Table S1. Baseline Sample Characteristics for Dementia and MCI Analysis Samples Compared to Excluded Participants

Incident Dementia Analysis Sample			
	Total (n=1959)	Excluded (n=387)	Included (n=1572)
Age in years, mean (SD)	77.6 (7.40)	78.3 (7.67)	77.4 (7.32)
Female Sex, n (%)	1201 (61.3%)	227 (58.7%)	974 (62.0%)
Education, n (%)			
<High School	265 (13.5%)	65 (16.8%)	200 (12.7%)
High School	884 (45.1%)	181 (46.8%)	703 (44.7%)
>High School	810 (41.3%)	141 (36.4%)	669 (42.6%)
Ever Smoker, n (%)	1035 (53.0%)	210 (55.1%)	825 (52.5%)
Incident MCI Analysis Sample			
	Total (n=1413)	Excluded (n=250)	Included (n=1163)
Age in years, mean (SD)	76.8 (7.27)	76.8 (7.45)	76.7 (7.23)
Female Sex, n (%)	898 (63.6%)	155 (62.0%)	743 (63.9%)
Education, n (%)			
<High School	162 (11.5%)	38 (15.2%)	124 (10.7%)
High School	649 (45.9%)	119 (47.6%)	530 (45.6%)
>High School	602 (42.6%)	93 (37.2%)	509 (43.8%)
Ever Smoker, n (%)	726 (51.5%)	137 (55.2%)	589 (50.6%)

Note: MCI=Mild Cognitive Impairment; SD=standard deviation.

Table S2. Retained Sample at each MYHAT Cycle Visit for Incident Dementia and Incident MCI Analyses

Incident Dementia Analysis Sample											
	Cycle										
	1 (n=1572)	2 (n=1558)	3 (n=1374)	4 (n=1214)	5 (n=1072)	6 (n=947)	7 (n=847)	8 (n=768)	9 (n= 688)	10 (n=580)	11 (n=484)
Age, mean (SD)	77.4(7.3)	78.4(7.3)	79.1(7.2)	79.9(7.1)	80.5(7)	81.2(6.9)	81.8(6.8)	82.3(6.6)	82.9(6.5)	83.2(6.3)	83.7(6.1)
Female, n(%)	974 (62%)	964 (61.9%)	863 (62.8%)	764 (62.9%)	675 (63%)	613 (64.7%)	556 (65.6%)	500 (65.1%)	449 (65.3%)	378 (65.2%)	319 (65.9%)
Education, n(%)											
<HS	200 (12.7%)	197 (12.6%)	161 (11.7%)	145 (11.9%)	126 (11.8%)	108 (11.4%)	92 (10.9%)	80 (10.4%)	63 (9.2%)	45 (7.8%)	39 (8.1%)
HS	703 (44.7%)	695 (44.6%)	611 (44.5%)	531 (43.7%)	465 (43.4%)	416 (43.9%)	360 (42.5%)	323 (42.1%)	282 (41%)	234 (40.3%)	190 (39.3%)
>HS	669 (42.6%)	666 (42.7%)	602 (43.8%)	538 (44.3%)	481 (44.9%)	423 (44.7%)	395 (46.6%)	365 (47.5%)	343 (49.9%)	301 (51.9%)	255 (52.7%)
Ever smoker, n(%)	825 (52.5%)	820 (52.6%)	709 (51.6%)	629 (51.8%)	546 (50.9%)	481 (50.8%)	431 (50.9%)	397 (51.7%)	356 (51.7%)	292 (50.3%)	236 (48.8%)
Incident MCI Analysis Sample											
	Cycle										
	1 (n=1163)	2 (n=1151)	3 (n=1025)	4 (n=920)	5 (n=824)	6 (n=743)	7 (n=666)	8 (n=606)	9 (n=550)	10 (n=468)	11 (n=393)
Age, mean (SD)	76.7(7.2)	77.8(7.2)	78.5(7.1)	79.3(7)	80(7)	80.9(6.9)	81.7(6.9)	82.2(6.7)	82.8(6.7)	83.2(6.4)	83.6(6.3)
Female, n(%)	743 (63.9%)	734 (63.8%)	660 (64.4%)	589 (64%)	532 (64.6%)	491 (66.1%)	447 (67.1%)	401 (66.2%)	367 (66.7%)	311 (66.5%)	263 (66.9%)
Education, n(%)											
<HS	124 (10.7%)	121 (10.5%)	102 (10%)	94 (10.2%)	82 (10%)	78 (10.5%)	66 (9.9%)	58 (9.6%)	47 (8.5%)	34 (7.3%)	30 (7.6%)
HS	530 (45.6%)	524 (45.5%)	465 (45.4%)	412 (44.8%)	365 (44.3%)	325 (43.7%)	281 (42.2%)	256 (42.2%)	228 (41.5%)	188 (40.2%)	155 (39.4%)
>HS	509	506	458	414	377	340	319	292	275	246	208

	(43.8%)	(44%)	(44.7%)	(45%)	(45.8%)	(45.8%)	(47.9%)	(48.2%)	(50%)	(52.6%)	(52.9%)
Ever smoker, n(%)	589 (50.6%)	585 (50.8%)	517 (50.4%)	465 (50.5%)	409 (49.6%)	368 (49.5%)	331 (49.7%)	310 (51.2%)	281 (51.1%)	234 (50%)	192 (48.9%)

Note: MYHAT= Monongahela-Youghiogheny Healthy Aging Team; MCI=Mild Cognitive Impairment; SD=Standard Deviation; HS=High School.

Table S3. Bayesian Spatial Survival Time-Dependent Models Associating $PM_{2.5}$ Exposure with Incident Dementia and Incident MCI with or Without Frailty

	Incident Dementia		Incident MCI	
Model 1: Single-Year $PM_{2.5}$				
	Without frailty DIC: 882.567 LPML: -441.481	With frailty DIC: 882.058 LPML: -441.26	Without frailty DIC: 2247.838 LPML: -1124.309	With frailty DIC: 2226.765 LPML: -1116.641
	HR(95% CI)	HR(95% CI)	HR(95% CI)	HR(95% CI)
$PM_{2.5}$ Single-Year Average	1.660(1.331,2.076)	1.669(1.298,2.136)	1.549(1.380,1.737)	1.746(1.518,2.032)
Age	1.130(1.092,1.166)	1.132(1.094,1.170)	1.086(1.070,1.105)	1.092(1.073,1.111)
Female Sex	0.806(0.505,1.251)	0.809(0.507,1.239)	1.133(0.893,1.455)	1.212(0.942,1.575)
Ever Smoked	0.883(0.548,1.425)	0.884(0.567,1.376)	0.876(0.683,1.120)	0.878(0.699,1.098)
High School Education	0.612(0.353,1.019)	0.597(0.369,0.974)	0.782(0.562,1.092)	0.739(0.538,1.009)
>High School Education	0.602(0.350,1.082)	0.586(0.335,1.003)	0.540(0.377,0.757)	0.525(0.368,0.751)
Model 2: Five-Year $PM_{2.5}$				
	Without frailty DIC: 872.754 LPML:-436.993	With frailty DIC: 873.146 LPML:-437.346	Without frailty DIC: 2211.644 LPML: -1107.149	With frailty DIC: 2132.22 LPML: -1073.092
	HR(95% CI)	HR(95% CI)	HR(95% CI)	HR(95% CI)
$PM_{2.5}$ Five-Year Average	2.162(1.599,3.110)	2.082(1.528,3.015)	2.175(1.848,2.585)	3.419(2.806,4.164)
Age	1.129(1.092,1.168)	1.133(1.095,1.175)	1.088(1.068,1.107)	1.102(1.079,1.126)
Female Sex	0.794(0.506,1.229)	0.805(0.530,1.278)	1.158(0.921,1.461)	1.228(0.950,1.639)
Ever Smoked	0.870(0.553,1.302)	0.885(0.564,1.382)	0.890(0.705,1.109)	0.888(0.675,1.148)
High School Education	0.626(0.381,1.043)	0.614(0.341,1.048)	0.790(0.589,1.087)	0.721(0.502,1.015)
>High School Education	0.620(0.350,1.082)	0.618(0.344,1.096)	0.558(0.414,0.819)	0.521(0.348,0.758)

Note: $PM_{2.5}$ = Fine Particulate Matter; MCI=Mild Cognitive Impairment; HR=Hazard Ratio; CI=Credible Interval; DIC: deviance information criterion; LPML: log pseudo marginal likelihood.

Incident Dementia and MCI outcomes were modeled separately.

$PM_{2.5}$ estimates correspond to a 1 $\mu g/m^3$ increase.

See also: Supplemental Methods.

Table S4. Spatial Regression Models Associating $PM_{2.5}$ Exposure with Incident Dementia and Incident MCI Additional Adjustment for Household Income

	Incident Dementia		Incident MCI	
	HR	95% CI HR	HR	95% CI HR
Model 1: Single-Year $PM_{2.5}$				
$PM_{2.5}$ Single-Year Average	1.712	(1.310,2.279)	1.745	(1.492,1.993)
Age (in years)	1.133	(1.086,1.183)	1.100	(1.078,1.122)
Female Sex	0.733	(0.412,1.332)	1.347	(0.971,1.890)
Ever Smoked	0.750	(0.438,1.267)	0.942	(0.715,1.234)
High School Education	0.574	(0.319,1.039)	0.680	(0.491,0.972)
>High School Education	0.501	(0.250,0.974)	0.480	(0.322,0.715)
≥$40,000 Household Income	0.230	(0.038,0.753)	0.815	(0.530,1.211)
Model 2: 5-Year $PM_{2.5}$				
$PM_{2.5}$ Five-Year Average	2.123	(1.519,3.094)	3.450	(2.834,4.286)
Age (in years)	1.133	(1.091,1.180)	1.107	(1.086,1.133)
Female Sex	0.730	(0.417,1.238)	1.420	(1.072,1.936)
Ever Smoked	0.775	(0.438,1.358)	0.984	(0.771,1.247)
High School Education	0.581	(0.324,1.053)	0.625	(0.441,0.862)
>High School Education	0.516	(0.250,1.063)	0.448	(0.308,0.644)
≥$40,000 Household Income	0.246	(0.068,0.722)	0.847	(0.556,1.258)

Note: $PM_{2.5}$ = Fine Particulate Matter; MCI=Mild Cognitive Impairment; HR=Hazard Ratio; CI=Credible Interval. Incident Dementia and MCI outcomes were modeled separately.
$PM_{2.5}$ estimates correspond to a 1 $\mu g/m^3$ increase.
Incident Dementia analysis sample n=1284; Incident MCI analysis sample n=976.

Supplemental Methods.

Assumptions of the frailty term in Bayesian spatial survival model:

We define each frailty term $v_i = v(s_i)$ arises from a Gaussian random field such that $\mathbf{v} = (v_1, \ldots, v_m)$ follows a multivariate Gaussian distribution as $\mathbf{v} \sim N_m(0, \tau^2 R)$, where s_i denotes each distinct spatial location; τ^2 captures the amount of spatial variation across locations; and R is the correlation matrix that controlling the spatial dependence of $v(s)$. In the survregbayes function in the R package spBayesSurv version 1.1.4, the correlation function for two locations s_i and s_j is defined as $\rho(s_i, s_j) = \rho(s_i, s_j; \phi) = \exp\{-(\phi \parallel s_i - s_j \parallel)^v\}$, where $\parallel s_i - s_j \parallel$ represents the distance between s_i and s_j; parameter ϕ controls the spatial decay over distance; and the shape parameter $v \in (0, 2]$ is prespecified. Therefore, $(v_1, \ldots, v_m)^T | \tau, \phi \sim GRF(\tau^2, \phi)$ is defined as $v_i | \{v_j\}_{j \neq i} \sim N\left(-\sum_{\{j: j \neq i\}} \frac{p_{ij} v_j}{p_{ii}}, \frac{\tau^2}{p_{ii}}\right), i = 1, \ldots, m$ distinct spatial locations, and p_{ij} is the (i, j) element of R^{-1}. For the priors, the package well-tested default priors are used throughout. More details can be found in Zhou et al (2018, 2020). A burn-in period of 2,000 iterates was considered and the Markov chain was subsampled every 5 iterates to get a final Monte Carlo sample size of 2,000.

Zhou, H., Hanson, T. (2018) A Unified Framework for Fitting Bayesian Semiparametric Models to Arbitrarily Censored Survival Data, Including Spatially Referenced Data. *Journal of the American Statistical Association*, 113:522, 571-581. doi:10.1080/01621459.2017.1356316

Zhou, H., Hanson, T., & Zhang, J. (2020). spBayesSurv: Fitting Bayesian spatial survival models using R. *Journal of Statistical Software*, 92(9):1–33. doi:http://dx.doi.org/10.18637/jss.v092.i09 .