.017)	0.722 (0.538, 0.968)
Late-readmission (8-30d)	All Causes	Peripheral arterial disease	1.003 (0.873, 1.153)	1.367 (0.511, 3.653)
Late-readmission (8-30d)	All Causes	All Respiratory	1.030 (1.020, 1.041)	1.083 (1.004, 1.169)
Late-readmission (8-30d)	All Causes	Asthma	1.071 (0.998, 1.150)	1.327 (0.739, 2.382)
Late-readmission (8-30d)	All Causes	COPD	1.046 (1.017, 1.076)	1.001 (0.813, 1.232)
Late-readmission (8-30d)	All Causes	Other*	1.030 (1.019, 1.041)	1.113 (1.028, 1.206)

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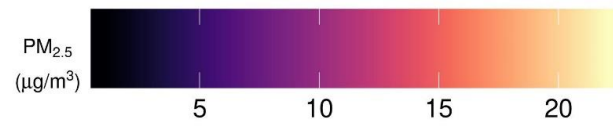| Late-readmission (8-30d)	All Causes	Pneumonia	1.059 (1.037, 1.082)	1.104 (0.940, 1.297)
Late-readmission (8-30d)	All Causes	Pulmonary embolism	1.063 (0.959, 1.178)	1.774 (0.742, 4.240)
Late-readmission (8-30d)	All Cardiovascular	All Causes	1.012 (1.003, 1.022)	1.030 (0.956, 1.109)
Late-readmission (8-30d)	All Cardiovascular	All Cardiovascular	1.016 (1.003, 1.029)	1.048 (0.950, 1.157)
Late-readmission (8-30d)	All Cardiovascular	Dysrhythmia*	1.035 (1.012, 1.058)	1.058 (0.884, 1.266)
Late-readmission (8-30d)	All Cardiovascular	Heart failure	1.035 (1.015, 1.055)	1.055 (0.907, 1.227)
Late-readmission (8-30d)	All Cardiovascular	Hypertension	1.007 (0.991, 1.023)	1.002 (0.889, 1.129)
Late-readmission (8-30d)	All Cardiovascular	Ischemic heart disease	0.977 (0.936, 1.020)	0.740 (0.542, 1.010)
Late-readmission (8-30d)	All Cardiovascular	Myocardial infarction	0.946 (0.894, 1.002)	0.593 (0.405, 0.868)
Late-readmission (8-30d)	All Cardiovascular	Peripheral arterial disease	1.013 (0.815, 1.258)	1.084 (0.257, 4.566)
Late-readmission (8-30d)	All Cardiovascular	All Respiratory	1.028 (1.015, 1.042)	1.086 (0.978, 1.206)
Late-readmission (8-30d)	All Cardiovascular	Asthma	1.057 (0.963, 1.160)	1.424 (0.654, 3.097)
Late-readmission (8-30d)	All Cardiovascular	COPD	1.047 (1.011, 1.084)	0.840 (0.645, 1.094)
Late-readmission (8-30d)	All Cardiovascular	Other*	1.028 (1.014, 1.042)	1.130 (1.012, 1.262)
Late-readmission (8-30d)	All Cardiovascular	Pneumonia	1.052 (1.023, 1.082)	1.203 (0.963, 1.504)
Late-readmission (8-30d)	All Cardiovascular	Pulmonary embolism	1.036 (0.909, 1.181)	1.251 (0.389, 4.020)
Late-readmission (8-30d)	All Respiratory	All Causes	1.010 (1.000, 1.020)	1.039 (0.963, 1.120)
Late-readmission (8-30d)	All Respiratory	All Cardiovascular	1.020 (1.006, 1.034)	1.076 (0.970, 1.194)
Late-readmission (8-30d)	All Respiratory	Dysrhythmia*	1.037 (1.012, 1.062)	1.053 (0.869, 1.277)
Late-readmission (8-30d)	All Respiratory	Heart failure	1.034 (1.013, 1.055)	1.130 (0.968, 1.319)
Late-readmission (8-30d)	All Respiratory	Hypertension	1.013 (0.996, 1.030)	1.040 (0.914, 1.184)
Late-readmission (8-30d)	All Respiratory	Ischemic heart disease	0.975 (0.932, 1.002)	0.759 (0.553, 1.040)
Late-readmission (8-30d)	All Respiratory	Myocardial infarction	0.948 (0.893, 1.006)	0.710 (0.472, 1.069)
Late-readmission (8-30d)	All Respiratory	Peripheral arterial disease	1.102 (0.894, 1.359)	1.895 (0.351, 10.226)
Late-readmission (8-30d)	All Respiratory	All Respiratory	1.019 (1.005, 1.032)	1.078 (0.974, 1.193)
Late-readmission (8-30d)	All Respiratory	Asthma	0.996 (0.905, 1.095)	1.200 (0.579, 2.489)
Late-readmission (8-30d)	All Respiratory	COPD	1.026 (0.991, 1.063)	0.887 (0.691, 1.138)
Late-readmission (8-30d)	All Respiratory	Other*	1.019 (1.005, 1.033)	1.119 (1.005, 1.246)
Late-readmission (8-30d)	All Respiratory	Pneumonia	1.062 (1.033, 1.092)	1.178 (0.947, 1.465)
Late-readmission (8-30d)	All Respiratory	Pulmonary embolism	1.070 (0.915, 1.252)	1.848 (0.599, 5.701)

9

4

10 **Table S3.** Relative risk (RR ± 95% CI) of all-cause and cause-specific daily county admission rates associated with a 10 μg/m³

11 increase in PM$_{2.5}$ for exposure lags 0-14 days. Models presented include the main model presented in the paper (model 1) where

12 PM$_{2.5}$ is considered as a linear variable and a model that considers PM$_{2.5}$ as a non-linear variable (model 2). Additionally, the main

13 model was stratified on the median of percent of individuals below poverty with respect to county (12.5% below poverty), with model

14 3 representing the model with counties with high % below poverty and model 4 representing counties with low % below poverty.

Endpoint	Lag	Model 1, PM linear RR (95%CI)	Model 2, PM non-linear RR (95%CI)	Model 3, PM linear high % poverty RR (95%CI)	Model 4, PM linear low % poverty RR (95%CI)
All-cause	0	1.003 (0.998, 1.009)	0.998 (1.009, 0.996)	1.009 (0.996, 0.978)	0.996 (0.978, 1.015)
All-cause	1	0.997 (0.99, 1.003)	0.99 (1.003, 0.988)	1.003 (0.988, 0.968)	0.988 (0.968, 1.008)
All-cause	2	0.999 (0.992, 1.005)	0.992 (1.005, 0.998)	1.005 (0.998, 0.978)	0.998 (0.978, 1.018)
All-cause	3	0.996 (0.99, 1.002)	0.99 (1.002, 1.011)	1.002 (1.011, 0.991)	1.011 (0.991, 1.032)
All-cause	4	1.002 (0.996, 1.008)	0.996 (1.008, 1.006)	1.008 (1.006, 0.986)	1.006 (0.986, 1.027)
All-cause	5	1.001 (0.995, 1.007)	0.995 (1.007, 0.977)	1.007 (0.977, 0.957)	0.977 (0.957, 0.997)
All-cause	6	1.001 (0.995, 1.008)	0.995 (1.008, 0.988)	1.008 (0.988, 0.968)	0.988 (0.968, 1.009)
All-cause	7	1 (0.993, 1.006)	0.993 (1.006, 0.982)	1.006 (0.982, 0.961)	0.982 (0.961, 1.003)
All-cause	8	1.004 (0.997, 1.01)	0.997 (1.01, 1.001)	1.01 (1.001, 0.981)	1.001 (0.981, 1.022)
All-cause	9	1.004 (0.998, 1.01)	0.998 (1.01, 0.985)	1.01 (0.985, 0.965)	0.985 (0.965, 1.006)
All-cause	10	0.999 (0.993, 1.005)	0.993 (1.005, 1.02)	1.005 (1.02, 1)	1.02 (1, 1.042)
All-cause	11	0.996 (0.989, 1.002)	0.989 (1.002, 0.998)	1.002 (0.998, 0.978)	0.998 (0.978, 1.019)
All-cause	12	1.002 (0.996, 1.009)	0.996 (1.009, 1.006)	1.009 (1.006, 0.986)	1.006 (0.986, 1.028)
All-cause	13	0.995 (0.989, 1.001)	0.989 (1.001, 0.979)	1.001 (0.979, 0.959)	0.979 (0.959, 0.999)
All-cause	14	1 (0.994, 1.005)	0.994 (1.005, 0.987)	1.005 (0.987, 0.968)	0.987 (0.968, 1.006)
Cardiovascular related causes	0	1.009 (1.002, 1.017)	1.002 (1.017, 0.994)	1.017 (0.994, 0.967)	0.994 (0.967, 1.022)
Cardiovascular related causes	1	0.995 (0.986, 1.004)	0.986 (1.004, 0.978)	1.004 (0.978, 0.949)	0.978 (0.949, 1.007)

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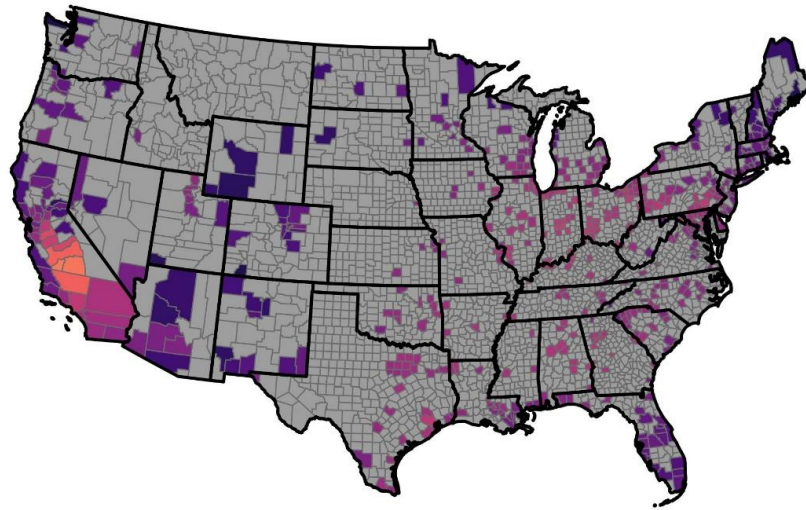
Cardiovascular related causes	2	0.998 (0.988, 1.007)	0.988 (1.007, 0.997)	1.007 (0.997, 0.968)	0.997 (0.968, 1.028)
Cardiovascular related causes	3	0.993 (0.984, 1.002)	0.984 (1.002, 1)	1.002 (1, 0.97)	1 (0.97, 1.03)
Cardiovascular related causes	4	1.003 (0.994, 1.012)	0.994 (1.012, 1.029)	1.012 (1.029, 0.999)	1.029 (0.999, 1.06)
Cardiovascular related causes	5	1.004 (0.994, 1.013)	0.994 (1.013, 0.976)	1.013 (0.976, 0.947)	0.976 (0.947, 1.006)
Cardiovascular related causes	6	0.999 (0.99, 1.008)	0.99 (1.008, 0.991)	1.008 (0.991, 0.962)	0.991 (0.962, 1.022)
Cardiovascular related causes	7	1.005 (0.995, 1.014)	0.995 (1.014, 0.979)	1.014 (0.979, 0.949)	0.979 (0.949, 1.01)
Cardiovascular related causes	8	1.002 (0.993, 1.011)	0.993 (1.011, 0.999)	1.011 (0.999, 0.969)	0.999 (0.969, 1.03)
Cardiovascular related causes	9	1.009 (1, 1.018)	1 (1.018, 0.992)	1.018 (0.992, 0.963)	0.992 (0.963, 1.023)
Cardiovascular related causes	10	0.992 (0.983, 1.001)	0.983 (1.001, 0.996)	1.001 (0.996, 0.966)	0.996 (0.966, 1.026)
Cardiovascular related causes	11	0.999 (0.99, 1.008)	0.99 (1.008, 1.017)	1.008 (1.017, 0.987)	1.017 (0.987, 1.048)
Cardiovascular related causes	12	0.999 (0.99, 1.008)	0.99 (1.008, 1.004)	1.008 (1.004, 0.974)	1.004 (0.974, 1.035)
Cardiovascular related causes	13	0.996 (0.987, 1.005)	0.987 (1.005, 0.969)	1.005 (0.969, 0.94)	0.969 (0.94, 0.999)
Cardiovascular related causes	14	1.002 (0.994, 1.009)	0.994 (1.009, 1.007)	1.009 (1.007, 0.978)	1.007 (0.978, 1.036)
Respiratory related causes	0	1.002 (0.994, 1.01)	0.994 (1.01, 0.998)	1.01 (0.998, 0.97)	0.998 (0.97, 1.027)
Respiratory related causes	1	0.998 (0.989, 1.008)	0.989 (1.008, 0.977)	1.008 (0.977, 0.948)	0.977 (0.948, 1.008)
Respiratory related causes	2	0.995 (0.985, 1.004)	0.985 (1.004, 1.007)	1.004 (1.007, 0.976)	1.007 (0.976, 1.039)
Respiratory related causes	3	0.995 (0.985, 1.004)	0.985 (1.004, 1.006)	1.004 (1.006, 0.975)	1.006 (0.975, 1.038)
Respiratory related causes	4	0.999 (0.989, 1.008)	0.989 (1.008, 0.997)	1.008 (0.997, 0.967)	0.997 (0.967, 1.029)

6

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Respiratory related causes	5	1.009 (1, 1.019)	1 (1.019, 0.993)	1.019 (0.993, 0.962)	0.993 (0.962, 1.024)
Respiratory related causes	6	0.999 (0.99, 1.009)	0.99 (1.009, 0.974)	1.009 (0.974, 0.944)	0.974 (0.944, 1.005)
Respiratory related causes	7	0.999 (0.989, 1.009)	0.989 (1.009, 0.984)	1.009 (0.984, 0.952)	0.984 (0.952, 1.017)
Respiratory related causes	8	1.005 (0.996, 1.015)	0.996 (1.015, 1.011)	1.015 (1.011, 0.98)	1.011 (0.98, 1.043)
Respiratory related causes	9	1.008 (0.999, 1.018)	0.999 (1.018, 0.979)	1.018 (0.979, 0.948)	0.979 (0.948, 1.01)
Respiratory related causes	10	0.995 (0.985, 1.004)	0.985 (1.004, 0.994)	1.004 (0.994, 0.963)	0.994 (0.963, 1.026)
Respiratory related causes	11	0.997 (0.988, 1.007)	0.988 (1.007, 1.013)	1.007 (1.013, 0.981)	1.013 (0.981, 1.046)
Respiratory related causes	12	1.002 (0.992, 1.011)	0.992 (1.011, 0.998)	1.011 (0.998, 0.967)	0.998 (0.967, 1.03)
Respiratory related causes	13	0.997 (0.987, 1.006)	0.987 (1.006, 0.979)	1.006 (0.979, 0.948)	0.979 (0.948, 1.011)
Respiratory related causes	14	1.001 (0.993, 1.009)	0.993 (1.009, 0.995)	1.009 (0.995, 0.966)	0.995 (0.966, 1.025)

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PM$_{2.5}$
($\mu g/m^3$)

5   10   15   20
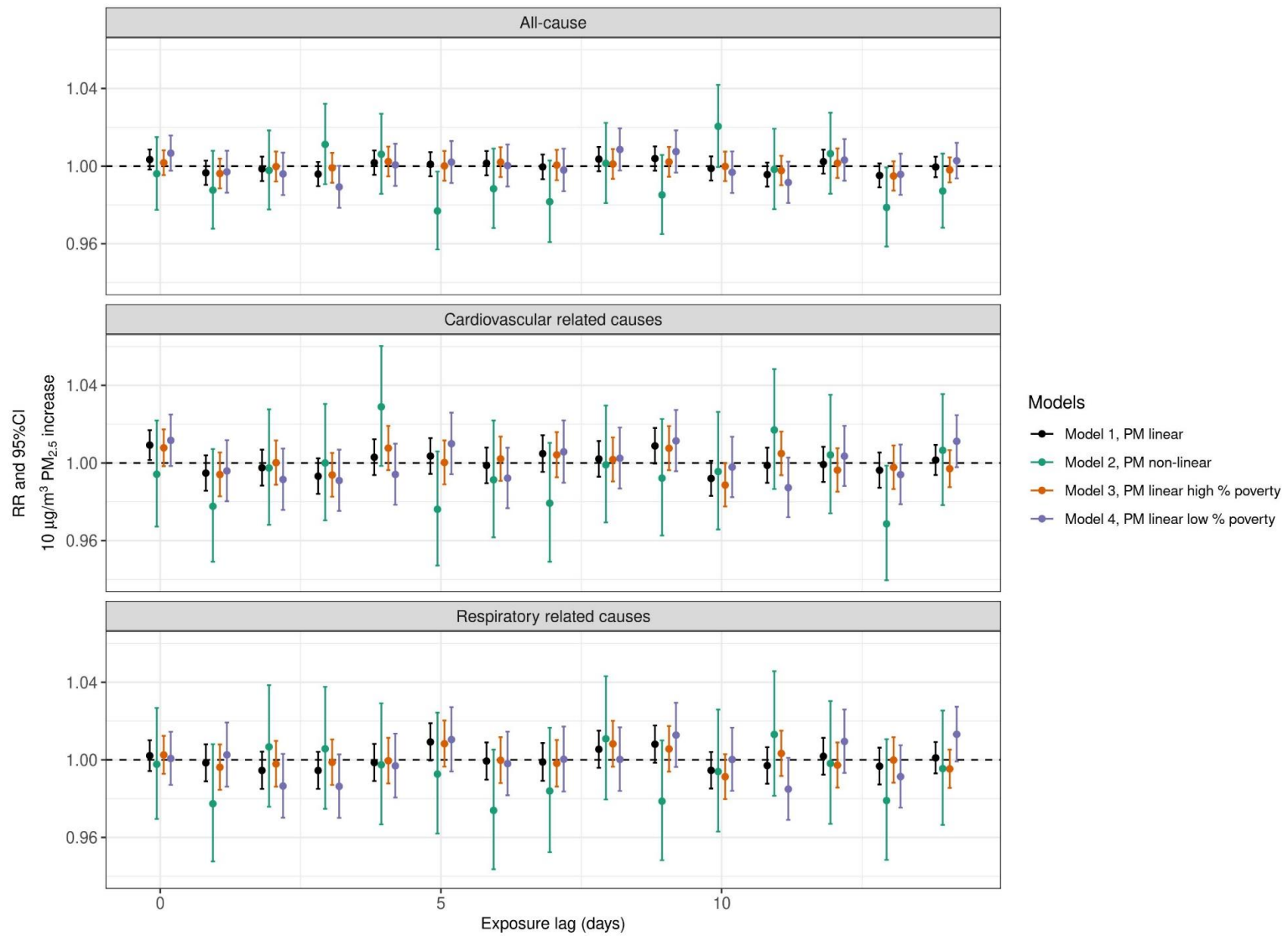
A) Long-term county PM$_{2.5}$ (7yr average)

B) 20% of county days are above PM$_{2.5}$ (80th percentile)

16
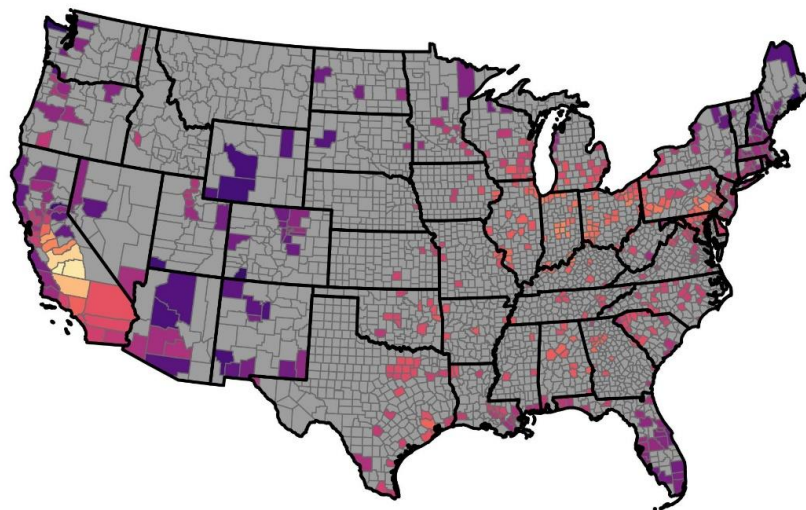
17   **Figure S1.** County $PM_{2.5}$ levels for the 530 counties included in the study. $PM_{2.5}$ levels shown

18   include the A) long-term average and B) 80th percentile (indicating that 20% of county days are

19   at or above this $PM_{2.5}$ level) for the years 2008-2014.

20

10

21   **Figure S2.** Relative risk (RR ± 95%CI) for daily county admission rates for all-cause hospitalization associated with a 10 μg/m^3

22   increase in PM$_{2.5}$ for exposure lags 0-14 days using an unconstrained distributed lag model. Models presented include the main

23   model presented in the paper (model 1) where PM$_{2.5}$ is considered as a linear variable in black and a model that considers PM$_{2.5}$ as a

24   non-linear variable (model 2) in green. Additionally, the main model was stratified on the median of percent of individuals below

25   poverty with respect to county (12.5% below poverty), with model 3 representing the model with counties with high % below poverty

26   in orange and model 4 representing counties with low % below poverty in purple (Table S2).
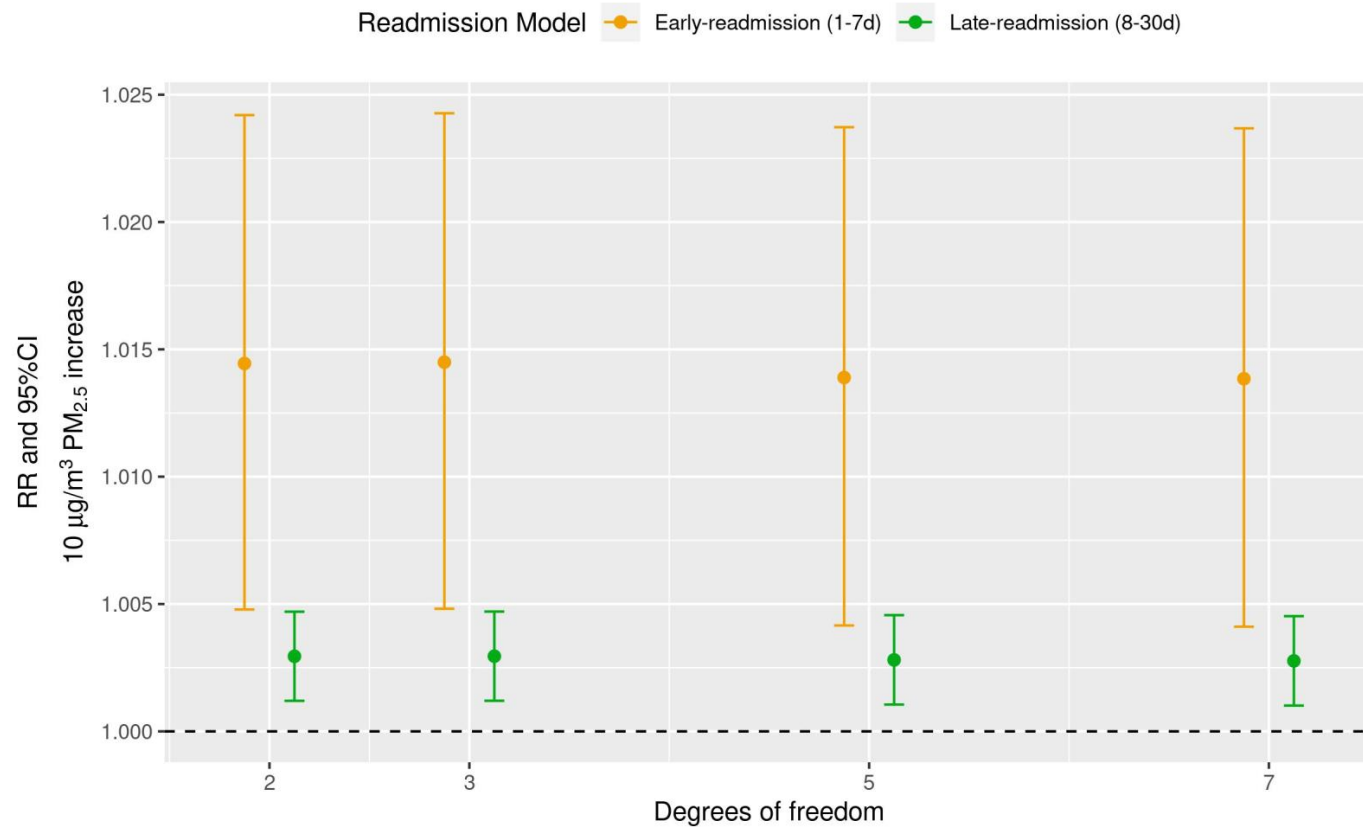
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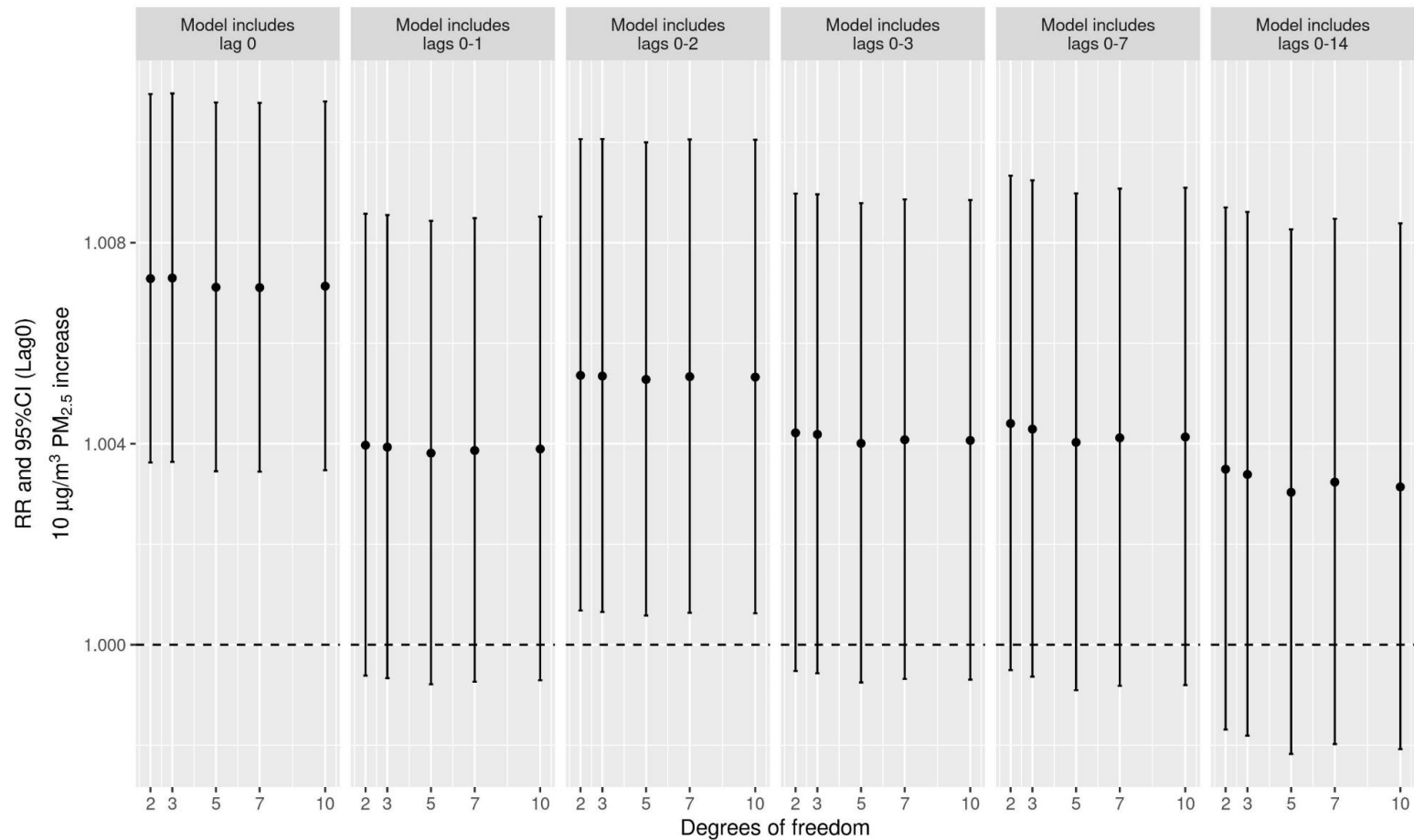
Figure S3. Sensitivity analysis for all-cause admissions models showing the impact on the lag 0 estimate from changing the number of lags considered (grouped figures), and the number of degrees of freedom (x-axis) for the temperature and relative humidity variables. Relative risk (RR ± 95%CI) of all-cause daily county admission rates associated with a 10 µg/m^3 increase in PM$_{2.5}$ on lag 0.

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Supplemental material

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Figure S4. Sensitivity analysis for all-cause readmission models showing the impact on the lag 0 estimate from changing the number

of degrees of freedom (x-axis) for the temperature and relative humidity variables. Relative risk (RR ± 95%CI) of all-cause daily

county admission rates associated with a 10 μg/m^3 increase in PM$_{2.5}$ on lag 0.

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