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Inferring the 1985-2014 impact of mobile phones use on selected brain cancer subtypes using Bayesian structural time series and synthetic controls.

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Online Supplementary Materials

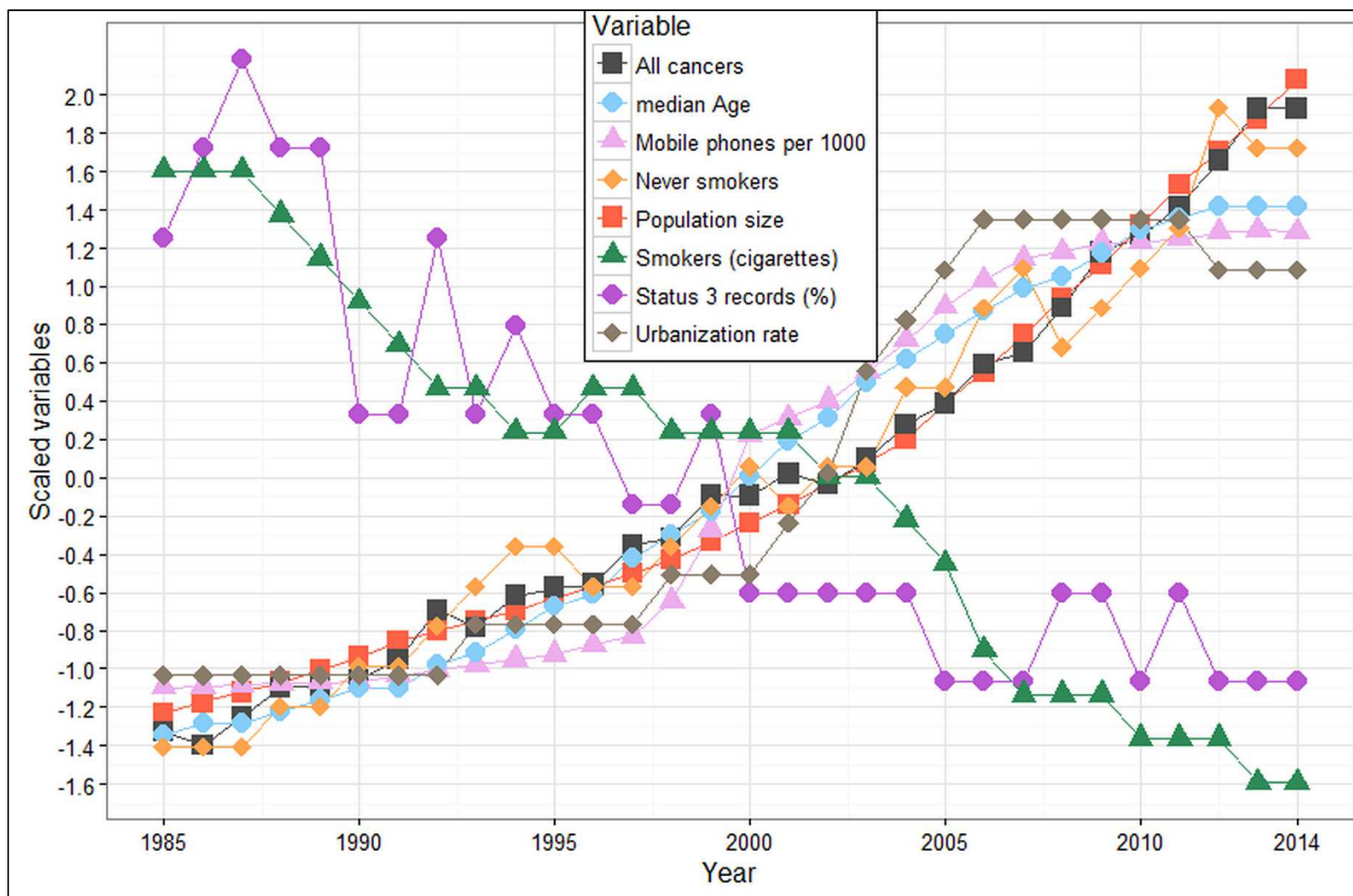


Figure S1. Standardized time series of covariates (note that the number of mobile phones per 1,000 people is not included any models, other than those in Table 2).

Table S1. Inclusion probabilities of covariates (10-year latency model only).

Covariate	Glioma	Glioblastoma multiforme	Temporal lobe	Parietal lobe
New registered cancer cases (all)	62.5%	71.0%	62.0%	65.0%
Population size	63.8%	65.5%	64.6%	65.8%
Median population age	64.0%	65.4%	65.7%	65.5%
Percentage of never smokers	61.7%	63.2%	62.5%	65.0%
Percentage of smokers (cigarettes)	49.2%	57.4%	58.3%	68.3%
Urbanization rate	32.1%	33.9%	44.9%	42.6%
Percentage of status 3 records	13.6%	16.8%	14.4%	23.1%
ICD9/10 transfer variable	99.8%	9.2%	6.4%	8.1%

Table S2. MCMC Convergence diagnostics

	Heidelberg stationary test (P value)	Heidelberg halfwidth test (halfwidth/mean)	Mean absolute 1-step error	Durbin-Watson test (P value)	Raftery diagnostic Dependence factor (I)	Geweke diagnostic
0 years						
GBM	0.12	0.05	3%	0.11	0.99	1.00
Glioma	0.12	0.01	3%	0.10	0.98	-0.21
Temporal lobe	0.90	0.01	2%	0.14	0.98	0.62
Parietal lobe	0.14	0.01	2%	0.09	0.98	-0.16
5 years						
GBM*	0.42	0.10	7%	0.09	2.11	-0.95
Glioma	0.82	0.02	5%	0.08	2.91	-0.71
Temporal lobe	0.65	0.01	3%	0.09	1.00	1.41
Parietal lobe	0.07	0.01	3%	0.08	1.01	1.14
10 years						
GBM*	0.21	0.30	9%	0.08	4.28	-1.42
Glioma	0.10	0.02	6%	0.07	3.20	-1.26
Temporal lobe*	0.57	0.02	3%	0.08	2.06	1.16
Parietal lobe	0.14	0.01	4%	0.08	2.06	-1.62
15 years						
GBM	0.37	0.14	13%	0.06	2.26	1.50
Glioma	0.50	0.03	7%	0.05	4.21	0.44
Temporal lobe**	0.30	0.04	7%	0.06	3.06	1.83
Parietal lobe	0.94	0.02	6%	0.07	2.10	0.43

*: 200,000 MCMC samples; **: 250,000 MCMC samples

Table S3. Alternative, stricter priors (10% of sd)

	Implied lag (from 1995)	Absolute average effect (95%CI)	Absolute cumulative effect (95%CI)	Relative effect (95%CI)	Posterior probability of effect
Malignant glioma ¹	0 years	-459 (-1129, 369)	-8718 (-21454, 7018)	-59% (-145%, 47%)	0.11
	5 years	34 (-204, 354)	471 (-2853, 4956)	14% (-83%, 145%)	0.48
	10 years	-48 (-164, 70)	-432 (-1479, 634)	-16% (-55%, 24%)	0.21
	15 years	-13 (-120, 93)	-54 (-478, 371)	-5.7% (-51%, 39%)	0.40
Malignant neoplasms of the temporal lobe ²	0 years	166 (-49, 464)	3153 (-936, 8810)	40% (-12%, 111%)	0.08
	5 years	-30 (-196, 161)	-415 (-2747, 2247)	-4.4% (-29%, 24%)	0.35
	10 years	164 (62, 265)	1479 (559, 2385)	29% (11%, 47%)	0.00
	15 years	48 (-87, 187)	192 (-349, 749)	6.3% (-11%, 25%)	0.25
Malignant neoplasms of the parietal lobe ³	0 years	-77 (-326, 259)	-1469 (-6195, 4916)	-13% (-55%, 43%)	0.26
	5 years	-354 (-564, -113)	-4960 (-7901, -1575)	-41% (-65%, -13%)	0.00
	10 years	-60 (-146, 26)	-541 (-1310, 235)	-10% (-25%, 4.5%)	0.09
	15 years	-71 (-149, 6.9)	-285 (-597, 27.4)	-12% (-26%, 1.2%)	0.04
Glioblastoma (multiforme) ⁴	0 years	12 (-400, 595)	231 (-7607, 11300)	3.0% (-99%, 148%)	0.49
	5 years	-214 (-655, 112)	-2997 (-9167, 1568)	-33% (-100%, 17%)	0.13
	10 years	-173 (-352, 8.50)	-1558 (-3166, 76.4)	-28% (-57%, 1.4%)	0.03
	15 years	-40 (-191, 112)	-161 (-762, 446)	-8.5% (-40%, 24%)	0.30

¹: ICD-9 191.9 (morphology codes M9380/3, M9400/3, M9382/3), ICD-10 C71.9 (morphology codes M9380/3, M9400/3, M9382/3)

²: ICD-9 191.2, ICD-10 C71.2

³: ICD-9 191.3, ICD-10 C71.3.

⁴: ICD-9 191.9 (morphology codes M9440/3, M9442/3, M9441/3), ICD-10 C71.9 (morphology codes M8440/3, M9442/3, M9441/3).

Table S4. Alternative, less informative priors (50% of sd)

	Implied lag (from 1995)	Absolute average effect (95%CI)	Absolute cumulative effect (95%CI)	Relative effect (95%CI)	Posterior probability of effect
Malignant glioma ¹	0 years	-394 (-1100,361)	-7492 (-20898, 6854)	-55% (-154%, 50%)	0.12
	5 years	-62 (-520, 421)	-867 (-7273, 5895)	-18% (-153%, 124%)	0.37
	10 years	-68 (-352, 219)	-612 (-3172, 1968)	-21% (-111%, 69%)	0.32
	15 years	-11 (-238, 217)	-44 (-953, 866)	-4.7% (-102%, 93%)	0.46
Malignant neoplasms of the temporal lobe ²	0 years	212 (-13, 439)	4020 (-252, 8341)	57% (-3.6%, 118%)	0.03
	5 years	124 (-192, 389)	1738 (-2687, 5445)	24% (-37%, 74%)	0.20
	10 years	208 (-29, 441)	1874 (-262, 3968)	40% (-5.5%, 84%)	0.04
	15 years	40 (-242, 319)	158 (-968, 1277)	5.1% (-31%, 41%)	0.39
Malignant neoplasms of the parietal lobe ³	0 years	-22 (-307, 257)	-409 (-5825, 4892)	-4% (-57%, 47%)	0.44
	5 years	-191 (-573, 127)	-2675 (-8021, 1780)	-27% (-81%, 18%)	0.13
	10 years	-23 (-200, 151)	-204 (-1797, 1356)	-4.2% (-37%, 28%)	0.40
	15 years	-21 (-150, 107)	-84 (-599, 429)	-3.9% (-28%, 20%)	0.37
Glioblastoma (multiforme) ⁴	0 years	90 (-380, 557)	1707 (-7214, 10588)	28% (-117%, 172%)	0.32
	5 years	41 (-579, 654)	569 (-8108,9152)	10% (-146%, 165%)	0.44
	10 years	-75 (-480, 326)	-677 (-4318, 2938)	-14% (-92%, 63%)	0.35
	15 years	37 (-273, 346)	146 (-1092, 1384)	9.3 (-69%, 88%)	0.41

¹: ICD-9 191.9 (morphology codes M9380/3, M9400/3, M9382/3), ICD-10 C71.9 (morphology codes M9380/3, M9400/3, M9382/3)

²: ICD-9 191.2, ICD-10 C71.2

³: ICD-9 191.3, ICD-10 C71.3.

⁴: ICD-9 191.9 (morphology codes M9440/3, M9442/3, M9441/3), ICD-10 C71.9 (morphology codes M8440/3, M9442/3, M9441/3).

Table S5. 5-year ‘nowcasting’ results

	Implied lag (from 1995)	Absolute average effect (95%CI)	Absolute 5-yr cumulative effect (95%CI)	Relative effect (95%CI)	Posterior probability of effect
Malignant glioma ¹	0 years	-178 (-415:199)	-890 (-2074:993)	-29% (-67%:32%)	0.107
	5 years	4.6 (-177:271)	23.2 (-887:1356)	1.4% (-55%:84%)	0.437
	10 years	-44 (-176:88)	-218 (-880:440)	-14% (-56%:28%)	0.255
	15 years	-15 (-147:117)	-59 (-588:468)	-6.2% (-62%:49%)	0.414
Glioblastoma (multiforme) ²	0 years	108 (-64:374)	538 (-318:1868)	44% (-26%: 154%)	0.083
	5 years	-8.8 (-360:240)	-44.2 (-1802:1199)	-2% (-83%:55%)	0.456
	10 years	-84 (-284:110)	-421 (-1420:550)	-16% (-53%:20%)	0.200
	15 years	4.3 (-181:191)	17.4 (-723:765)	1% (-42%:45%)	0.842
Malignant neoplasms of the temporal lobe ³	0 years	54 (-30:181)	270 (-151:906)	16% (-8.9%:53%)	0.083
	5 years	-66 (-230:107)	-330 (-1149:534)	-12% (-41%:19%)	0.233
	10 years	132 (17:245)	662 (83:1224)	25% (3.1%:45%)	0.013
	15 years	43 (-128:212)	172 (-513: 847)	5.6% (-17%:28%)	0.307
Malignant neoplasms of the parietal lobe ⁴	0 years	38 (-68:190)	189 (-340:952)	7.6% (-14%:38%)	0.204
	5 years	-214 (-420:-20)	-1072 (-2101:-98)	-29% (-57%:-2.7%)	0.012
	10 years	-22 (-113: 66)	-111 (-567:331)	-4.1% (-21%:12%)	0.314
	15 years	-44 (-132:39)	-175 (-526:158)	-7.9% (-24%:7.1%)	0.155

¹: ICD-9 191.9 (morphology codes M9380/3, M9400/3, M9382/3), ICD-10 C71.9 (morphology codes M9380/3, M9400/3, M9382/3)

²: ICD-9 191.9 (morphology codes M9440/3, M9442/3, M9441/3), ICD-10 C71.9 (morphology codes M8440/3, M9442/3, M9441/3).

³: ICD-9 191.2, ICD-10 C71.2

⁴: ICD-9 191.3, ICD-10 C71.3.