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Supplemental Material

Examining the Shape of the Association between Low Levels of Fine Particulate Matter and Mortality across Three Cycles of the Canadian Census Health and Environment Cohort

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Figure S1. Flow chart of subject exclusion criteria for all person-years of follow up in the 1991, 1996, and 2001 CanCHEC cohorts combined. numbers rounded to the nearest 100 for confidentiality. see methods for list of exclusion criteria, totals will exceed number of deleted person-years given that more than one exclusion criteria may apply to a single person-year; immigrated to Canada less than 10 years before survey date n = 9,364,400, age during follow-up period exceeds 89 years n = 7,357,200, no postal code n = 25,425,400, could not be linked to air pollution values n = 17,814,400 , could not be linked to Can-MARG values n = 25,973,900, could not be linked to Census Metropolitan Area/Census Agglomeration size n = 25,613,100, could not be linked to airshed n = 25,545,500, 3-year moving average being informed by only one year of exposure n = 20,056,400, year after subject death n = 17,936,100.

Figure S2. Directed acyclical graphs (DAGs) for the CanCHEC (A) and CCHS cohorts (B). Unmeasured parameters are shown in grey. The following covariates were included in the DAG-based model for both CanCHEC and CCHS: airshed, community size, neighbourhood dependence, neighbourhood deprivation, ethnic concentration, neighbourhood instability, and urban form. A second model was also examined adding all subject -level covariates available in each cohort. Figure prepared with DAGitty (Textor et al. DAGitty: A Graphical Tool for Analyzing Causal Diagrams. Epidemiology, 5(22):745, 2011).

Table S1. AIC/SBC values with covariates

Subject Characteristic		Model Form	1991 Cohort		1996 Cohort		2001 Cohort	
All Subjects	**All Subjects**		AIC	SBC	AIC	SBC	AIC	SBC
All respondents		**DAG** [a]	4607944	4608266	11594177	11594525	8585618	8585956
		Full [b]	4589687	4590227	11542271	11542854	8544931	8545498
Immigrant Status [c]	**No**	**DAG** [a]	4176837	4177155	9618970	9619311	7037006	7037337
		Full [b]	4159461	4159994	9571618	9572190	7000482	7001037
	Yes	**DAG** [a]	430941.7	431196	1974414	1974710	1548046	1548334
		Full [b]	429796.7	430223.2	1969037	1969533	1543415	1543899
Sex [c]	**Females**	DAG [a]	1928558	1928853	5261734	5262057	3840820	3841133
		Full [b]	1921461	1921955	5241019	5241561	3824369	3824895
	Males	**DAG** [a]	2678893	2679198	6330959	6331288	4743882	4744202
		Full [b]	2667590	2668102	6299445	6299996	4719449	4719986
Age During Follow up [c]	**<65 Years**	**DAG** [a]	1055226	1055499	2494220	2494518	1857729	1858018
		Full [b]	1046185	1046644	2467224	2467724	1834585	1835069
	65-74 Years	**DAG** [a]	1157518	1157797	2790514	2790817	1974175	1974467
		Full [b]	1151192	1151660	2773119	2773627	1961714	1962204
	>75 Years	**DAG** [a]	2338415	2338718	6184696	6185026	4664254	4664575
		Full [b]	2334431	2334939	6174201	6174754	4656525	4657064
Single pollutant								
	NO$_2$	**DAG** [a]	4607933	4608266	11594177	11594536	8585618	8585968
	NO$_2$	**Full** [b]	4589659	4590209	11542272	11542866	8544931	8545509
	O$_3$	**DAG** [a]	4607936	4608268	11594051	11594410	8585488	8585837
	O$_3$	**Full** [b]	4589621	4590171	11541701	11542295	8544452	8545030
	O$_x$	**DAG** [a]	4607922	4608254	11594080	11594439	8585493	8585843
	O$_x$	**Full** [b]	4589573	4590124	11541762	11542357	8544487	8545066
Two-pollutant								
NO$_2$ Adjustment [d]		**DAG** [a]	4607933	4608266	11594177	11594536	8585618	8585968
		Full [b]	4589659	4590209	11542272	11542866	8544931	8545509

O$_3$ Adjustment[d]		**DAG** [a]	4607936	4608268	11594051	11594410	8585488	8585837
		Full [b]	4589621	4590171	11541701	11542295	8544452	8545030
Ox Adjustment[d]		**DAG** [a]	4607922	4608254	11594080	11594439	8585493	8585843
		Full [b]	4589573	4590124	11541762	11542357	8544487	8545066

A Directed Acyclic Graph (DAG) model is stratified by 5-year age groups by age at baseline, sex, and immigrant status and included the geographic based covariates: four Canadian Marginalization Index Dimensions, Urban Form, Community Size, and Airshed.

B Full model is stratified by 5 year age groups by age at baseline, sex, and immigrant status and included the geographic based covariates: four Canadian Marginalization Index Dimensions, Urban Form, Community Size, and Airshed, and the subject based covariates: marital status, education, income quintile, aboriginal status, visible minority status, employment status, and occupational class.

C Note that the models by Immigrant Status are not stratified by Immigrant Status. The models by Sex are not stratified by Sex.

D PM$_{2.5}$ always uses 10 units, co-pollutants use: O$_3$ 10.20 ppb, NO$_2$ 6.63 ppb, O$_X$ 8.05 ppb

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┌─────────────────────────┐  ┌─────────────────────┐  ┌─────────────────────┐
│  Respondents to the     │  │  Mortality records  │  │  Mobility history   │
│  Canadian long-form     │  │  1,961,100 deaths   │  │  9,743,000          │
│  census in 1991, 1996,  │  │  linked             │  │  respondents with   │
│  and 2001               │  │                     │  │  postal code history│
└─────────────────────────┘  └─────────────────────┘  └─────────────────────┘
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Statistics Canada Social Data Linkage Environment Derived Record Depository

Exclude subjects (1) with reported deaths that occurred before date of survey administration, (2) those under 25 or over 89 years of age at date of survey administration

9,077,200 respondents in cohort

Multiply by all years of mobility history (n=36) and exclude person years before census date (n=139,021,400)

187,756,900 person-years

Exclusions by person-year [b]
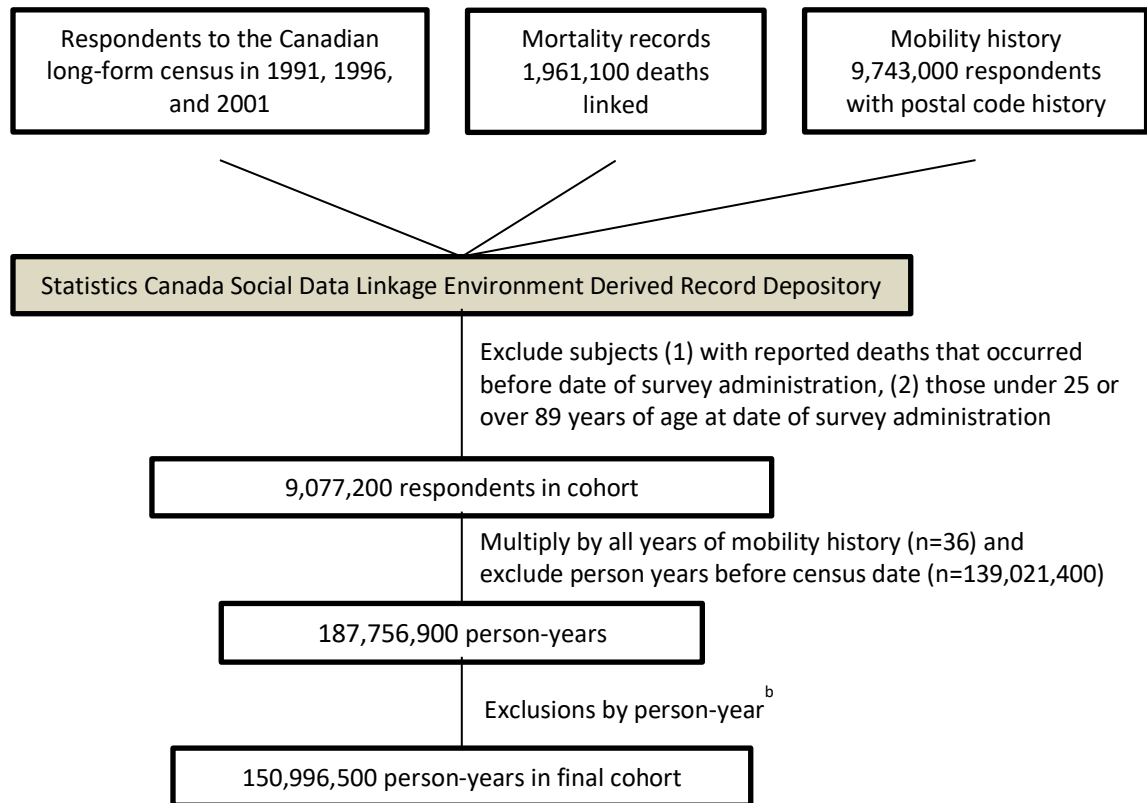
150,996,500 person-years in final cohort

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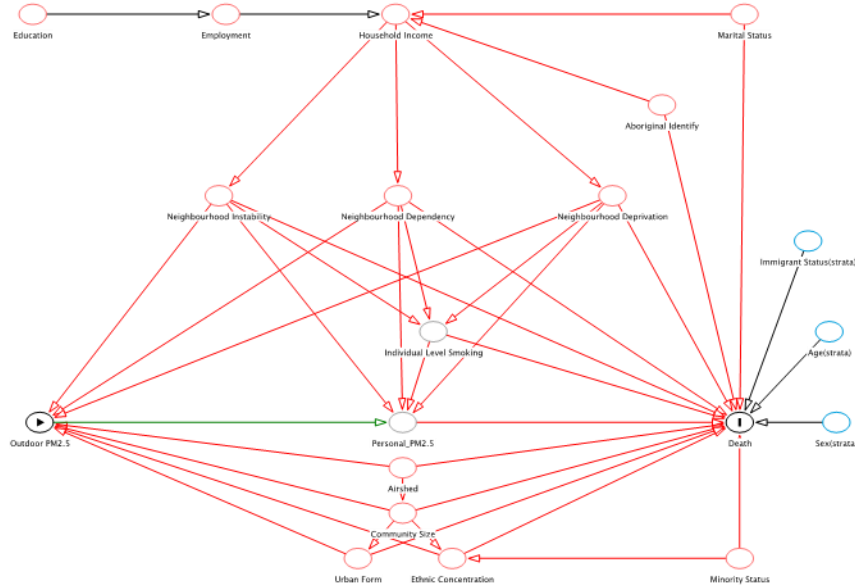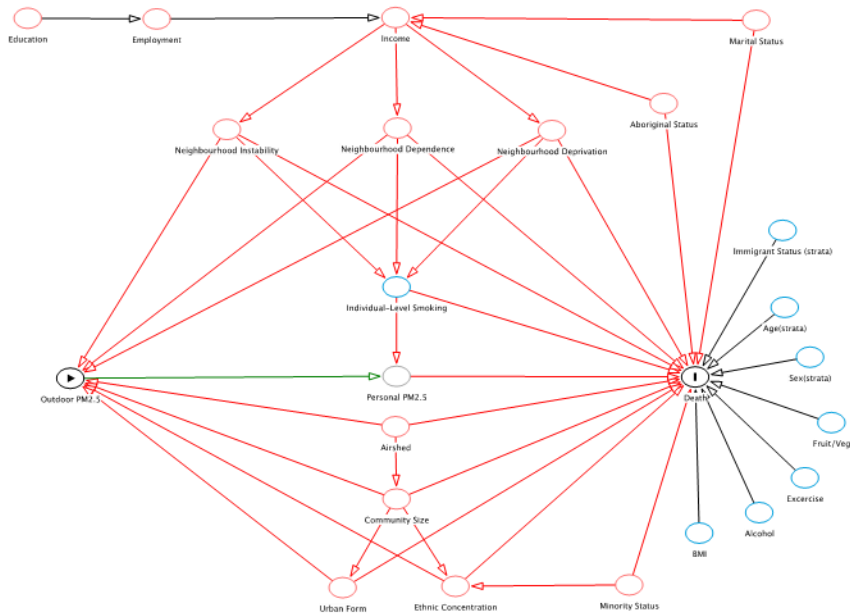
A

B

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