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MASCC/ISOO

ANNUAL MEETING ON SUPPORTIVE CARE IN CANCER



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#MASCC18



Fractures in Patients with Cancer

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Conflicts of Interest

- None



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DEFINITION



- The most common metabolic bone disease that results in low bone mineral density and bone fragility leading to fractures



Bone Mineral Density across Lifespan

Postmenopausal bone loss
Age-related bone loss

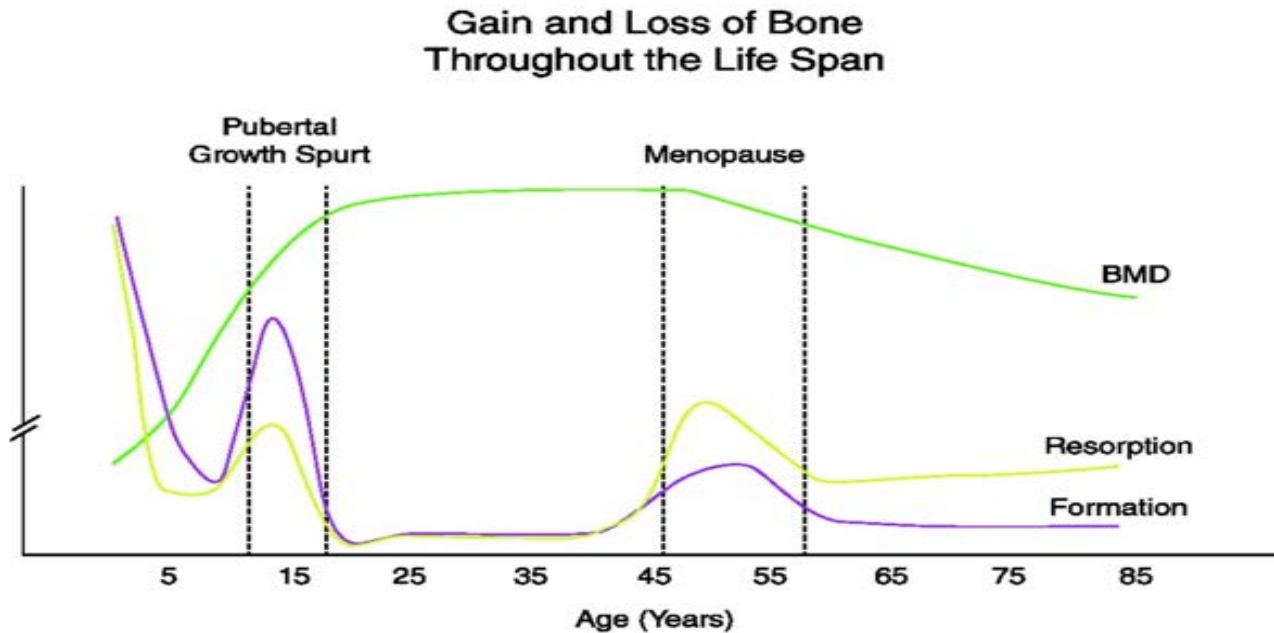
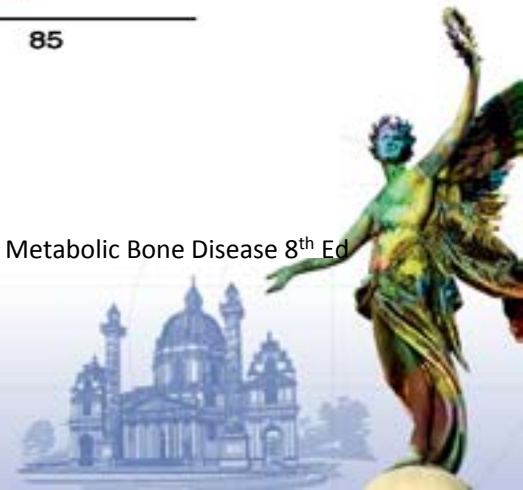


Fig. 39.1. Schematic representation of gain and loss of bone and changes in bone remodeling throughout life in women.

Primer on Metabolic Bone Disease 8th Ed



Low BMD in Older Patients with Cancer

- Much of the research and all guidelines in cancer are related to hormonal therapies
- Breast Cancer and Prostate Cancer guidelines
- Age related bone loss is not recognized in current bone health guidelines





Fracture Risk Among 122,255 Cancer Patients: A Population-Based Cohort Study from Manitoba, Canada

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Background

- Many studies have assessed osteoporosis-related fracture risk among patients with breast or prostate cancer
- For other cancers population-based data are limited on occurrence of fractures, their time course and risk factors.



Objective



- To estimate fracture burden from multiple cancer types:
 - Comparison with the general population
 - Time course pre and post cancer diagnosis
 - Determine predictors of fracture risk among cancer patients.



Study Population



- Population-based cancer registry and repository of hospital, physician services, pharmacy use
 - First cancer diagnosis (excluding non-melanoma skin cancer) 1987-2013
 - Matched with up to 4 controls without a cancer diagnosis by age ($\pm 5y$), sex and area of residence on the date of cancer diagnosis (index date).



Manitoba Cancer Registry



- **Manitoba Cancer Registry (MCR):**
 - population-based central cancer registry 1956
 - member of the North American Association of Central Cancer Registries
 - administers a program that reviews member registries for their ability to produce complete, accurate, and timely data.

Tucker TC, Howe HL, Weir HK (1999) Certification for population-based cancer registries. *J Regist Manag* 26:24–27.



Study Population



	Cases % N=122,255	Controls % N=460,040
Male	48.9	45.7
Female	51.1	54.3
Age mean, years	65.3	63.5
Chronic Obstructive Pulmonary Disease	8.5	5.6
Alcohol / Substance Abuse	2.2	1.8
Rheumatoid Arthritis	1.2	1.2
Prolonged Glucocorticoid Use	1.1	0.8
Osteoporotic Medication Use	1.8	1.7
Charlson Comorbidity Index		
0	32.5	67.8
1	13.8	20.6
2	29.4	6.8
3+	24.3	4.9
Socioeconomic factor index (SEFI) quintiles		
1 (lowest)	18.9	19.9
2	19.3	19.8
3	20.1	19.6
4	20.5	19.4
5 (highest)	19.7	19.5
Missing	1.5	1.9



Cancer Population

Cancer Subtype	N	%
Breast	17,238	14.1
Lung	15,404	12.6
Colorectal	15,282	12.5
Prostate	14,793	12.1
Melanoma	9,903	8.1
Gynecological	8,191	6.7
Urinary Tract	6,846	5.6
Myeloma / NH Lymphoma	6,357	5.2
Hematological	4,157	3.4
Hepatobiliary	3,912	3.2
Upper GI	3,790	3.1
Head and Neck	3,790	3.1
Thyroid	1,712	1.4
Others	10,880	8.9
Stage (available January 1 2004 onwards)		
I	12,001	10.2
II	10,731	9.1
III	7154	6.1
IV	9090	7.7
Unspecified	6702	5.7



Fracture Outcomes



- Previously validated algorithms were used to identify hip, clinical vertebral, forearm, and humerus fractures (“major fractures” [MF])
 - Cases median 13.5 years (1.7 million person-years)
 - Controls median 15.7 years (6.8 million person-years)
- Fractures stratified according to index date:
 - Before cancer diagnosis: 5-10y, 1-5y, 0-1y
 - After cancer diagnosis: 0-1y, 1-5y, 5-10y

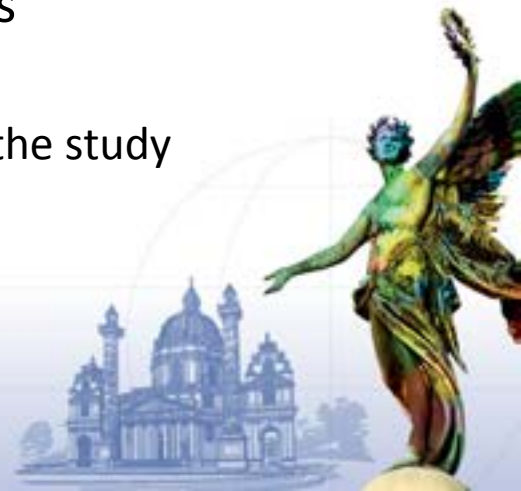
1 Lix LM. BMC Public Health 2012;12:301



Analysis



- Fracture incidence rates and incidence rate ratios (IRRs) were calculated for MF overall and by fracture site for all cancer cases and then stratified by sex, age and cancer site
 - Multiple fractures, limit once per year per fracture site
- For individuals with cancer, competing risk time-to-event analysis (competing event=death) was used to assess cancer-specific and general risk factors associated
 - Time to first MF (censoring migration or end of the study March 31, 2015)





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Incidence Rate Ratios (95% CIs) by Fracture Site

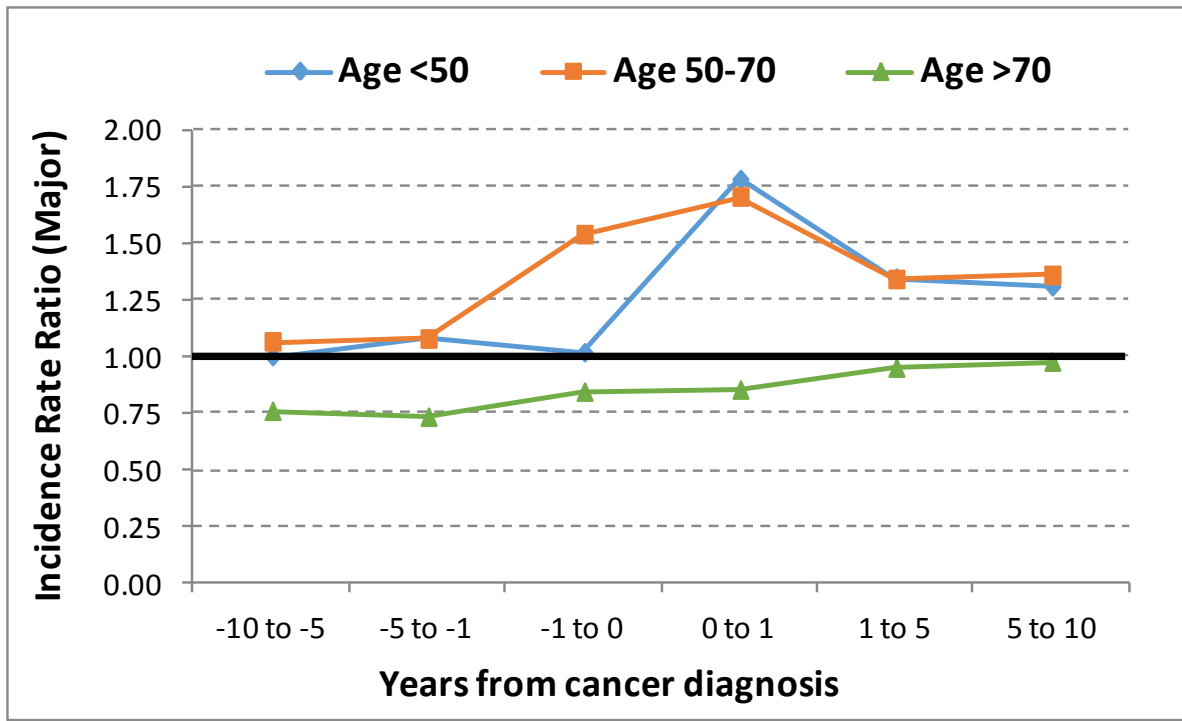
Years before (-) or after (+) diagnosis	Hip	Wrist	Humerus	Spine	Any
-10 to -5	0.76 (0.69,0.85)	0.99 (0.92,1.06)	0.92 (0.83,1.02)	0.96 (0.87,1.05)	0.92 (0.88,0.96)
-5 to -1	0.68 (0.64,0.72)	1.00 (0.95,1.05)	0.97 (0.91,1.04)	0.97 (0.91,1.03)	0.91 (0.88,0.93)
-1 to 0	0.80 (0.71,0.90)	0.97 (0.85,1.11)	1.20 (1.03,1.39)	1.65 (1.48,1.85)	1.10 (1.03,1.17)
0 to +1	0.90 (0.81,1.00)	0.95 (0.82,1.11)	1.33 (1.15,1.55)	1.73 (1.53,1.95)	1.15 (1.08,1.23)
+1 to +5	1.07 (1.01,1.12)	1.11 (1.04,1.18)	1.27 (1.18,1.36)	1.45 (1.37,1.55)	1.19 (1.15,1.23)
+5 to +10	1.22 (1.13,1.32)	1.17 (1.07,1.29)	1.39 (1.24,1.56)	1.46 (1.32,1.61)	1.28 (1.22,1.34)





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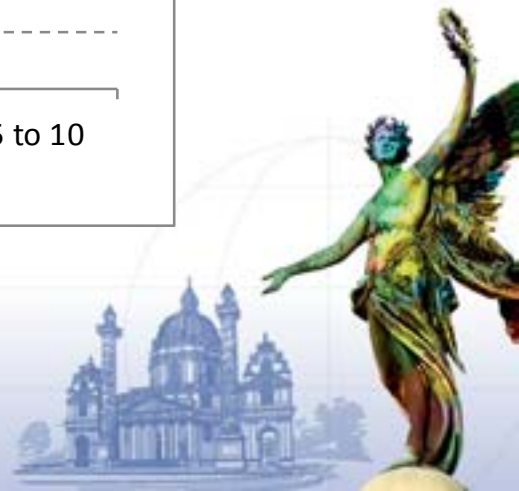
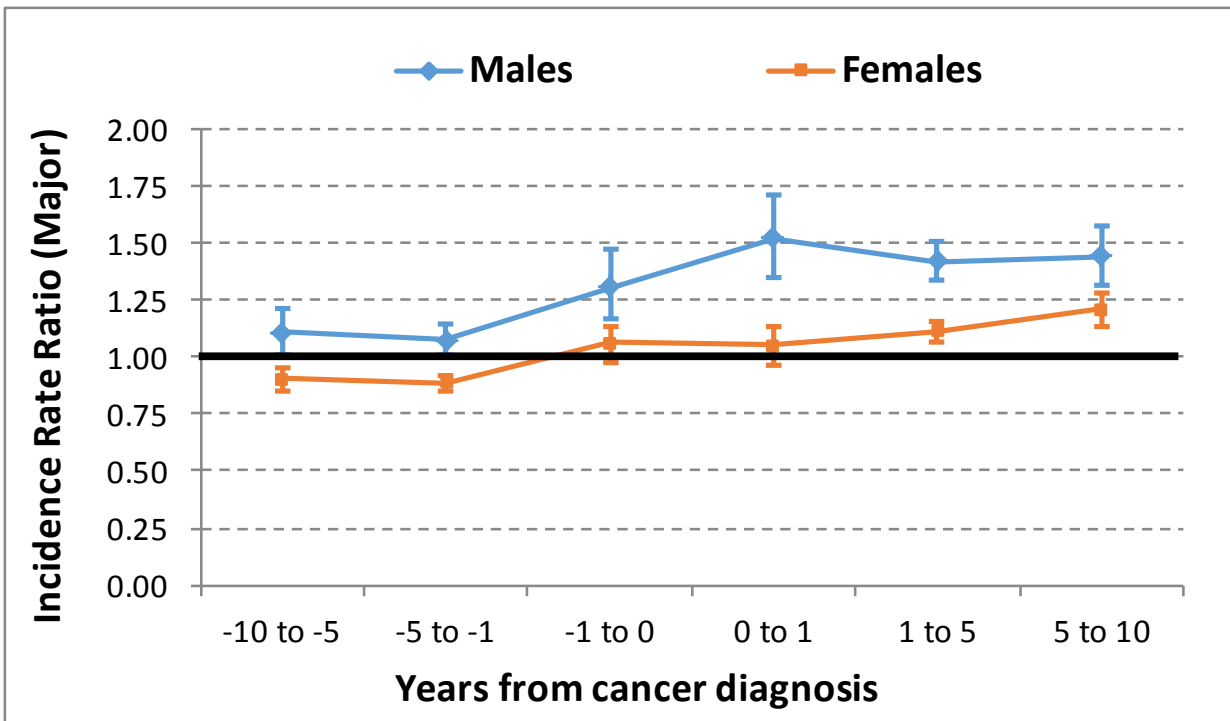
Major Fracture Incidence Rate Ratios by Age





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Major Fracture Incidence Rate Ratios (95% CIs) by Sex





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Major Fracture Incidence Rate Ratios (95% CIs) by Cancer Site

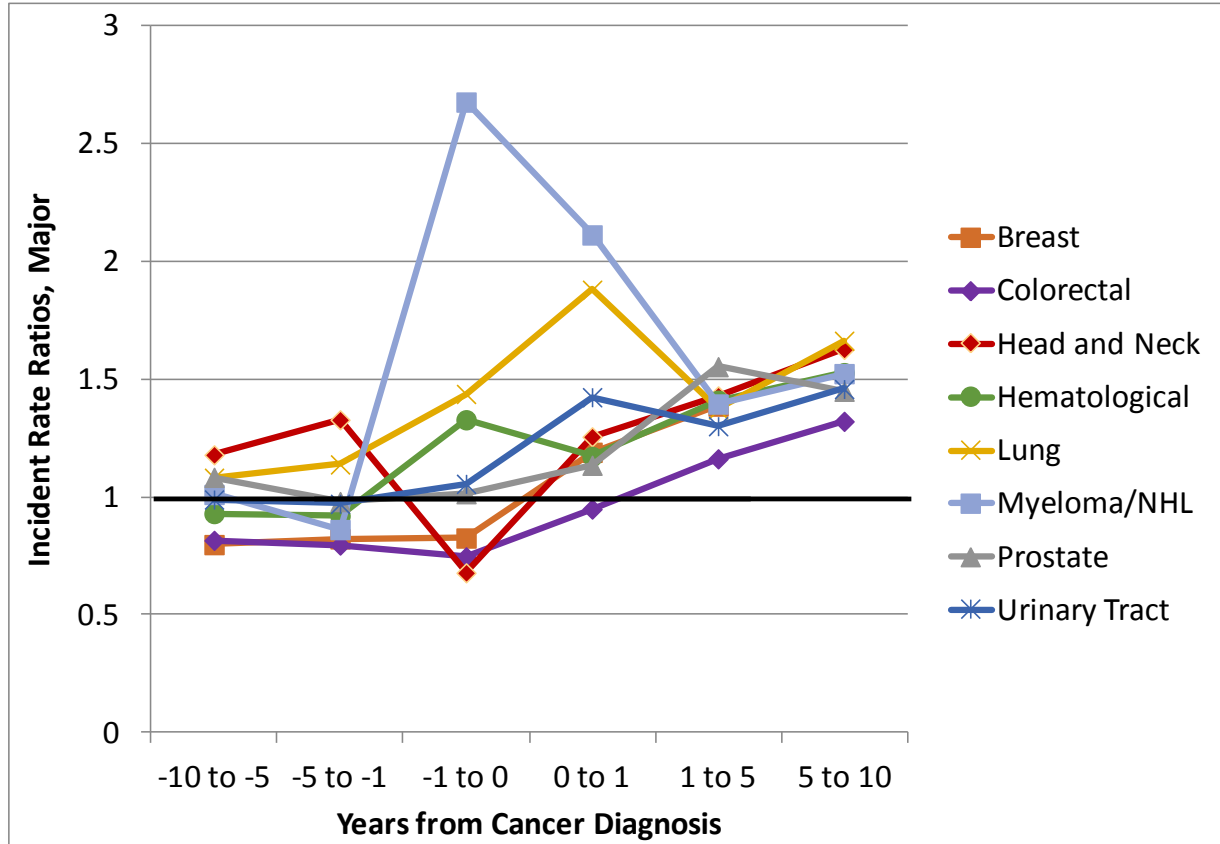
	0 to 1y	1 to 5y	5 to 10y
Hepatobiliary	1.58 (1.07-2.34)	0.94 (0.59-1.52)	1.68 (0.73-3.87)
Lung	1.88 (1.59-2.23)	1.37 (1.21-1.56)	1.66 (1.36-2.04)
Head / Neck	1.26 (0.86-1.82)	1.43 (1.18-1.74)	1.63 (1.23-2.15)
Hematological	1.17 (0.80-1.71)	1.41 (1.19-1.68)	1.53 (1.19-1.97)
Myeloma/NHL	2.11 (1.68-2.66)	1.40 (1.22-1.60)	1.52 (1.24-1.87)
Urinary Tract	1.42 (1.10-1.85)	1.30 (1.13-1.50)	1.46 (1.18-1.80)
Prostate	1.14 (0.89-1.44)	1.55 (1.41-1.71)	1.45 (1.26-1.67)
Breast	0.83 (0.07-0.98)	1.19 (1.11-1.28)	1.39 (1.25-1.54)
Colorectal	0.95 (0.80-1.13)	1.16 (1.07-1.27)	1.32 (1.16-1.51)
Others	1.27 (1.02-1.59)	1.16 (1.02-1.32)	1.21 (0.98-1.48)
Upper GI	1.05 (0.71-1.56)	1.07 (0.82-1.41)	1.12 (0.68-1.84)
Gynecological	0.82 (0.62-1.08)	0.97 (0.86-1.10)	0.97 (0.80-1.16)
Thyroid	0.32 (0.07-1.34)	0.87 (0.59-1.29)	0.96 (0.52-1.74)
Melanoma	1.10 (0.90-1.36)	1.00 (0.89-1.12)	0.95 (0.79-1.14)





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Major Fracture Incidence Rate Ratios by Cancer Site





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Cox Regression in Cancer Cases

(with competing mortality)

General risk factors	Major Fracture HR (95% CI)	Cancer Site	Major Fracture HR (95% CI)
Female (vs Male)	1.78 (1.63-1.94)	Colorectal	1.00 (referent)
Age (per 10 years)	1.60 (1.55-1.64)	Hepatobiliary	1.44 (1.05-1.98)
Prior major fracture	2.06 (1.89-2.25)	Hematological	1.40 (1.18-1.67)
COPD	1.10 (0.97-1.24)	Myeloma/NHL	1.36 (1.17-1.58)
Rheumatoid arthritis	1.50 (1.21-1.87)	Lung	1.32 (1.15-1.52)
High alcohol	1.45 (1.14-1.83)	Others	1.25 (1.08-1.46)
Glucocorticoid use	1.55 (1.24-1.94)	Upper GI	1.25 (0.97-1.62)
Charlson=1 vs 0	1.19 (1.08-1.32)	Urinary Tract	1.02 (0.87-1.20)
Charlson=2 vs 0	1.11 (1.02-1.20)	Head and Neck	0.95 (0.76-1.18)
Charlson=3+ vs 0	1.32 (1.20-1.45)	Breast	0.93 (0.83-1.04)
SEFI quintile 2 vs 1	1.09 (0.98-1.20)	Prostate	0.92 (0.80-1.06)
SEFI quintile 3 vs 1	1.05 (0.95-1.17)	Melanoma	0.90 (0.79-1.02)
SEFI quintile 4 vs 1	1.10 (1.00-1.22)	Gynecological	0.76 (0.65-0.88)
SEFI quintile 5 vs 1	1.19 (1.08-1.32)	Thyroid	0.51 (0.35-0.75)
SEFI missing vs 1	1.62 (1.10-2.38)		





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Cox regression (with competing mortality)	Major Fracture HR (95% CI)	Stage adjusted HR (95% CI)	Stages I and II HR (95% CI)	Stages III and IV HR (95% CI)
Female (vs Male)	1.78 (1.63-1.94)	1.83 (1.61-2.08)	2.00 (1.65-2.43)	1.79 (1.41-2.27)
Age (per 10 years)	1.60 (1.55-1.64)	1.60 (1.54-1.68)	1.72 (1.63-1.82)	1.55 (1.42-1.69)
Prior major fracture	2.06 (1.89-2.25)	2.14 (1.88-2.42)	2.32 (1.97-2.72)	1.55 (1.17-2.05)
COPD	1.10 (0.97-1.24)	1.09 (0.91-1.30)	1.06 (0.84-1.36)	1.25 (0.88-1.77)
Rheumatoid arthritis	1.50 (1.21-1.87)	1.26 (0.89-1.78)	1.26 (0.80-1.97)	2.02 (1.08-3.76)
High alcohol	1.45 (1.14-1.83)	1.08 (0.65-1.80)	1.34 (0.74-2.44)	0.89 (0.33-2.40)
Prolonged glucocorticoid use	1.55 (1.24-1.94)	1.54 (1.09-2.16)	1.85 (1.20-2.84)	1.17 (0.51-2.65)
Charlson=1 vs 0	1.19 (1.08-1.32)	1.13 (0.97-1.32)	1.25 (1.03-1.51)	0.72 (0.51-1.04)
Charlson=2 vs 0	1.11 (1.02-1.20)	1.16 (1.02-1.31)	1.13 (0.95-1.33)	0.96 (0.75-1.24)
Charlson=3+ vs 0	1.32 (1.20-1.45)	1.31 (1.14-1.50)	1.35 (1.12-1.63)	1.04 (0.80-1.37)
SEFI quintile 2 vs 1	1.09 (0.98-1.20)	1.22 (1.04-1.42)	1.35 (1.10-1.66)	1.40 (1.02-1.94)
SEFI quintile 3 vs 1	1.05 (0.95-1.17)	1.14 (0.97-1.33)	1.16 (0.93-1.43)	1.24 (0.89-1.72)
SEFI quintile 4 vs 1	1.10 (1.00-1.22)	1.15 (0.98-1.36)	1.21 (0.98-1.50)	1.24 (0.89-1.72)
SEFI quintile 5 vs 1	1.19 (1.08-1.32)	1.35 (1.15-1.60)	1.51 (1.22-1.88)	1.18 (0.83-1.68)
SEFI missing vs 1	1.62 (1.10-2.38)	2.09 (1.24-3.52)	3.24 (1.79-5.86)	0.52 (0.07-3.74)
Breast (vs Colorectal)	0.93 (0.83-1.04)	0.99 (0.83-1.18)	1.02 (0.82-1.27)	0.69 (0.46-1.02)
Gynecological	0.76 (0.65-0.88)	0.82 (0.64-1.04)	0.85 (0.63-1.15)	0.78 (0.50-1.22)
Hematological	1.40 (1.18-1.67)	1.37 (1.01-1.86)	2.77 (1.21-6.32)	0.47 (0.07-3.35)
Head and Neck	0.95 (0.76-1.18)	1.04 (0.74-1.46)	1.10 (0.70-1.72)	0.80 (0.44-1.43)
Hepatobiliary	1.44 (1.05-1.98)	1.61 (1.08-2.39)	1.87 (1.12-3.11)	0.79 (0.32-1.96)
Lung	1.32 (1.15-1.52)	1.36 (1.10-1.67)	1.21 (0.90-1.63)	1.59 (1.16-2.18)
Myeloma/NHL	1.36 (1.17-1.58)	1.38 (1.11-1.73)	1.30 (0.90-1.90)	1.08 (0.75-1.56)
Others	1.25 (1.08-1.46)	1.22 (0.94-1.58)	1.53 (0.96-2.44)	1.74 (0.95-3.18)
Prostate	0.92 (0.80-1.06)	0.88 (0.70-1.11)	0.95 (0.70-1.27)	0.92 (0.60-1.40)
Melanoma	0.90 (0.79-1.02)	0.94 (0.77-1.14)	0.96 (0.75-1.24)	0.93 (0.63-1.36)
Thyroid	0.51 (0.35-0.75)	0.41 (0.22-0.78)	0.50 (0.23-1.08)	0.34 (0.11-1.06)
Upper GI	1.25 (0.97-1.62)	1.16 (0.77-1.74)	1.10 (0.54-2.25)	1.02 (0.51-2.02)
Urinary Tract	1.02 (0.87-1.20)	1.24 (0.98-1.58)	1.36 (1.01-1.84)	1.16 (0.74-1.82)





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Males: Cox regression (with competing mortality)	Major Fracture HR (95% CI)	Females: Cox regression (with competing mortality)	Major Fracture HR (95% CI)
Age (per 10 years)	1.48 (1.41-1.57)	Age (per 10 years)	1.66 (1.60-1.71)
Prior major fracture	2.42 (2.01-2.92)	Prior major fracture	1.95 (1.76-2.15)
COPD	1.03 (0.84-1.27)	COPD	1.14 (0.98-1.33)
Rheumatoid arthritis	1.40 (0.85-2.30)	Rheumatoid arthritis	1.53 (1.20-1.95)
High alcohol	1.24 (0.86-1.79)	High alcohol	1.60 (1.17-2.18)
Prolonged glucocorticoid use	1.51 (0.98-2.32)	Prolonged glucocorticoid use	1.58 (1.22-2.06)
Charlson=1 vs 0	1.22 (1.02-1.47)	Charlson=1 vs 0	1.17 (1.04-1.33)
Charlson=2 vs 0	1.15 (1.00-1.33)	Charlson=2 vs 0	1.08 (0.98-1.19)
Charlson=3+ vs 0	1.34 (1.14-1.58)	Charlson=3+ vs 0	1.31 (1.17-1.46)
SEFI quintile 2 vs 1	1.05 (0.88-1.25)	SEFI quintile 2 vs 1	1.11 (0.97-1.25)
SEFI quintile 3 vs 1	1.00 (0.83-1.20)	SEFI quintile 3 vs 1	1.07 (0.95-1.21)
SEFI quintile 4 vs 1	1.25 (1.05-1.48)	SEFI quintile 4 vs 1	1.04 (0.92-1.17)
SEFI quintile 5 vs 1	1.35 (1.13-1.61)	SEFI quintile 5 vs 1	1.12 (0.99-1.27)
SEFI missing vs 1	2.24 (1.22-4.12)	SEFI missing vs 1	1.36 (0.83-2.25)
Breast (vs Prostate)	2.20 (0.98-4.92)	Colorectal (vs Breast)	2.69 (0.82-8.95)
Colorectal (vs Prostate)	0.83 (0.14-4.89)	Gynecological (vs Breast)	0.82 (0.71-0.94)
Hematological (vs Prostate)	1.30 (0.97-1.74)	Hematological (vs Breast)	1.59 (1.31-1.94)
Head and Neck (vs Prostate)	0.96 (0.72-1.29)	Head and Neck (vs Breast)	1.05 (0.79-1.41)
Hepatobiliary (vs Prostate)	1.23 (0.67-2.25)	Hepatobiliary (vs Breast)	1.70 (1.18-2.45)
Lung (vs Prostate)	1.39 (1.10-1.77)	Lung (vs Breast)	1.43 (1.23-1.66)
Myeloma/NHL (vs Prostate)	1.67 (1.33-2.09)	Myeloma/NHL (vs Breast)	1.35 (1.14-1.60)
Others (vs Prostate)	1.29 (1.02-1.63)	Others (vs Breast)	1.33 (1.12-1.58)
Melanoma (vs Prostate)	0.98 (0.81-1.19)	Melanoma (vs Breast)	0.95 (0.83-1.10)
Thyroid (vs Prostate)	0.37 (0.12-1.16)	Thyroid (vs Breast)	0.59 (0.39-0.89)
Upper GI (vs Prostate)	1.50 (1.04-2.18)	Upper GI (vs Breast)	1.20 (0.86-1.69)
Urinary Tract (vs Prostate)	1.04 (0.83-1.31)	Urinary Tract (vs Breast)	1.12 (0.92-1.37)



Discussion



Limitations

- Administrative data for fractures (e.g., fracture etiology not accurate)
- Staging data incomplete before 2004
- Difficulty with high quality matches (esp. early years, elderly)

Strengths

- Population based cancer registry and linkable data
- Stable population, long term fracture prediction





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Summary

- Fracture risk increases and remains increased for up to 10 years after cancer diagnosis, and this is seen overall and for most cancer diagnoses
- Risk factors for fracture are similar to traditional risk factors in the non-cancer population.



Acknowledgements

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Extra Slides



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Major Fracture Incidence Rate Ratios (95% CIs) by Cancer Site

	-10 to -5	-5 to -1	-1 to 0	0 to 1	1 to 5	5 to 10
Breast	0.84 (0.75-0.95)	0.80 (0.74-0.87)	0.82 (0.69-0.98)	0.83 (0.07-0.98)	1.19 (1.11-1.28)	1.39 (1.25-1.54)
Colorectal	0.82 (0.72-0.93)	0.80 (0.73-0.87)	0.75 (0.62-0.90)	0.95 (0.80-1.13)	1.16 (1.07-1.27)	1.32 (1.16-1.51)
Gynecological	0.9 (0.75-1.06)	0.89 (0.79-1.01)	0.69 (0.52-0.91)	0.82 (0.62-1.08)	0.97 (0.86-1.10)	0.97 (0.80-1.16)
Hematological	0.93 (0.70-1.24)	0.92 (0.76-1.12)	1.33 (0.93-1.89)	1.17 (0.80-1.71)	1.41 (1.19-1.68)	1.53 (1.19-1.97)
Head / Neck	1.18 (0.90-1.54)	1.33 (1.10-1.60)	0.68 (0.41-1.12)	1.26 (0.86-1.82)	1.43 (1.18-1.74)	1.63 (1.23-2.15)
Hepatobiliary	1.07 (0.85-1.33)	0.97 (0.83-1.14)	1.23 (0.92-1.65)	1.58 (1.07-2.34)	0.94 (0.59-1.52)	1.68 (0.73-3.87)
Lung	1.08 (0.96-1.22)	1.14 (1.05-1.24)	1.44 (1.22-1.69)	1.88 (1.59-2.23)	1.37 (1.21-1.56)	1.66 (1.36-2.04)
Myeloma/NHL	1.01 (0.83-1.23)	0.86 (0.75-0.99)	2.68 (2.19-3.27)	2.11 (1.68-2.66)	1.40 (1.22-1.60)	1.52 (1.24-1.87)
Prostate	1.08 (0.90-1.30)	0.98 (0.86-1.11)	1.01 (0.79-1.30)	1.14 (0.89-1.44)	1.55 (1.41-1.71)	1.45 (1.26-1.67)
Melanoma	0.92 (0.79-1.07)	0.85 (0.77-0.94)	0.99 (0.80-1.23)	1.10 (0.90-1.36)	1.00 (0.89-1.12)	0.95 (0.79-1.14)
Thyroid	1.10 (0.67-1.82)	1.09 (0.75-1.59)	0.75 (0.26-2.19)	0.32 (0.07-1.34)	0.87 (0.59-1.29)	0.96 (0.52-1.74)
Upper GI	0.79 (0.60-1.04)	0.81 (0.67-0.97)	0.82 (0.57-1.19)	1.05 (0.71-1.56)	1.07 (0.82-1.41)	1.12 (0.68-1.84)
Urinary Tract	0.99 (0.79-1.24)	0.97 (0.84-1.13)	1.06 (0.80-1.39)	1.42 (1.10-1.85)	1.30 (1.13-1.50)	1.46 (1.18-1.80)
	0.84	0.92	1.51	1.27	1.16	1.21





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Incidence Rate Ratios (95% CIs) by Fracture Site – 1996-2013

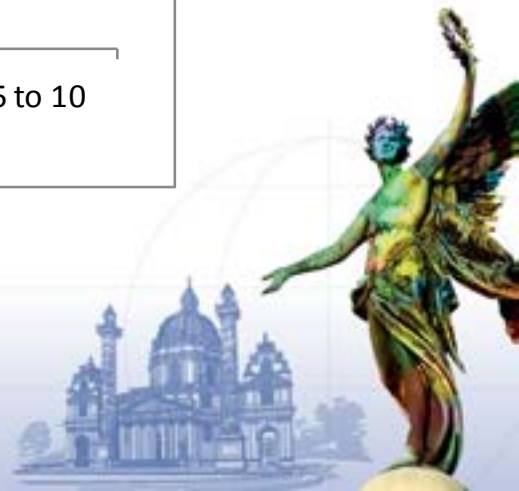
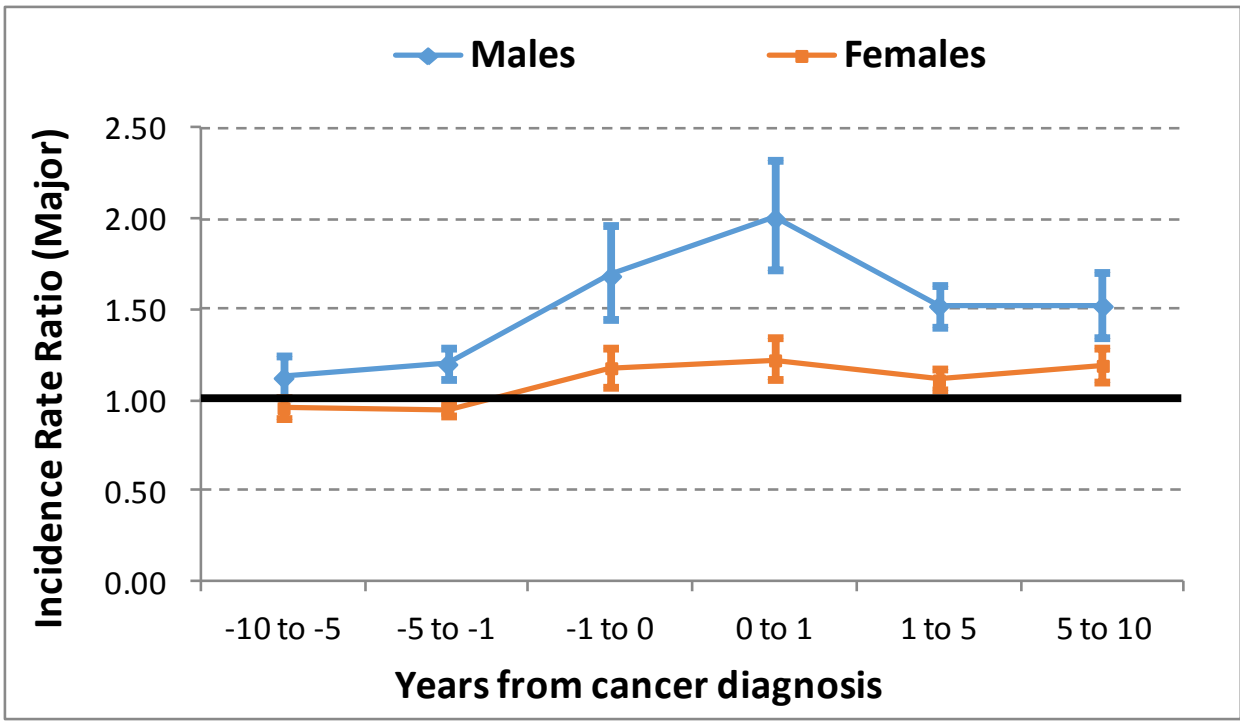
Years before (-) or after (+) diagnosis	Hip	Wrist	Humerus	Spine	Any
-10 to -5	0.85 (0.75,0.97)	1.00 (0.92,1.08)	0.95 (0.84,1.06)	1.03 (0.92,1.15)	0.97 (0.92,1.02)
-5 to -1	0.79 (0.73,0.86)	1.02 (0.96,1.08)	1.04 (0.96,1.13)	1.05 (0.97,1.13)	0.98 (0.94,1.01)
-1 to 0	0.99 (0.85,1.15)	1.00 (0.85,1.17)	1.33 (1.11,1.60)	2.00 (1.74,2.31)	1.26 (1.16,1.36)
0 to +1	1.20 (1.05,1.38)	0.96 (0.80,1.15)	1.52 (1.27,1.83)	2.00 (1.72,2.32)	1.36 (1.26,1.48)
+1 to +5	1.09 (1.02,1.17)	1.08 (1.00,1.08)	1.29 (1.17,1.41)	1.46 (1.34,1.59)	1.20 (1.15,1.25)
+5 to +10	1.16 (1.04,1.29)	1.19 (1.05,1.34)	1.38 (1.19,1.60)	1.54 (1.34,1.76)	1.26 (1.19,1.35)





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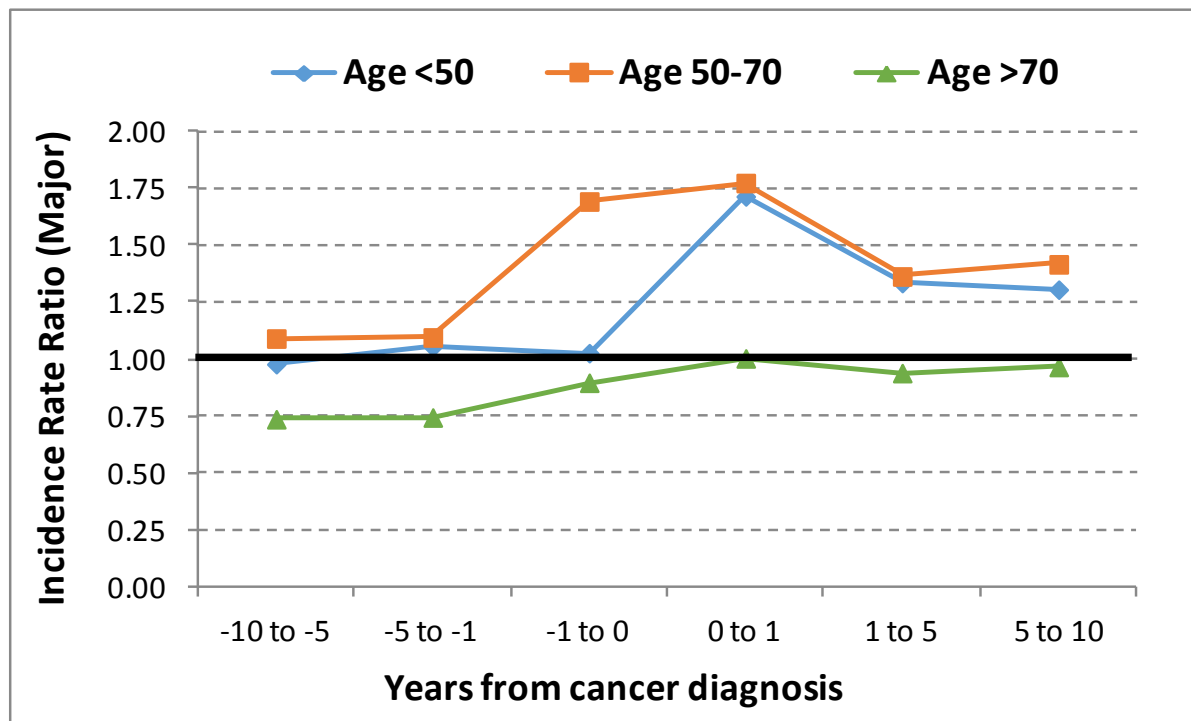
Major Fracture Incidence Rate Ratios (95% CIs) by Sex – 1996-2013





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Major Fracture Incidence Rate Ratios by Age – 1996-2013





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Major Fracture Incidence Rate Ratios (95% CIs) by Cancer Site – 1996-2013

	0 to 1y	1 to 5y	5 to 10y
Breast	0.96 (0.78-1.18)	1.22 (1.12-1.34)	1.39 (1.22-1.58)
Colorectal	1.25 (1.01-1.54)	1.21 (1.08-1.35)	1.36 (1.14-1.61)
Gynecological	0.93 (0.65-1.31)	0.97 (0.83-1.14)	1.01 (0.79-1.29)
Hematological	1.31 (0.76-2.23)	1.48 (1.14-1.92)	1.61 (1.08-2.39)
Head / Neck	1.60 (1.04-2.47)	1.47 (1.19-1.80)	1.53 (1.12-2.09)
Hepatobiliary	2.09 (1.33-3.30)	1.42 (0.89-2.28)	2.96 (1.28-6.80)
Lung	2.15 (1.75-2.65)	1.49 (1.28-1.73)	1.83 (1.42-2.37)
Melanoma	1.17 (0.91-1.49)	0.94 (0.82-1.08)	0.86 (0.69-1.08)
Myeloma/NHL	2.36 (1.78-3.12)	1.43 (1.21-1.69)	1.48 (1.15-1.92)
Prostate	1.62 (1.16-2.26)	1.63 (1.43-1.86)	1.47 (1.20-1.79)
Thyroid	0.42 (0.10-1.81)	0.88 (0.54-1.42)	0.88 (0.37-2.10)
Upper GI	1.52 (0.95-2.45)	1.25 (0.89-1.75)	1.56 (0.90-2.73)
Urinary Tract	1.76 (1.26-2.46)	1.37 (1.14-1.66)	1.61 (1.21-2.14)
Others	1.40 (1.06-1.85)	1.14 (0.97-1.34)	1.18 (0.91-1.54)



Bone and Musculoskeletal Study

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- Join us...
- Email: bjedwards2400@gmail.com
- Projects: Epidemiology of Fractures in SEER-Medicare (USA)
- Epidemiologic studies internationally
- Mechanisms of bone loss,
- Assess new agents: Imatinib, Immune-therapy (current RCTs or clinical practice)
- Assess fractures as AEs in the FDA Adverse event reporting, ADRAC, EMA, HealthCanada, others
- Assess QoL in cancer patients who suffer a fracture
- Are cancer patient who suffer fractures being assessed and treated for osteoporosis



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