The Association between Older Age, Co-Morbidity, and Treatment Status of Incident Osteoporotic Fractures: A Population-Based Nested Cohort Study

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Background

- Osteoporosis, a skeletal disease, is a serious public health problem with an estimated 1.4 million Canadians and 10 million Americans affected.
- The epidemiological and clinical importance lies in the resulting fractures.
- The routine management of osteoporosis should target all aspects of the disease, including maximizing and preserving bone mass and preventing future fractures through pharmacotherapy and lifestyle modification.
- Despite strong evidence-based rationale for both the primary and secondary prevention of osteoporosis, there remains an overall low prevalence of osteoporosis treatment in older adults.
- There is some question whether low treatment rates in older adults are simply age related variations (in treatments) or due to the presence of co-morbid conditions.

Objectives

- To determine if older adults with multiple co-morbid conditions were less likely to receive osteoporosis treatment following an incident osteoporosis fracture than younger healthier patients with fewer co-morbid conditions.

Materials & Methods

Design:
- Retrospective nested cohort study.

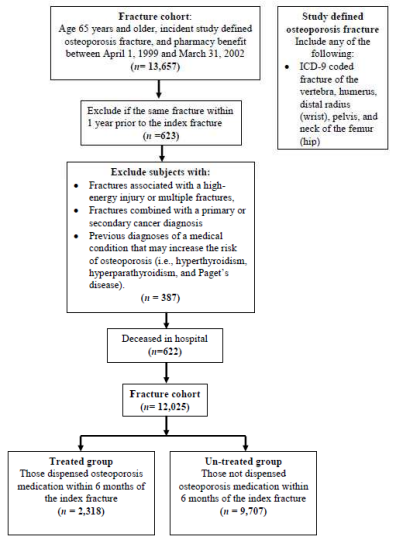
Data Sources
- De-identified administrative healthcare data derived from the British Columbia (Canada) Linked Health Database (BCLHD).
- Data bases used: Prescription data (PharmaCare) and hospital separations (Discharge Abstract Database [DAD]).

Study Population
- All residents in the province of BC, Canada aged 65 years and older who had continuous enrolment in the PharmaCare prescription benefits plan between 1999 and 2002.

Outcome Measures
- **Dependent variable** - osteoporosis medication dispensation.
- **Independent variables (main)**- age and co-morbidity (CDI).
- **Covariates** - sex, fracture site, year of fracture, health region, and osteoporosis treatment prior to the index fracture.

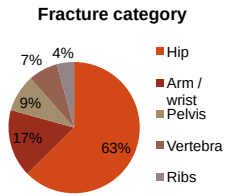
Statistical Analysis
- Using multivariate logistic regression techniques, we used the *Enter* procedure in which all independent variables are entered in a single step and then tested for the possibility of statistical interaction between the main independent variables (age and CDI score) and all other covariates.
- We pre- specified that we would consider only interaction terms that achieved a level of statistical significance of $p < 0.10$.
- The calculated ORs were considered statistically significant if the 95% CI did not include 1.

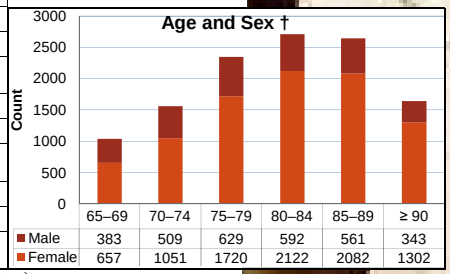
Cohort Selection



Results: Patient Characteristics *

Variable	Total fracture cohort n = 12,025
Year of fracture	
1999/2000	4,037 (33.6)
2000/2001	3,770 (31.4)
2001/2002	4,218 (35.1)
Charlson-Deyo Index (CDI) †	
≤ 1	7,599 (63.2)
2–3	3,724 (31)
≥ 4	702 (5.8)
Health Authority †	
Vancouver Coastal	3,202 (26.6)
Interior	2,611 (21.7)
Fraser	3,047 (25.3)
Vancouver Island	2,531 (21.0)
Northern	525 (4.4)
Unknown	109 (0.9)





* All data are shown as number (percentage)
† $p < 0.001$ for chi square differences between categories within group

Results

Osteoporosis treatment:

- Low treatment rate prior to incident fracture (15% of the sample).
- Treatment rate improved to 19% following the index fracture.
- Those who received treatment following the fracture were significantly younger, more often female, and had fewer co-morbid conditions ($p < 0.001$).
- The treatment rate improved significantly every year ($p < 0.001$).
- Patients residing in more central health regions received treatment significantly more often than those residing in the Northern region ($p < 0.001$).
- Age, sex, co-morbidity (CDI), fracture site, and health region were all significantly associated with the dispensation of an osteoporosis medication within six months following the index fracture.

Factors Predicting No Drug Treatment Post-Fracture

Variable	Adjusted odds ratio (95% Confidence Interval)	*p*-value
Constant	0.220	.000
Age category (years)		.000
65–69	1 (reference)	
70–74	1.12 (0.86 – 1.47)	0.389
75–79	0.96 (0.75 – 1.24)	0.777
80–84	0.90 (0.70 - 1.16)	0.414
85–89	0.64 (0.49 - 0.83)	0.001
≥ 90	0.47 (0.35 - 0.63)	0.000
Sex		0.000
Female	1 (reference)	
Male	0.23 (0.19–0.29)	0.000
Charlson-Deyo Index (CDI)		0.000
≤ 1	1 (reference)	
2–3	0.83 (0.73–0.94)	0.003
≥ 4	0.63 (0.48–0.83)	0.001
Fracture site		0.000
Hip	1 (reference)	
Arm / Wrist	1.10 (0.93 – 1.32)	0.273
Pelvis	1.27 (1.01 – 1.60)	0.039
Vertebrae	2.64 (2.12 – 3.29)	0.000
Ribs	1.01 (0.69 – 1.46)	0.976
Health Authority		0.000
Vancouver Coastal	1 (reference)	
Interior	0.68 (0.58 – 0.80)	0.000
Fraser	0.92 (0.80- 1.07)	0.287
Vancouver Island	0.69 (0.59 – 0.81)	0.000
Northern	0.48 (0.35 – 0.67)	0.000
Missing	0.71 (0.39 – 1.32)	0.282
Prior treatment		.000
No treatment	1 (reference)	
Prior treatment	15.89 (9.69 – 26.04)	0.000

Subjects ≥ 90 years were dispensed medication less than 50% of the time compared to subjects 69 years and younger

Those with ≥ 4 co-morbidities were 1.6 times less likely to have been dispensed treatment

Those with a fractured vertebrae were 2.64 times more likely to receive treatment

Prior treatment was the strongest predictor of osteoporosis treatment following an incident fracture

Conclusions

Despite the wide availability of osteoporosis medications, our findings suggest that the majority of older adults, many of who have at least one co-morbid condition, are not receiving treatment to prevent the progression of the disease and to prevent further fractures.