

# Modelling the retirement timing of Canadian nurses using a panel survey

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## Background

- 40% nurses is expected to retire in the next 15 years<sup>1</sup>
- Nurses withdraw from the labour force early<sup>2</sup>
  - Generous retirement packages
  - Wage profile is flat
- Anticipated increase in the demand for nurses
- A shortage of nurses impacts the quality of care that patients receive<sup>3-5</sup>

## Gaps in the literature

- A theoretical framework
- Intent vs actual retirement
- Causal studies
- Effect of health status on nurses' retirement timing
  - Issues: endogeneity and justification bias
  - Poor health, health limitations and health shocks increases the probability of (early) retirement<sup>6-8</sup>
  - Having poor health may be the principal cause of retirement<sup>9-10</sup>

## Research objectives

- To determine the impact of health on nurses' retirement timing.
  
- To ascertain the impact of job characteristics on retirement timing.
  - Working in the hospital sector
  - Shift type: regular days/nights or irregular shifts
  - Public employment
  - Unionization
  - Having employer-based pension

## Rationale

- A shortage of nurses impacts the quality of care that patients receive<sup>3-5</sup>
- Understaffing causes job burnout and dissatisfaction amongst nurses
- Findings can be used to inform:
  - Programs and policies aimed at retaining late career nurses in the labour force
  - Nursing forecasting models

## Theoretical framework

Galama and colleagues (2013)

$$\int_0^R U_w[C(t), H(t)]e^{-\beta t}dt + \int_R^T U_R[C(t), H(t)] e^{-\beta t}dt^{13}$$

- $U_w$  = Utility derived while working
- $U_R$  = Utility derived while retired
- 0 = Age nurse starts working
- R = Retirement age
- T = Age at death
- C = Consumption
- H = Health
- B = Discount factor

## Theoretical framework

□ Time derivatives of constraints:

- $H(t) = \mu(t)m(t) - d(t)H(t)$  if  $0 \leq t \leq T$
- $A(t) = \delta A(t) + Y[H(t)] - C(t) - p(t)m(t)$  if  $0 \leq t \leq T$
- $Y[H(t)] = \begin{cases} w_0(t) + \varphi(t)H(t) & \text{if } 0 \leq t \leq R \\ b & \text{if } R \leq t \leq T \end{cases}$

H = health ;  $\mu$  = efficiency of m ; m = health investments ; d = natural deterioration of health  
 A = assets ;  $\delta$  = interest rate ;  $Y[H(t)]$  = earnings ; C = consumption ; p = price of m  
 $w_0$  = base wage ;  $\varphi$  = marginal production of health ; b = pension benefits<sup>13</sup>

## Methodology: Covariates

	<b>Labour force participation model</b>
<b>Individual characteristics</b>	age, married, sah_poor, sah_fair, sah_good, sah_vgood, disability
<b>Human capital variables</b>	lpn, diploma, uni, exp, exp2
<b>Household and financial variables</b>	prtnr_unemp, hhsiz, n_schoolage, earners Earnings_hat, hhincome, CPP, OASGI, PRIVPEN, wRRSP
<b>Job characteristics</b>	hospital, days, evenings, public, union, pplan
<b>Control variables</b>	a55, 160, a65, MR_lifted east, west, year groups



## Data source & Data prep

### Survey of Labour, Income & Dynamics (SLID)

- Nationally representative<sup>14</sup>
- Panel data
- Follows respondents for 6 years

### Inclusion & exclusion criteria

- RNs & LPNs
- At least 50 years of age
- Health status and two years lagged health status are not missing (1996 – 2010)
- Exclude: did not participate in the labour force while surveyed

## Methodology: Pooled 2 Stage Residual Inclusion (2SRI)<sup>16</sup> + FE

### First stage: **Ordered probit regression**

- Dependent variable: **Self assessed health** (poor, fair, good, very good, excellent)
- Instrument: **Lagged (2 years) self-assessed health**<sup>17</sup>
- N=1,520 nurses

### Second stage: **Multinomial logit regression**

- Dependent variable: **Labour force activity** (working fulltime, part-time, retired)
- Residuals from the first stage as an added explanatory variable
- N=1,520 nurses

## Results: RETIREMENT – Part-time vs Full-time

Variable	2SRI + FE Coefficients		2SRI + FE dy/dx	Variable	2SRI + FE Coefficients		2SRI + FE dy/dx
sah_poor	-0.87	(1.2711)	-0.16	earnings_hat (10k)	0.025	(0.4270)	0.058
sah_fair	-0.56	(0.7202)	-0.09	hhincome (10k)	-0.041	(0.0377)	-0.0091
sah_good	-0.43	(0.4493)	-0.06	CPP (10k)	0.17	(0.1196)	0
sah_vgood	-0.10	(0.3011)	-0.01	OASGI (1k)	-1.52**	(0.3466)	-0.2***
disability	0.44*	(0.2241)	0.06	PRIVPEN (1k)	0.069*	(0.0366)	0.0086*
hospital	0.68	(0.8779)	0.04	wRRSP (1k)	-0.019	(0.0119)	0
days	-0.74***	(0.2306)	-0.11***				
evenings	-0.14	(0.4159)	-0.03				
public	0.26	(0.9191)	0.12				
union	0.31	(0.3607)	0.05				
pplan	-1.43***	(0.2919)	-0.22***				

\*(p<0.10) \*\* (p<0.05) \*\*\* (p<0.01)  
 Base case: A registered nurse with excellent health, who works irregular shifts in central Canada

## Results: RETIREMENT – Retired vs Full-time

Variable	2SRI + FE Coefficients	2SRI + FE dy/dx	Variable	2SRI + FE Coefficients	2SRI + FE dy/dx
sah_poor	1.88 (2.3651)	0.06	earnings_hat (10k)	-1.22** (0.6087)	-0.0033**
sah_fair	0.41 (0.1.7492)	0.02	hhincome (10k)	0.18*** (0.0607)	0.0048***
sah_good	-0.65 (1.1842)	-0.01	CPP (1k)	0.45***(0.0142)	0.0077***
sah_vgood	-0.09 (0.8848)	-0.0005	OASGI (1k)	-0.64 (0.3960)	0.0094
disability	0.71 (0.5225)	0.01	PRIVPEN (1k)	0.13*** (0.0442)	0.0019**
hospital	3.87*** (1.2524)	0.09***	wRRSP (1k)	-0.053 (0.0628)	-0.00092
days	-0.40 (0.3737)	0.003			
evenings	0.37 (0.6288)	0.01			
public	-4.80*** (1.6966)	-0.12***			
union	0.008 (1.0731)	-0.005			
pplan	0.09 (0.5790)	0.02**			

\*(p<0.10) \*\* (p<0.05) \*\*\* (p<0.01)  
 Base case: A registered nurse with excellent health, who works  
 irregular shifts in central Canada

## Limitations & Next steps

### ☐ Limitations of the study:

- Issues related to using lagged variable as an instrument<sup>14-15</sup>
- Labour force status of nurse's partner is taken as exogenous
- Standard errors in the retirement model have not been adjusted

### ☐ Next steps:

- Bootstrap standard errors<sup>13</sup>
- Different specifications of “retired” and fulltime worker
- Calculating accumulated pension benefits and yearly accrued benefit
- Raw vs. standardized residuals

## Conclusion

- Importance in accounting for unobserved heterogeneity
- Health does not appear to be significant in retirement timing
  - Statistically significant in the earning's selection model
- Financial resources appear to matter more in nurses' decision to retire

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# Thank you!

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## Institutional features: Nursing in Canada

- Regulated nurses
  - Registered Nurses (including Nurse Practitioners)
  - Registered Psychiatric Nurses
  - Licensed Practical Nurses
- Requirements to practice
  - Fulfill educational requirements
  - Pass the entry-level exam
  - Registered with a provincial/territorial nursing regulatory body<sup>9</sup>
    - Ongoing registration: Practicing at least 1,125 hours in the last 3-5 years
    - Non-working & retired class

## Institutional features: Mandatory retirement in Canada

### Year MR was lifted:

- 1983: Manitoba & Quebec
- 2006: Ontario
- 2007: Newfoundland & Labrador, Saskatchewan
- 2008: British Columbia
- 2009: Nova Scotia

### Never implemented MR:

- Alberta, Northwestern Territories, Nunavut, Prince Edward Island & Yukon

### New Brunswick: companies are allowed to enforce MR if employers offer a retirement or pension plan<sup>10</sup>

## Institutional features: Retirement finances

- Canadian/Quebec Pension Plan (C/QPP)
- Old Age Security (OAS)<sup>11</sup>

## Institutional features: Retirement funds

	<b>Eligibility</b>	<b>Age &amp; Collection</b>	<b>Amount</b>	<b>Additional benefits</b>
<b>C/QPP</b>	<ul style="list-style-type: none"> <li>Contributed at least once</li> <li>Residential req.</li> </ul>	<ul style="list-style-type: none"> <li>60-64.92: Reduced rate</li> <li>65.08-70: Premium</li> </ul>	<ul style="list-style-type: none"> <li>Dependent on contributions made</li> </ul>	<ul style="list-style-type: none"> <li>Long term disability benefit</li> </ul>
<b>OAS</b>	<ul style="list-style-type: none"> <li>Canadian citizen or legal resident</li> <li>Residential req.</li> </ul>	<ul style="list-style-type: none"> <li>At least 65</li> <li>Shifting to 67</li> </ul>	<ul style="list-style-type: none"> <li>Proportional to years of Canadian residence and annual income</li> </ul>	<ul style="list-style-type: none"> <li>Guaranteed Income Supplement</li> <li>Allowance</li> <li>Allowance for Survivor<sup>11</sup></li> </ul>

## Hypotheses

### Hastens retirement:

#### Increase in:

- Initial assets
- Pension benefits
- Portion of wages saved towards retirement
- Initial health
- Efficiency of health investments

### Delays retirement:

#### Increase in:

- Earnings
- Health deterioration
- Price of health investments<sup>13</sup>

## Institutional features: Retirement finances

- Canadian/Quebec Pension Plan (C/QPP)
- Old Age Security (OAS)<sup>11</sup>
- Private pension
  - Personal savings
    - Non-registered (e.g. chequing & savings accounts, mutual bonds, stocks & bonds)
    - Registered savings plans (RRSPs & TFSAs)
  - Employer-Based Pension (EBP) plans
    - Defined contribution
    - Defined benefit<sup>12</sup>

## Data Source: Survey of Labour, Income & Dynamics (SLID)

- Panel data collected by Statistics Canada (1993 - present )
- Nationally representative, excluding 3% of the Canadian population
- Stratified multi-stage design using probability sampling
- A panel consists of ~17,000 households; followed for 6 years
- Has variables related to individual's socio-demographic characteristics, family structure, labour force activity and financial status over time<sup>14</sup>

## Data source

### Inclusion criteria

- RN & LPN
- At least 50 years of age
- Health status and two years lagged health status are not missing (1996 – 2010)
- Must have made the decision to retire while surveyed

### Data prep:

- Added indicator variables for:
  - Years mandatory retirement was eliminated
  - Age nurses are eligible to apply for EBP, CPP & OAS
- Adjust money variables for inflation using CPI



## Methodology: Covariates

	Earnings selection model (participation)	Earnings model (earnings)	Ordered probit for SAH (sahealth)	Labour force participation model (LFS_30)
<b>Individual characteristics</b>	male, married, age, age2, poor_fair	male, married, age, age2, poor_fair	sahealth_lag2, age, married, Sah_poor, sah_fair, sah_good, sah_vgood, disability	age, married, Sah_poor, sah_fair, sah_good, sah_vgood, disability
<b>Human capital variables</b>	lpn, diploma, bachelor, graduate, exp, exp2	lpn, diploma, bachelor, graduate, exp, exp2	lpn, diploma, uni, exp, exp2	lpn, diploma, uni, exp, exp2
<b>Household and financial variables</b>	hhincome, prtnr_unemp, hhsiz, childless18, n_preschool, n_schoolage, earners	hhincome	prtnr_unemp, hhsiz, n_schoolage, earners Earnings_hat, hhincome, CPP, OASGI, PRIVPEN, wRRSP	prtnr_unemp, hhsiz, n_schoolage, earners Earnings_hat, hhincome, CPP, OASGI, PRIVPEN, wRRSP
<b>Job characteristics</b>			hospital, days, evenings, public, union, pplan	hospital, days, evenings, public, union, pplan
<b>Control variables</b>	province of residence & year	province of residence & year	a55, 160, a65, MR_lifted east, west, year groups	a55, 160, a65, MR_lifted east, west, year groups

## Methodology: Empirical approach

Estimate nurses' retirement timing

### Issues:

- Self-assessed health as an explanatory variable
  - Non-comparability
  - Justification bias
  - Incentives in reporting poor health<sup>15</sup>
- Earnings are only available for nurses who continue to work

## Methodology: Empirical approach

### 1. Estimate nurses' annual earnings

#### Issues:

- Sample selection

### 2. Estimate nurses' retirement timing

#### Issues:

- Issues related to health as an explanatory variable
  - Non-comparability
  - Justification bias
  - Financial incentives in reporting poor health<sup>15</sup>
- Earnings are only available for nurses who continue to work

## Methodology: Wooldridge's test & correction for sample selection in panel data<sup>15</sup>

### First stage: **Pooled probit regression**

- Dependent variable: Labour force participation
- Instrument: partner's labour force participation, household size, number of preschool and school-aged children & number of earners in the family
- N=8,960 nurses

### Second stage: **Pooled linear regression**

- Dependent variable: Nurses' annual earnings
- Includes lambda from the first stage as an explanatory variable
- Bootstrapped SE
- N=8,814 nurses

# Results: EARNINGS

Variable	Naïve Pooled model	Naïve RE	Naïve FE	FE + Sample selection
male	4,503.78*** (639.33)	3,606.86*** (1,039.57)	4,305.9781*** (1,041.80)	4,600.08*** (719.42)
married	-4,480.39*** (586.71)	-2,075.20*** (718.35)	-881.50 (986.59)	-667.64 (1,642.03)
age	2,122.42*** (148.88)	2,501.67*** (206.62)	2,253.97*** (733.48)	3,194.87*** (1,121.58)
age2	-26.91*** (1.74)	-31.73*** (2.44)	-40.39*** (7.68)	-34.51*** (10.01)
poor_fair	-3,645.88*** (725.28)	-1,763.86*** (675.66)	-1,081.58 (767.92)	-1,208.04 (1,110.78)
lpn	-8,515.48*** (424.28)	-7,930.68*** (616.68)	-3,825.27** (1,501.93)	-4,236.37* (2,216.65)
diploma	4,653.51*** (611.14)	6,339.07*** (1,088.35)	4,896.19** (2,021.39)	2,946.10 (2,233.73)
bachelor	9,591.87*** (734.78)	12,025.03*** (1,306.99)	11,392.55*** (1,285.06)	8,633.38*** (763.63)
graduate	16,800.18*** (1748.13)	17,998.69*** (3139.39)	24,849.92** (11,489.309)	18,479.64 (11,896.72)
exp	656.84*** (60.56)	824.64*** (91.82)	2,773.10*** (462.70)	1,390.43* (11896.72)
exp2	-6.10*** (1.63)	-9.01*** (2.45)	-18.18** (7.41)	-17.82* (796.45)
hhincome	0.11*** (0.02)	0.070*** (0.02)	0.04*** (0.02)	0.04 (0.02)

\*(p<0.10) \*\* (p<0.05) \*\*\* (p<0.01)  
 Base case: RN stating no diploma as the highest educational attainment

## Results: EARNINGS- Selection model

Variable	Coefficient	Instrument	Coefficient
male	0.06 (0.2230)	prtnr_unemp	0.3009 (0.3053)
married	-0.32 (0.2994)	hhsiz	-0.56096*** (0.1505)
age	-1.2725*** (0.2762)	childless18	-0.2622 (0.4682)
age2	0.0004 (0.0020)	n_preschool	-0.2136 (0.3384)
poor_fair	0.3124** (0.1567)	n_schoolage	0.3236 (0.4093)
lpn	0.2345 (0.5458)	earners	0.7492*** (0.1802)
diploma	0.4750** (0.2256)		
bachelor	0.3865** (0.1833)		
graduate	-3.5967*** (0.8547)		
exp	1.3176*** (0.1855)		
exp2	-0.0043** (0.0019)		
hhincome	0.0816* (0.0474)		

\* (p<0.10) \*\* (p<0.05) \*\*\* (p<0.01)

dydx

	Part-time	Retired
age	-0.002116	0.0265258***
a55	-0.0100048	0.0062865
a60	0.2000625***	-0.0296549
a65	0.4761601***	-0.1262766***
married	-0.0332757	0.1381175
prtnr_unemp	0.2013843***	-0.0440718
hhsiz	-0.0377518	-0.0051785
n_schoolage	-0.0334189	-0.0179008
earners	0.0781006**	-0.0354191**
lpn	-0.1124388	-0.0451766***
exp	-0.0467551	-0.0413548**
exp2	0.0008067	-0.0000104