

CANCER AND THE HEALTHY IMMIGRANT EFFECT

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CAHSPR - May 11, 2016

The healthy immigrant effect

- The healthy immigrant effect: immigrants are in better health on arrival in a host country than otherwise comparable non-immigrants
- A consistent finding for Canada, the US, Australia and some European countries
- Multiple measures of health – self assessed health status, chronic conditions, health behaviors like smoking
- Self-reported measures because of a lack of data combining admin health and immigrant status

The 1991 Canadian Census Cohort

- Individuals aged 25+ who completed the 1991 Census long form, linked to:
 - Canadian Cancer registry (CCR) from 1984-2008
 - Canadian Mortality database (CMD) from 1991- 2008
 - Tax file data on location of residence and marital status 1986-2008
- Individual level data are linked using probabilistic linkage methods (Peters et.al, Int.J. Epid, 2013)
- 2.7 million individuals could be linked to at least one tax return, including ~500,000 immigrants. ~250,000 cases of cancer diagnosed in the 1991 cohort up to 2003.

Research Questions

- Is there evidence of a healthy immigrant effect for cancer? How does it vary by place of birth?
- Is such an advantage lost with time in Canada?
- Do differences in smoking account for much of the difference?

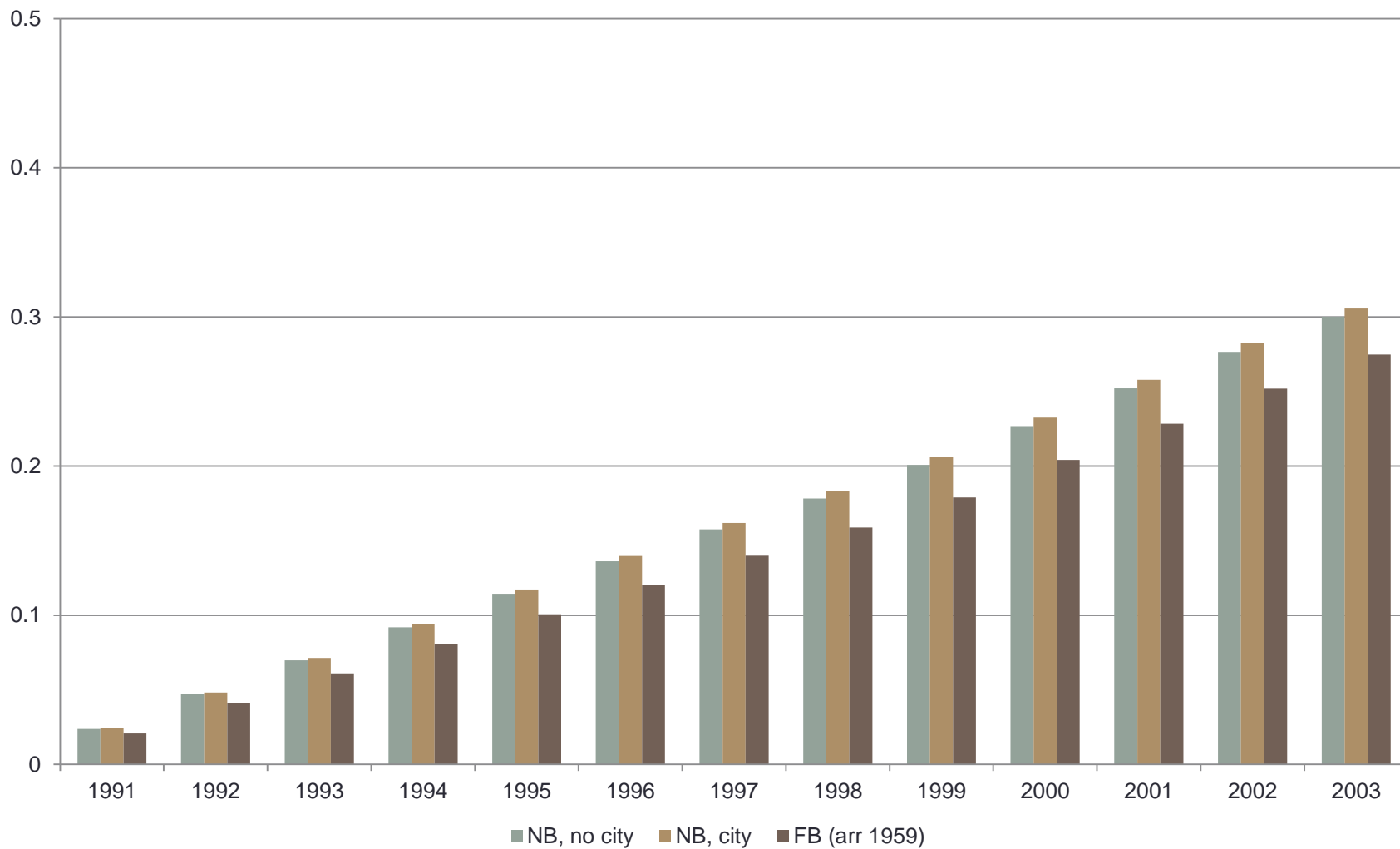
Methods

- Discrete time Logistic duration model
 - Time until diagnosis of cancer
 - Calendar years 1991-2003 as discrete intervals (so up to 13 person-years of observation per individual)
 - Dependent variable – (0/1) diagnosed with cancer in a given year, conditional on being in the sample during the year and not previously diagnosed with cancer
 - Censoring: death, no tax return filed, end of sample period

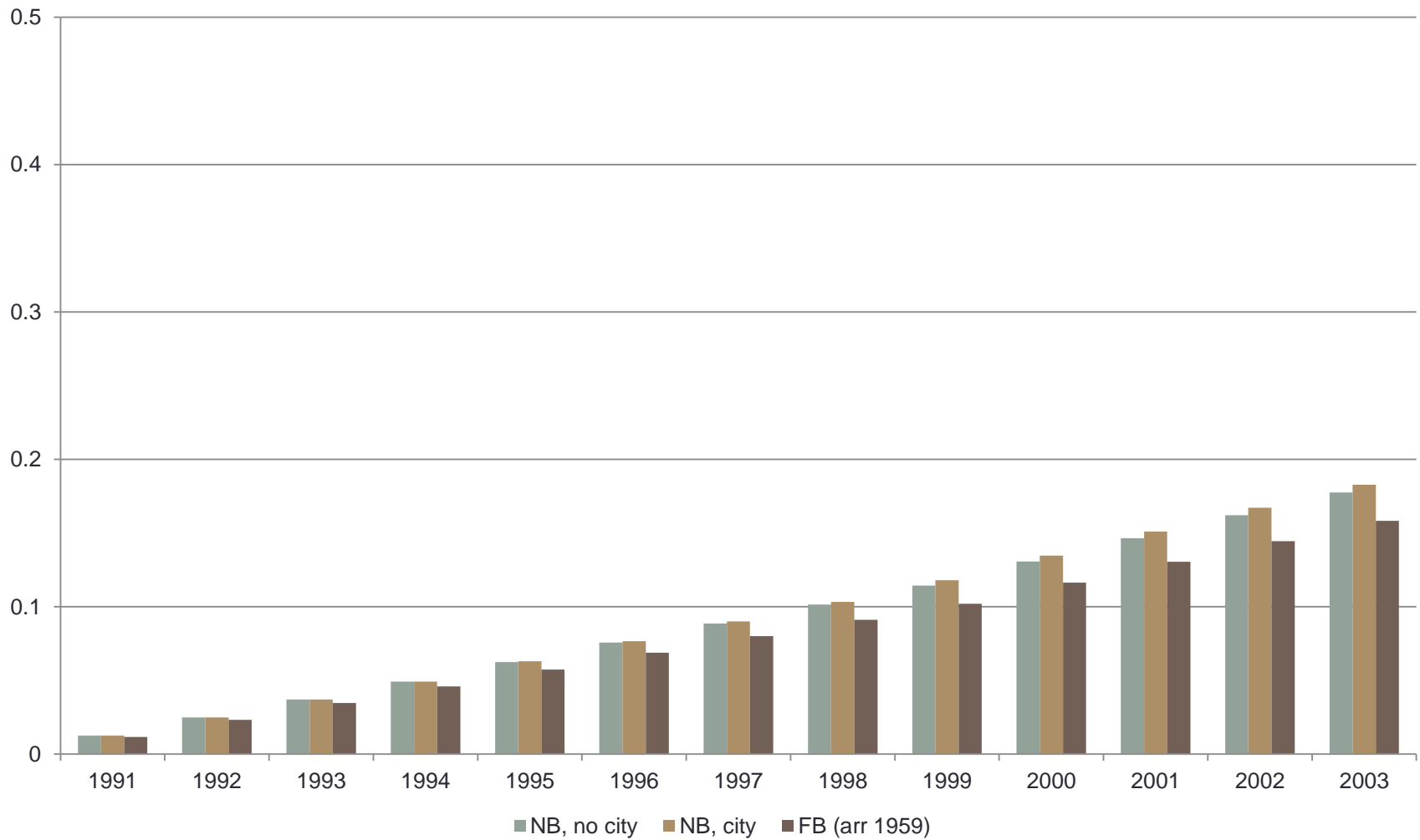
- Sample: aged 25-79 in 1991 in the Census cohort and not previously diagnosed with cancer
- Flexible specification of year/age/birth cohort effects
- Time invariant: education level, visible minority status, immigrant status; country of birth, period of arrival in Canada for immigrants
- Other time-varying covariates: resides in a large city, years in Canada if an immigrant

Age/time paths by birth cohort

1a: Men Born in 1925 – failure rate



1b: Women Born in 1925 - failure rate



Any cancer - selected odds ratios

	MEN		WOMEN	
	OR	p-val	OR	p-val
Secondary school	0.950	0.000	0.961	0.000
Trades certificate or diploma	0.937	0.000	0.968	0.000
Bachelor's degree	0.859	0.000	0.929	0.000
Higher degree	0.817	0.000	0.962	0.000
Born in Canada, white	1.000		1.000	
Born in Canada, other race	0.870	0.000	0.910	0.053
Immigrant (UK base)	0.723	0.006	1.174	0.231
Years in Canada (YSM)	1.015	0.000	1.006	0.152
YSM ²	1.000	0.006	1.000	0.101
# individuals	1.23m		1.23m	
# observations	14.3m		14.5m	
Pseudo-Rsq	0.117		0.047	

Region of birth

	MEN		WOMEN	
	OR	p-val	OR	p-val
UK/Ireland/Aus/NZ	1		1	
US	0.961	0.473	1.056	0.662
Europe	0.905	0.052	0.849	0.002
Western Asia/Mideast	0.693	0.000	0.783	0.004
Other Asian countries	0.628	0.000	0.709	0.000
Born elsewhere	0.839	0.001	0.771	0.000

Specific cancer sites - adult men

	Prostate		Colorectal		Lung	
	OR	p-val	OR	p-val	OR	p-val
Education						
No secondary school	1	--	1	--	1	--
Secondary school	1.074	0.000	1.004	0.867	0.734	0.000
Trade certificate	1.138	0.000	0.946	0.007	0.698	0.000
Bachelor's degree	1.231	0.000	0.801	0.000	0.412	0.000
Higher degree	1.247	0.000	0.793	0.000	0.291	0.000

	Prostate		Colorectal		Lung	
	OR	p-val	OR	p-val	OR	p-val
Immigrant	0.397	0.000	1.205	0.555	0.945	0.851
Years in Canada (YSM)	1.044	0.000	1.010	0.385	0.985	0.126
YSM²	1.000	0.000	1.000	0.160	1.000	0.067
Region of Birth						
US	1	--	1	--	1	--
UK/Ireland*	1.059	0.324	1.275	0.010	1.008	0.923
Other Europe	0.860	0.008	1.190	0.058	0.842	0.041
Western Asia/Mideast	0.851	0.206	0.922	0.669	0.576	0.005
South Asia	0.670	0.000	0.462	0.000	0.273	0.000
other Asia	0.506	0.000	1.064	0.571	0.696	0.001
Africa	0.908	0.354	0.655	0.021	0.532	0.000
Americas	1.588	0.000	0.814	0.110	0.419	0.000

Specific cancer sites – adult women

	Breast		Colorectal		Lung	
	OR	p-val	OR	p-val	OR	p-val
Education						
No secondary school	1	--	1	--	1	--
Secondary school	1.127	0.000	0.965	0.184	0.737	0.000
Trade certificate	1.174	0.000	0.924	0.003	0.658	0.000
Bachelor's degree	1.314	0.000	0.820	0.000	0.371	0.000
Higher degree	1.331	0.000	0.812	0.002	0.308	0.000

	Breast		Colorectal		Lung	
	OR	p-val	OR	p-val	OR	p-val
Immigrant	1.186	0.474	0.687	0.346	2.118	0.113
Years in Canada (YSM)	1.013	0.062	1.012	0.349	0.984	0.286
YSM²	1.000	0.040	1.000	0.582	1.000	0.392
Region of Birth						
US	1	--	1	--	1	--
UK/Ireland*	0.984	0.768	1.008	0.937	1.063	0.550
Other Europe	0.824	0.000	0.928	0.427	0.450	0.000
Western Asia/Mideast	1.059	0.614	0.544	0.033	0.295	0.002
South Asia	0.658	0.000	0.424	0.000	0.180	0.000
other Asian nations	0.737	0.000	0.765	0.026	0.590	0.000
Africa	0.986	0.879	0.481	0.003	0.390	0.001
Americas	0.716	0.000	0.671	0.003	0.266	0.000

Accounting for smoking

- Discrete time hazard models for the duration to starting smoking daily using retrospective information on smoking initiation from successive waves of the CCHS
- 200+ separate regressions for age/sex/cohort/region of birth subgroups, and include controls for education, language, specific country of birth, and tobacco price
- Estimates are used to predict #/1000 people of each particular set of characteristics who have never started to smoke daily
- Predictions are merged with the cancer data for people with the same set of characteristics and included as a covariate.

Impact?

- The predicted smoking measure is strongly significant for cancer overall and for most specific cancers by site
- Controlling for smoking does not have a large quantitative effect on the estimates of education and the immigrant controls.
 - Odds ratios with smoking controls marginally closer to 1 but significant
 - Exception - female immigrants from Africa and Western Asia for any cancer and for lung cancer.

Conclusions

- Evidence of a HIE is found for cancer incidence
 - The gap is widest for immigrants from East and South Asia;
 - For some cancers, the gap is wider for more recent arrivals and the gap narrows with additional years in Canada
 - Differences in SES, region of residence, demographic factors do not explain the immigrant cancer gap
- Canadian born visible minorities also have significantly lower cancer incidence
- Overall, HIE effects are not due to group-level differences in smoking behavior