Work Loss Costs Associated with Osteoarthritis in Canada from 2010 to 2031

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Background

- Indirect cost of a disease: Value of production lost to society due to disease

- Major categories for Indirect cost : Absenteeism, Presenteeism, Work Loss Cost (WLC)

- Chronic diseases that increase in prevalence with age result in potential withdrawal from the workforce

Work loss costs have been extensively studied for cardiovascular disease, diabetes, cancer and rheumatoid arthritis

Background (cont'd)

- Osteoarthritis (OA) is a highly prevalent chronic joint disease that affects about 1 in 8 individuals worldwide.
- Recent studies: OA patients have a significantly higher rate of work loss due to illness compared to non-OA individuals [1]
- Literature is scarce on the work loss costs associated with Osteoarthritis (OA)[2]

1. Sharif B, et al. Risk of work loss due to illness or disability in patients with osteoarthritis: a population-based cohort study. Rheumatology. [Epub ahead of print]. January 11, 2016.
2. Sharif B, et al. Work Loss Costs Associated with Osteoarthritis in Canada from 2010 to 2031. Submitted to *Osteoarthritis and Cartilage*, February 2016.

Objectives

- To estimate and project the work loss cost (WLC) associated with osteoarthritis (OA) in Canada from 2010 to 2031

- To identify high-cost sub-populations by age and sex groups in terms of WLC associated with OA

➢ *We used a computer simulation model*

Population Health Microsimulation Model (POHEM)

- POHEM is a validated individual-level, continuous-time microsimulation model, developed by Statistics Canada.

- Previous disease models by POHEM: Cardiovascular Diseases (CVD), Cancer, Diabetes and OA (POHEM-OA) [1]

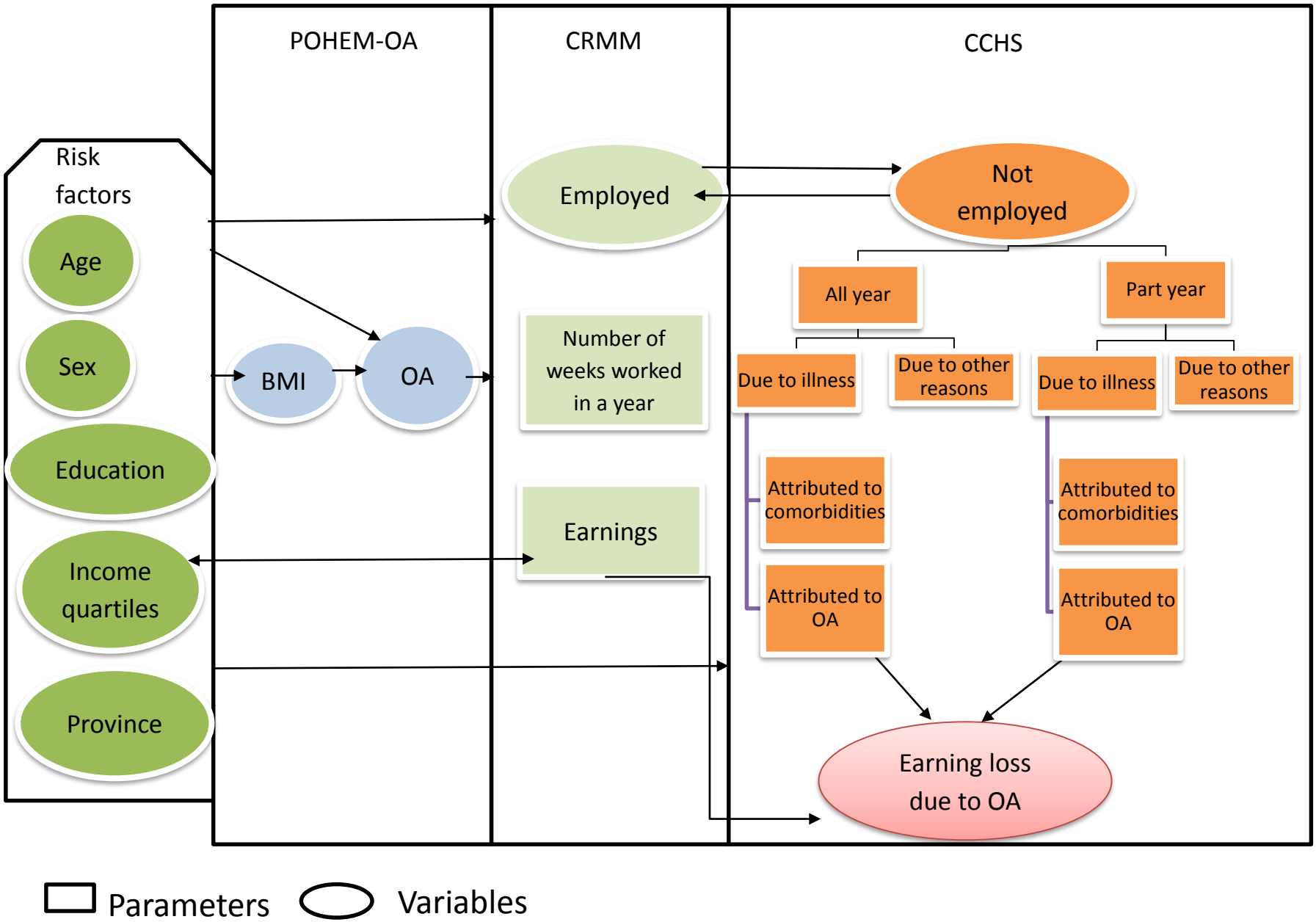
1. Sharif, B et al. Projecting the direct cost burden of osteoarthritis in Canada using a microsimulation model. *Osteoarthritis and Cartilage* 23.10 (2015): 1654-1663.

Methods

- Employment module and OA model: integrated POHEM-OA model and employment modules from the Cancer Risk Management model (CRMM) based on 2006 Census within the POHEM framework.

- Estimating probabilities of none-employment attributed to OA: probabilities of non-employment due to illness and those attributed to OA were estimated from The Canadian Community Health Survey (CCHS) Cycle 2.1
  - CCHS OA sample (n=7,067) between ages of 25-64

Integrated Simulation Model



Methods (Cont'd)

- Total work loss cost (WLC) in this study represents the total earning loss of individuals attributed to OA
- WLC is therefore from patients' perspective.
- WLC is a major part of the overall cost to the economy.

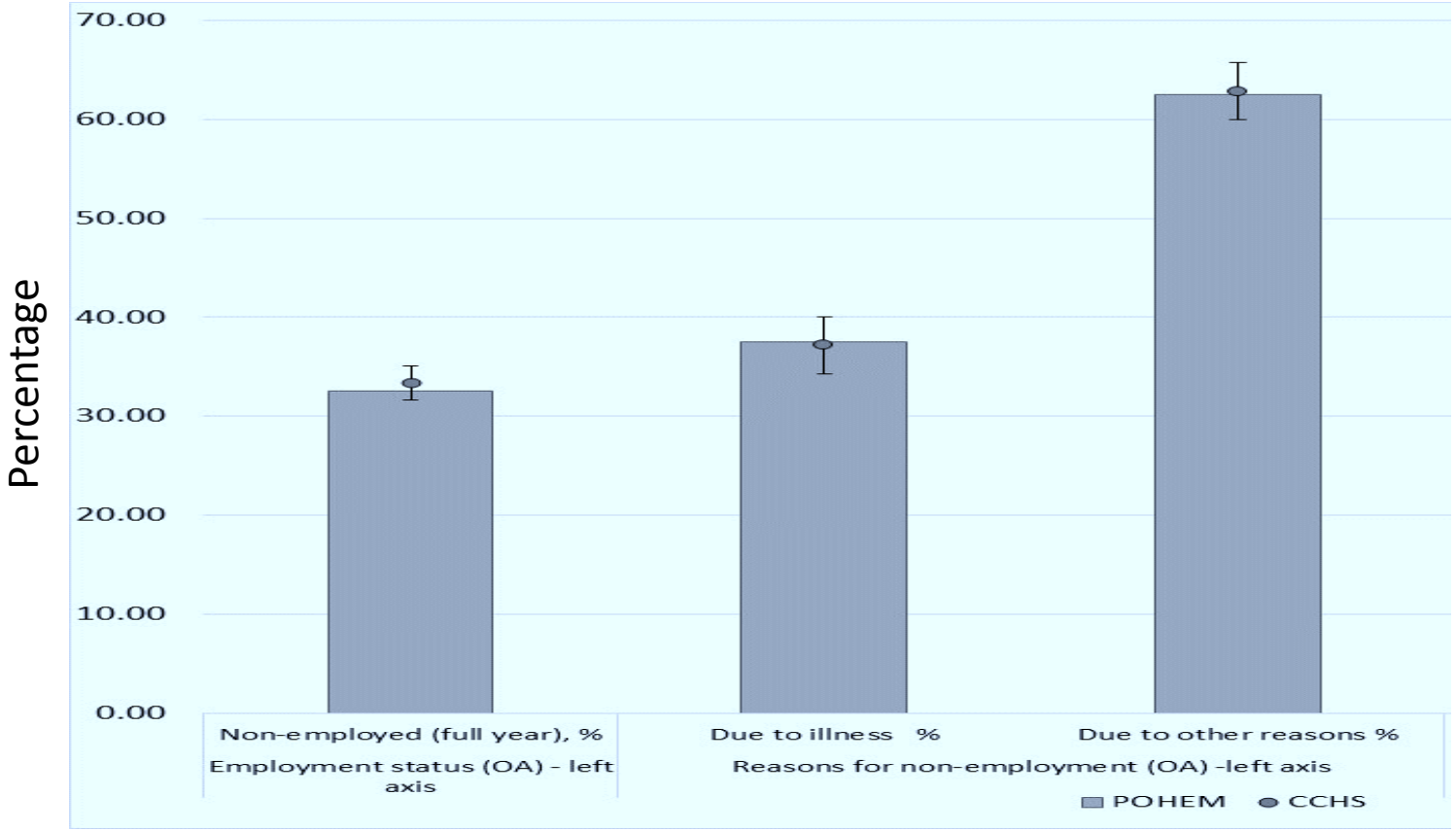
Results

- Probability that non-employment due to illness was attributable to OA was 44.4% and 59.4% for those not working a full-year and a part-year, respectively.

Table 1. Prevalence ratios (PR) of full-year non-employment and non-employment due to illness among OA vs. non-OA

Employment status concept	Educational attainment	Age group	Males		Females	
			PR	95% CI	PR	95% CI
Prevalence ratios (PR) of full-year non-employment [a]	Less than high school graduate	25-34	1.40	0.54, 3.65	0.81	0.41, 1.63
		35-44	2.02	1.18, 3.48	2.12	1.70, 2.66
		45-54	2.71	2.10, 3.51	1.27	1.08, 1.49
		55-64	1.61	1.40, 1.85	0.98	0.91, 1.06
	High school graduate	25-34	2.93	1.09, 7.86	0.87	0.47, 1.61
		35-44	2.88	1.41, 5.90	0.94	0.65, 1.35
		45-54	2.51	1.69, 3.72	1.44	1.18, 1.76
		55-64	1.05	0.82, 1.34	1.10	0.98, 1.22
	At least some post-secondary	25-34	1.12	0.32, 3.94	1.30	0.78, 2.20
		35-44	2.89	1.90, 4.41	1.04	0.78, 1.40
		45-54	2.86	2.19, 3.74	1.68	1.43, 1.97
		55-64	1.65	1.44, 1.88	1.18	1.07, 1.29
Prevalence ratios (PR) of full-year non-employment due to illness [b]	All	25-44	1.98	1.66, 2.35	4.43	3.68, 5.35
		45-54	1.88	1.70, 2.08	1.74	1.52, 1.99
		55-64	1.49	1.27, 1.76	1.56	1.36, 1.80
Prevalence ratios (PR) of part-year non-employment due to illness [b]	All	25-44	3.36	1.86, 6.05	3.42	2.34, 4.99
		45-54	2.66	1.72, 4.12	1.08	0.74, 1.58
		55-64	1.86	1.03, 3.34	2.26	1.54, 3.32

Results from simulation model matches those from CCHS in terms of probability of non-employment among OA population



- Comparison of POHEM and CCHS estimates for OA population (year 2003)

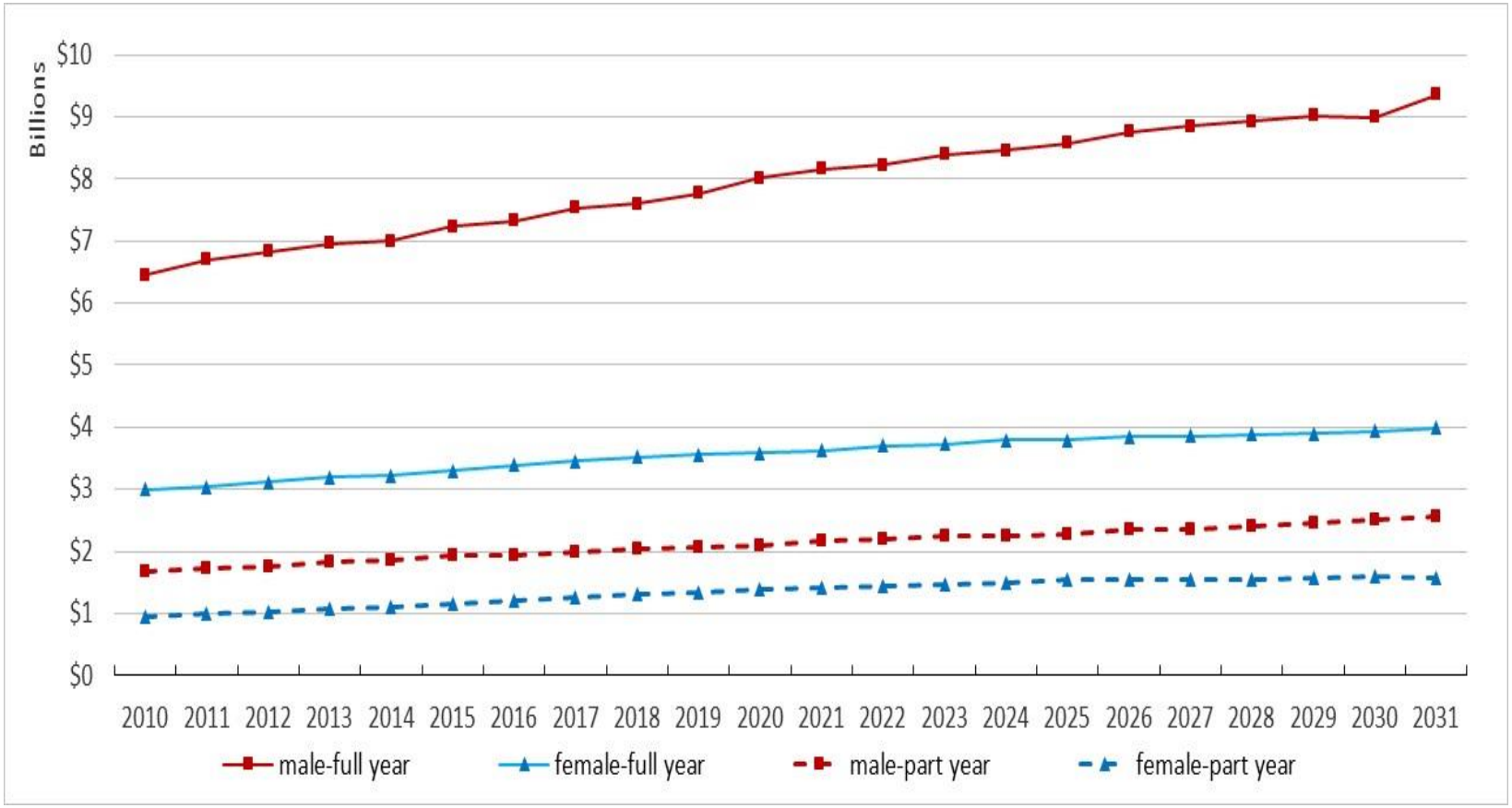
Results of simulation model

- The size of the working age population with OA was projected to increase by 13%, from 1.5 million in 2010 to 1.7 million in 2031.

Characteristics of simulated individuals over time for individuals 25-64 years

Characteristic	Projection year		
	2010	2021	2031
Total population size (all)	19,129,435	20,738,584	20,603,509
OA population size	1,505,697	1,720,130	1,708,831
Prevalence of OA (per 10,000)	787.1	829.4	829.4
Sex-specific OA prevalence rates (per 10,000)			
Male	715.2	752.1	753.3
Female	858.3	906.3	905.2
Age group (among OA) (%)			
25-44	13.3	12.8	13.1
45-54	31.8	25.2	29.3
55-64	54.9	62.0	57.5
Employment status (among OA) (%)			
Not employed, all year	31.7	30.7	28.5
Not employed, part year	28.0	28.4	28.7
Employed full year	40.3	40.9	42.8
Reasons for non-employment (among OA) (%)[b]			
Due to illness	35.2	33.6	34.1
Due to other reasons	64.8	66.4	65.9
Non-employed due to OA (%)[b]	7.5	6.9	6.8
Weeks worked in past year, mean[c] (among OA)	32.3	32.5	33.5
Average earnings (among OA) ($)			
Overall	41,353	48,992	58,900
Males	55,777	65,598	78,107
Females	29,425	35,255	42,925
Age 25-44	49,465	59,136	67,126
Age 45-54	52,607	65,762	76,190
Age 55-64	32,947	40,167	48,325

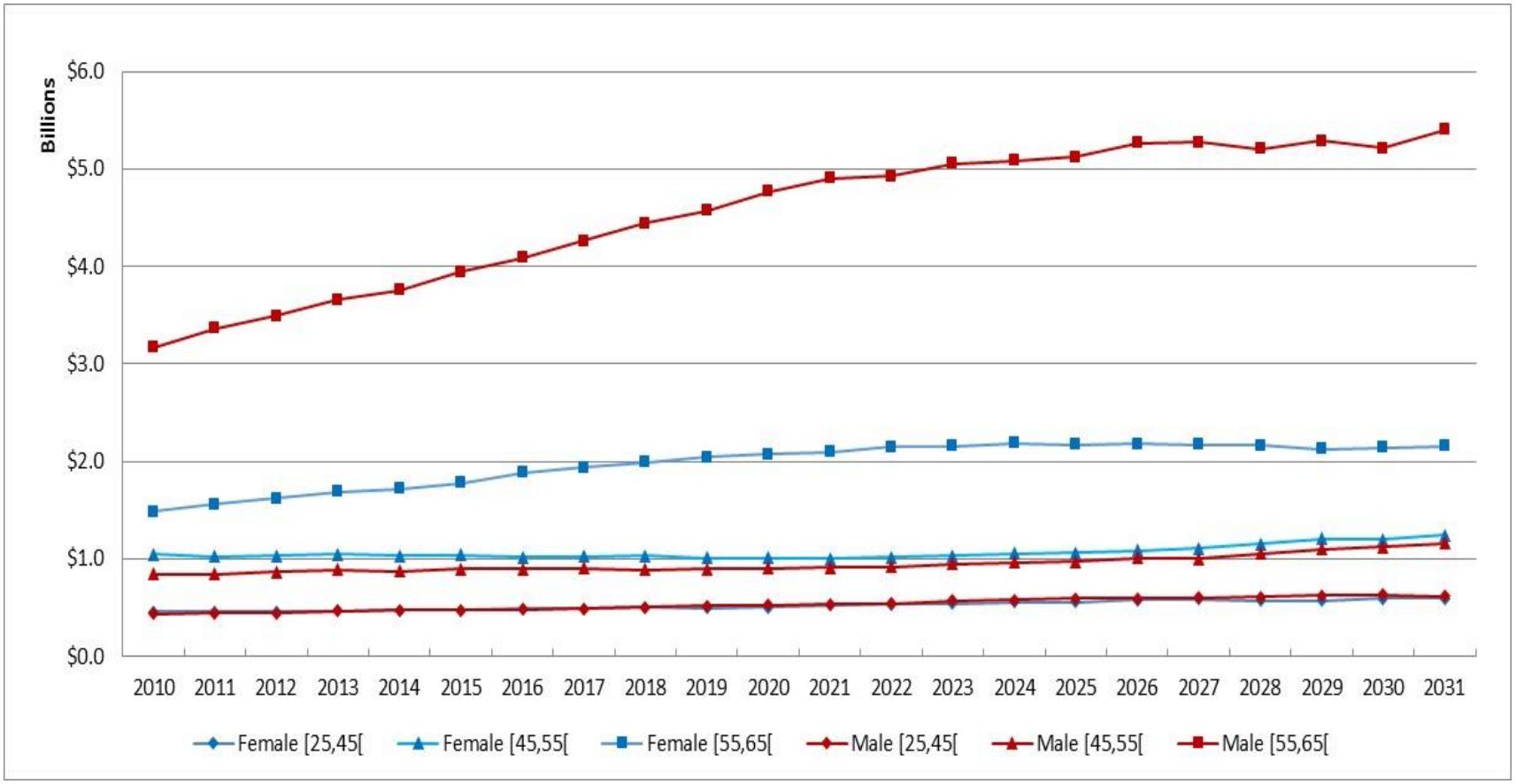
Total work loss cost attributable to OA increased by 46% from 2010 to 2031



- The WLC associated with OA increased from $12 billion in 2010 to $17.5 billion in 2031 (in 2008 $CAD).

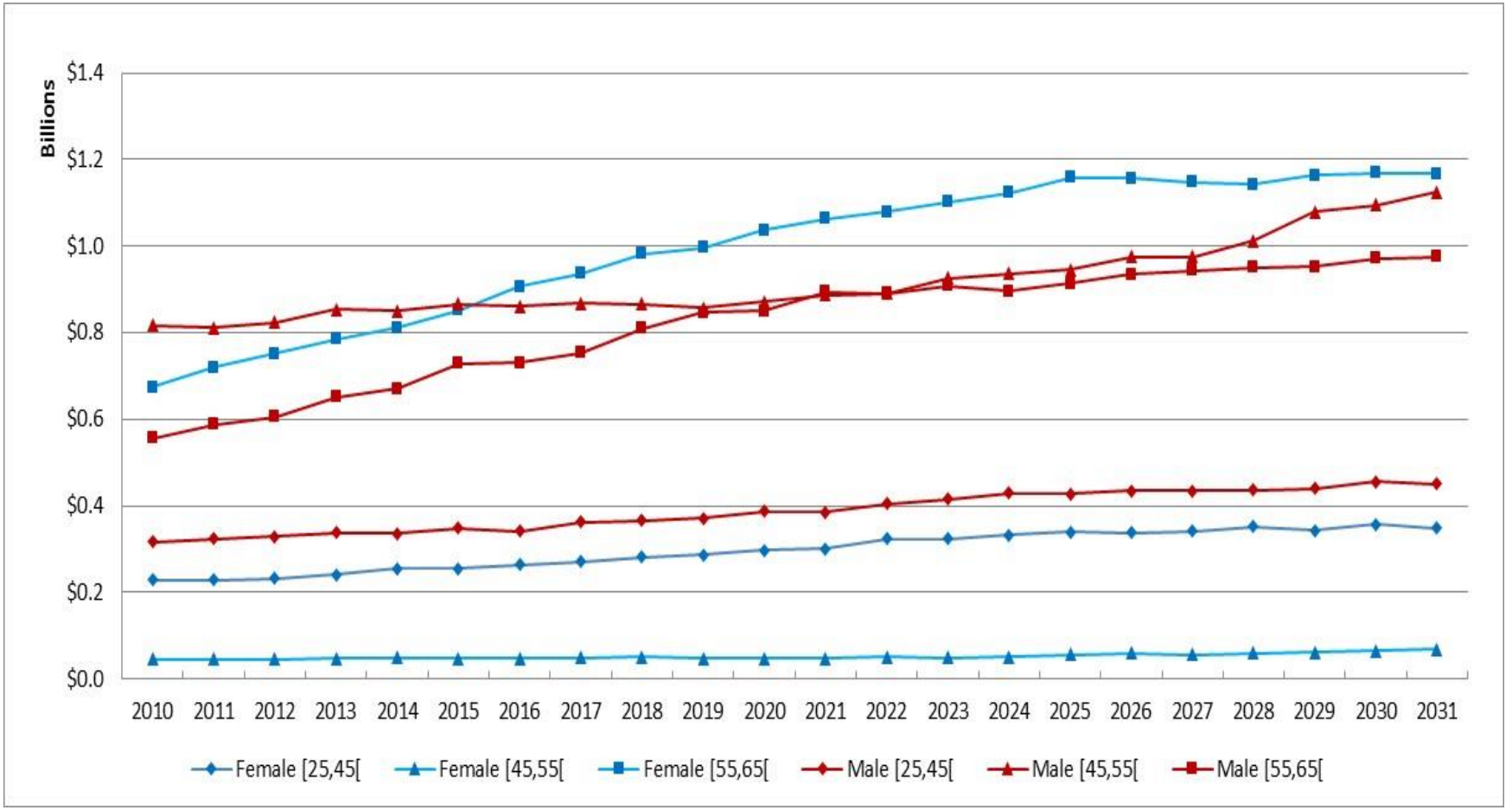
- Males (70%) had higher WLC associated with OA compared to females (30%).

Males 55-65 had the highest WLC due to OA associated with full-time non-employment



- Male and female OA patients between 55-65 years of age had the highest total projected WLCs, respectively.

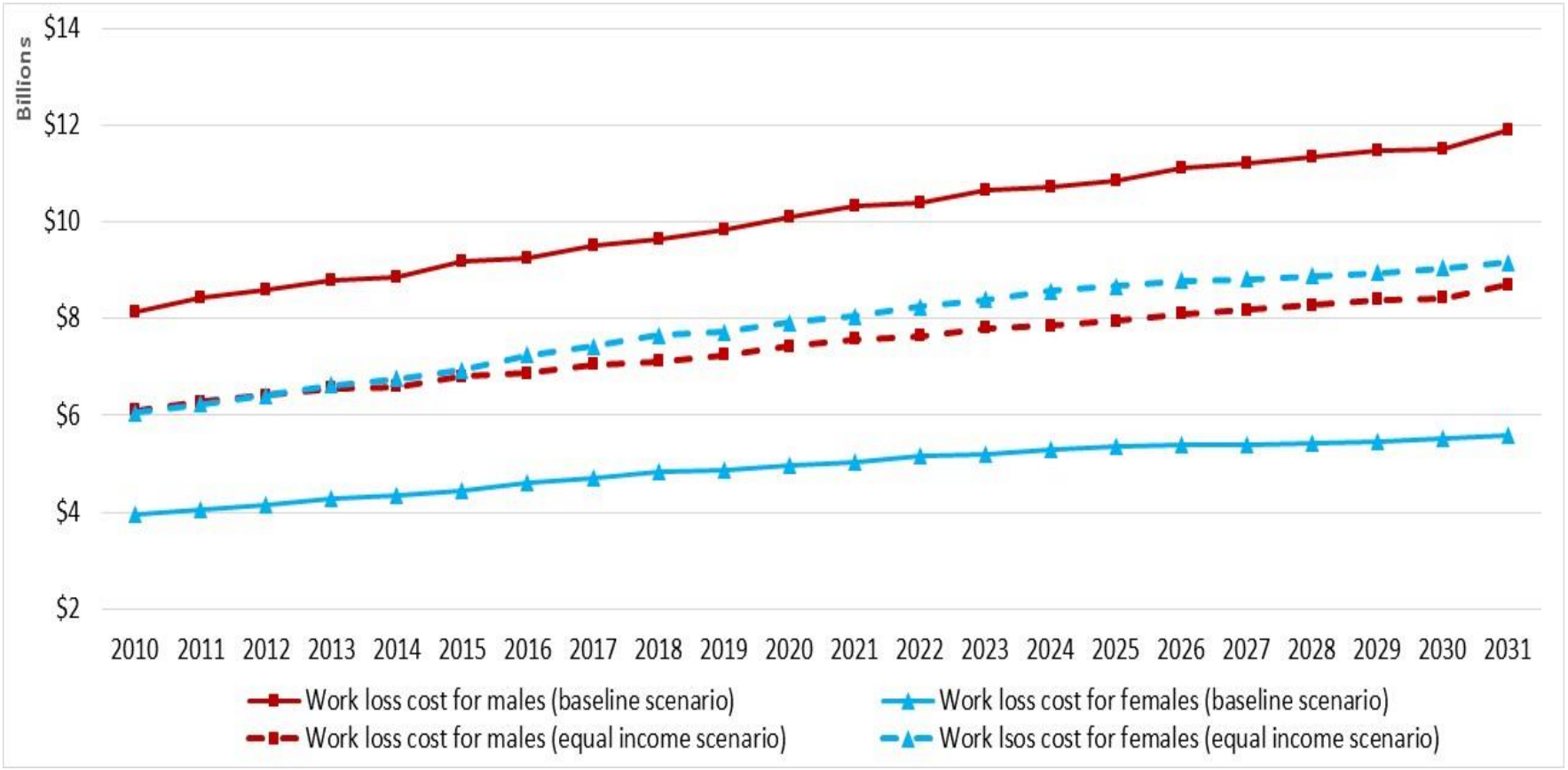
Females 55-65 had the highest WLC due to OA associated with part-time non-employment



Results of the simulation model (cont'd)

- Most (62%) of the increase was due to economic growth and 38% was due to the increase in OA prevalence and changes in demographics.

If equal income was assigned to males and females, females had the highest WLC.



Conclusion

- The total WLC associated with OA in Canada is substantial and is projected to increase in future years.

- Males and females with (55-65) of age have the highest total indirect cost , respectively.

- Results of this study could be used to inform policies aiming to increase employment sustainability for individuals with OA.

Limitations

- We did not take into account differences in terms of rates of return to work after a period of non-employment among OA and non-OA
- We did not take into account the increased benefits paid by the government and the amount of income tax loss
- Our model did not take into account external factors affecting employment rates, such as recessions.

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- This analysis is based on Statistics Canada's POHEM micro-simulation model.

The assumptions and calculations underlying the simulation results were prepared by the author and the responsibility for the use and interpretation of these data is entirely that of the author.

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Thank You

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Appendix

Figure A1. Sample sizes for CCHS analysis

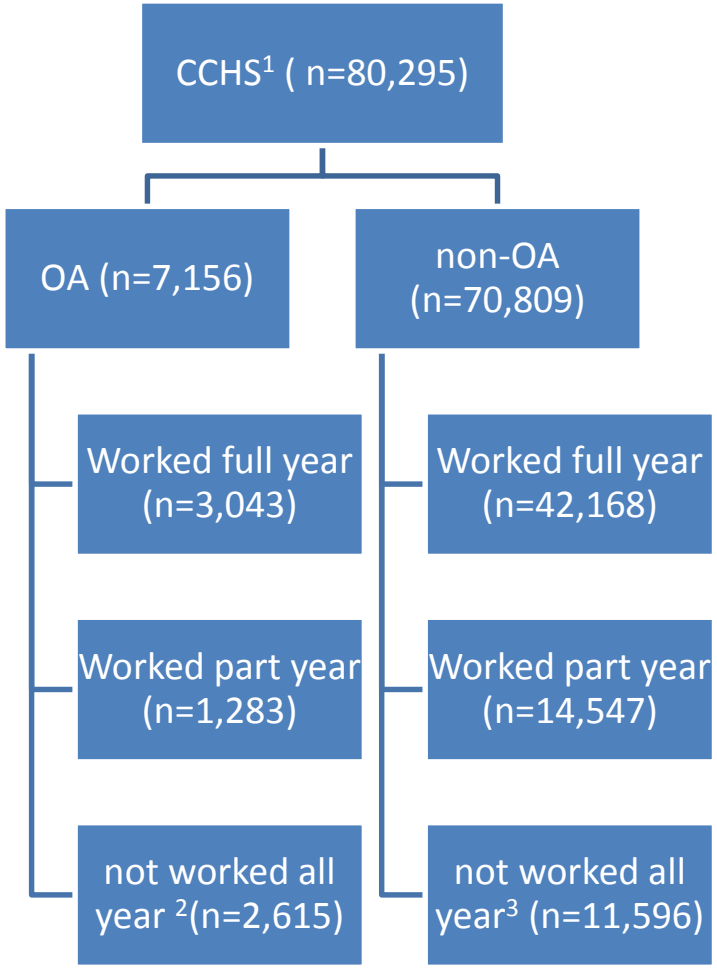

Table A1. Breakdown of the reason for non-employment by age and OA status, unweighted sample size and weighted proportions, CCHS 2.1

	OA						Non-OA			
Age	Non-employment %(full year or part year)	N (non-employed)[2]	Own illness/disability Perm. unable to work	Early retire	Other reasons[3]	Non-employment %(full year or part year)	N (non-employed)	Own illness/disability/Perm. unable to work	Early retire	Other reasons
25-45 (n= 38,477)	41.33%*	319	47.13%*	2.15%	50.7%*	32.30%	6676	13.7%	0.41%	85.9%
46-55 (n=20,295)	45.67%*	756	52.13%*	13.67%	34.2%*	30.04%	3581	28.68%	13.98%	57.34%
56-65 (n=18,656)	65.19%*	2065	28.35%*	58.08%*	13.6%*	54.36%	6810	18.7%	63.26%	18.04%
All	53.43%*	3140	37.17%*	39.87%*	23.55%*	35.35%	17067	18.3%	20.4%	61.3%

Table A2. List of parameters and sources

Parameters	Sources	References
Risk factors at baseline	Sampled form CCHS 1.1 (2001)	
Risk factors evolution (Education, income)	Models estimated from NPHS	
OA	OA incident estimated from BC-pop data ; effect of BM on OA estimated form NPHS; calibrated prevalence model form POHEM-OA	
Employment	Probabilities worked full year estimated from census (modeled in CRMM) for each year	
Earnings	Weekly earnings estimated from census 2006 (modeled in CRMM); annual economic growth ye set at 1%	
No. weeks worked	Estimated from census 2006 (modeled in CRMM)	
Probabilities for non-employment due to illness	Estimated from CCHS 2.1 (2002)	
Probabilities for non-employment attributable o OA	Estimated from regression models based on CCHS 2.1 (2002)	

Table A3. Predicted relative risk for non-employment all year for OA vs .non-OA by age, sex and education levels (used in calibration)

		Age 25-34		Age 35-44		Age 45-54		Age 55-64	
		Male	Female	Male	Female	Male	Female	Male	Female
Education	No high school	1.57	1.011	2.375	1.198	2.430	1.358	1.432	1.060
	High school	1.64	1.014	2.673	1.240	2.875	1.506	1.520	1.086
	Post-secondary	1.63	1.014	2.615	1.235	2.769	1.483	1.501	1.083

Table A4. Reason for non-employment among those not employed for a full year

Sex	Age group	Regression coefficients	Regression model 1		Probability that non-employment is due to illness 2		Relative Risk (OA vs. Non-OA)	Attributable risk
			Unadjusted	Adjusted	Non-OA	OA (adjusted)		
Males	25-45 N=921	Intercept	-0.4660	-0.1909	38.56	82.65	2.1436	0.7824
		OA status	1.6270	1.7518				
	46-55 N=947	Intercept	-0.0919	-0.1949	47.70	86.47	1.8127	0.6957
		OA status	2.2334	2.0499				
	56-65 N=2790	Intercept	-1.1614	-1.1907	23.84	34.20	1.4344	0.5140
		OA status	0.5700	0.5362				
Females	25-45 N= 3041	Intercept	-1.9939	-1.9687	11.98	48.08	4.0119	0.9379
		OA status	2.1194	1.8919				
	46-55 N= 2126	Intercept	-0.9486	-0.9512	27.92	48.03	1.7205	0.6622
		OA status	0.8914	0.8724				
	56-65 N= 5070	Intercept	-1.6134	-1.5725	16.61	22.47	1.3524	0.4533
		OA status	0.5647	0.3338				

Table A5. Reason for non-employment among those not employed for part of year

Sex	Age group	Regression coefficients	Regression model[1]		Probability that non-employment is due to illness[2]		Relative Risk (OA vs. Non-OA)	Attributable risk
			Unadjusted	Adjusted	Non-OA	OA (adjusted)		
Males	25-45 N=1278	Intercept	-2.2574	-1.7218	9.47	40.78	4.5166	0.9510
		OA status	1.4946	1.4309				
	46-55 N=669	Intercept	-1.7611	-2.0299	14.67	24.22	1.6518	0.6335
		OA status	1.3154	0.8895				
	56-65 N=806	Intercept	-2.1603	-0.3029	10.34	52.90	5.1173	0.9618
		OA status	0.7236	0.4190				
Females	25-45 N=1928	Intercept	-2.4767	-1.5318	7.75	49.69	6.4113	0.9757
		OA status	1.4559	1.5195				
	46-55 N=799	Intercept	-1.2737	-0.5152	21.86	58.84	2.6912	0.8619
		OA status	0.1029	0.8724				
	56-65 N=747	Intercept	-1.8890	-0.9804	13.14	48.44	3.6873	0.9264
		OA status	1.0239	0.9178				