| Project InitiationThis Section must be Completed Prior to Project Dataset(s) Creation |
| --- |
| **Project Title:** | Real World Outcomes and Costs of Osteoporosis Fractures in Ontario, Canada |
| **Project TRIM number:** | P2018 0970 103 000 |
| **Research Program:** | DAS |
| **Site:** | ICES Central |
| **Project Objectives:** | *Insert Project Objectives as listed in the approved ICES Project PIA* |
| **Primary Objectives*** To describe the incidence of primary fragility fractures in patients over 65 years of age in Ontario, Canada;
* To describe the real-world management, including screening and treatment and Health Resource Utilization (HRU) following a primary fragility fracture in patients over 65 years of age in Ontario, Canada.

**Secondary Objectives*** To characterize the publicly-insured Ontario fragility fracture patient;
* To describe patient management, including screening and treatment, prior to a fragility fracture in patients over 65 years of age in Ontario, Canada; and
* To describe the rate of subsequent fractures, related procedures, complications hospitalizations and mortality subsequent to a primary fragility fracture in Ontario, Canada.

**Exploratory Objectives*** To describe the persistence to osteoporosis treatments in patients over 65 years of age who have had a fragility fracture in Ontario, Canada;
* To describe comorbidities of interest and steroid-use in patients over 65 years of age who have had a fragility fracture in Ontario, Canada;
* To describe opioid pain medications in patients over 65 years of age prior to, and following a fragility fracture in Ontario, Canada;
* To describe the HRU costs for matched patients who have not had a fragility fracture; and
* To describe mortality for matched patients who have not had a fragility fracture
 |
| **ICES Project PIA Initial Approval Date:** | *The ICES Employee or agent who is responsible for creating the Project Dataset(s) is responsible for ensuring there is an approved ICES Project PIA and verifying the date of approval prior to creating the Project Dataset(s)* |
| 2017-09-25 |
| **Principal Investigator (PI):** | Louisa PericleousTel : (905) 285-3123louisap@amgen.comPonda Motsepe-DitshegoTel: (905) 285-3002pondam@amgen.com |
| **Check the applicable box if the PI is an ICES Student/Trainee** | [ ]  ICES Student [ ]  ICES Fellow [ ]  ICES Post-Doctoral Trainee [ ]  Visiting Scholar |
| **Responsible ICES Scientist:** | *Name the Responsible ICES Scientist if the PI is not a Full Status ICES Scientist* |
| Refik Saskinrefik.saskin@ices.on.ca |
| **Project Team Member(s) Responsible for Project Dataset Creation and/or Statistical Analysis and date joined (list all):** | *All person(s) (ICES Analyst, Appointed Analyst, Analytic Epidemiologist, PI, and/or Student) responsible for creating the Project Dataset(s) and/or statistical analysis on the Research Analytics Environment (RAE) and the date they joined the project must be recorded* |
| Analytical Epidemiologist: Ryan Ngryan.ng@ices.on.caAnalyst: Lisa EllisonLisa.ellison@ices.on.caEliane KimEliane.kim@ices.on.ca  | 2017-OCT-172018-MAR-202018-JUN-06 |
| **Other ICES Project Team Members and date joined (list all):** | *All other Research Project Team Members (e.g., Research Administrative Assistants, Research Assistants, Project Managers, Epidemiologists) and the date they joined the project must be recorded* |
| Project Manager: Lisa Ishigurolisa.ishiguro@ices.on.ca | 2017-OCT-11 |
| **Confirmation that DCP is consistent with Project Objectives:** | *The following individuals must confirm that the ICES Data provided for in this DCP is relevant (e.g., with respect to cohort, timeframe, and variables) and required to achieve the Project Objectives stated in the ICES Project PIA prior to initial Project Dataset creation: 1) PI; 2) Responsible ICES Scientist if the PI is not a Full Status ICES Scientist, or a second ICES Scientist or the Scientific Program Lead if the PI is creating both the DCP and the Project Dataset[s]; 3) ICES Research and Analysis Staff creating the DCP; and 4) ICES Analytic Staff (ICES Employee or agent responsible for creating the Project Dataset[s]). This may be delegated either verbally or via e-mail.* |
| ***Principal Investigator*** | [x]  | 2018-APR-26 |
| ***Responsible ICES Scientist or Second ICES Scientist/Lead*** | [ ]  | yyyy-mon-dd |
| ***ICES Research and Analysis Staff Creating the DCP*** | [x]  | 2018-APR-26 |
| ***ICES Analytic Staff*** | [x]  | 2018-APR-26 |
| **Designated ICES Research and Analysis Staff accountable for Project Documentation:** | *The person named (ICES staff) is accountable for ensuring that the approved ICES Project PIA, ICES Project PIA Amendments, and DCP are saved on the T Drive, ensuring ICES Project PIA Amendments are submitted as required, ensuring DCP Amendments are documented, and sharing the final DCP with the PI/Responsible ICES Scientist at project completion* |
| Eliane Kim (formerly Lisa Ellison) |
| **DCP Creation Date and Author:** | *Date DCP was finalized prior to Project Dataset(s) creation* | *Name of person who created the DCP* |
| ***Date*** | ***Name*** |
| 2018-MAR-13 | Ryan Ng, Amgen |

| ICES DataThis Section must be Completed Prior to Project Dataset(s) Creation |
| --- |
| *The ICES Employee or agent who is responsible for creating the Project Dataset(s) must ensure that this list includes only data listed in the ICES Project PIA**Changes to this list after initial ICES Project PIA approval require an ICES Project PIA Amendment* | *Mandatory for all datasets that are available by individual year* |
| ***General Use Datasets – Health Services*** | ***Years (where applicable)*** |
| CCRS | 2010 to 2017 |
| CIHI DAD | 2006 to 2017 |
| CIHI SDS | 2006 to 2017 |
| CONTACT | 2006 to 2017 |
| HCDMOH | 2016 to 2015 |
| NACRS | 2006 to 2017 |
| NRS | 2010 to 2017 |
| ODB | 2006 to 2017 |
| OHIP | 2006 to 2017 |
| OMHRS | 2010 to 2017 |
| ***General Use Datasets – Care Providers*** |  |
| CPDB | 2006 to 2017 |
| See list |  |
| ***General Use Datasets – Population*** |  |
| POP | 2006 to 2017 |
| RPDB | 2006 to 2017 |
| ***General Use Datasets – Coding/Geography*** |  |
| REF | 2006 to 2017 |
| PCCF | 2006 to 2017 |
| ***General Use Datasets – Facilities*** |  |
| INST | 2006 to 2017 |
| ***General Use Datasets – Other*** |  |
| ADP | 2010 to 2016 |
| ASTHMA | 1988 to 2016 |
| CAPE | 2006 to 2016 |
| CHF | 1988 to 2016 |
| COPD | 1988 to 2016 |
| MIS | 2010 to 2016 |
| ODD | 1988 to 2016 |
| OMID | 1988 to 2016 |
| OTR | 2011 to 2017 |
| ORAD | 1988 to 2016 |
| See list |  |
| ***Controlled Use Datasets*** |  |
| OCR | 1988 to 2016 |
| ORRS | 2010 to 2016  |
| See list |  |
| ***Other Datasets*** |  |
| CJRR | 2010 to 2016 |
| ESTSOB | 2010 to 2016 |
|  |  |

| Project Amendments and Reconciliation |
| --- |
| **ICES Project PIA Amendment History (add additional rows as needed):** | *Privacy approval date* | *Person who submitted amendment* | *Note that any changes to the list of ICES Data or Project Objectives require an ICES Project PIA Amendment* |
| ***Date*** | ***Name*** | ***Amendment*** |
| yyyy-mon-dd |  |  |
| **DCP Amendment History (add additional rows as needed):** | *Date DCP amended* | *Person who made the DCP amendment* | *Note that any DCP amendments involving changes to the list of ICES Data or Project Objectives require an ICES Project PIA Amendment* |
| ***Date*** | ***Name*** | ***Amendment*** |
| 2018-JUL-182018-AUG-082018-NOV-022018-DEC-132019-FEB-28 | Eliane KimEliane KimEliane KimEliane KimEliane Kim | Added footnote to table 2 & 3a, added another column for table 3b & c (year 2016 & 2017); updated definition of subsequent fracturesUpdate DXCODES for appendix 5Updated billing codes for BMD screening & title for Table 13Update definition of persistence of OP treatmentUpdate denominator definition for “all years” column in tables 2, 3a, 3b, 3c and 16 |
| **Date Programs/DCP reconciled** | *The person(s) creating the dataset and/or analyzing the data are responsible for ensuring that the final DCP reflects the final program(s) when the project is completed* |
| 2019-MAR-31 |

| Project Cohort |
| --- |
| **Study Design** | [x]  Cohort study [x]  Matched cohort study [ ]  Case-control study[ ]  Cross-sectional study [ ]  Other (specify):  |
| **Index Event / Inclusion Criteria** | **Fragility fracture** in persons aged 66 years and older at the time of the index event, between January 1, 2011 and Marchr 31, 2015 – *DAD / SDS / ED* databases* Definition:
	+ *DAD/SDS: dx10code1-25* withMain diagnosis or admitting diagnosis (*dxtype1-25=M,1)*
	+ *NACRS: dx10code1-dx10code10*
	+ Types:
		- Hip
		- Humerus
		- Vertebral
		- Wrist
		- Pelvis
		- Femur
		- Clavicle, ribs and sternum
		- Radius and ulna
		- Other (tibia, fibula, knee, foot)
	+ See **Appendix 1** for ICD-10 codes for fragility fractures
	+ Identify individuals with single fractures and multiple fractures (i.e. more than one fracture type during the index fracture)
* Index date:
	+ Admission date – *admdate* (*DAD/SDS*)
	+ Registration date – *regdate* (*NACRS*)
* Calculate as (see **Statistical analyses** for more details):
	+ Incidence
	+ Incident frature proportion
 |
| **Estimated Size of Cohort** **(if known)** | 30,000-35,000 per year150,000-175,000 total |
| **Exclusions (in order)****\***Provide a table showing the inclusion and exclusion frequencies. | *Step* | Description |
| 1 | Invalikd IKN. |
| 2 | Event date after date of death. |
| 3 | Missing age or sex. |
| 4 | Age > 105 years.* Data are unstable for these individuals
 |
| 5 | Non-Ontario residence (PRCDDABLK does not begin with 35). |
| 6 | Exclude if the fragility fracture is associated with a trauma code (e.g. accident, polytrauma)* See **Appendix 2** for a list of trauma codes
 |
| 7 | Previous fragility fracture (5-year lookback from index date) PRIOR to 01Jan2011 (from 01Jan2006 to 01Jan2011).* Use the same definition and codes as the fragility fracture index event definition
 |

| Project Time Frame Definitions |
| --- |
| Look-back WindowObservation Window(in which to look for outcomes)**Index Event Date**Accrual WindowMax Follow-up Date |
| **Accrual Start/End Dates** | January 1, 2011 to March 31, 2015  |
| **Max Follow-up Date** | March 31, 2017 |
| **When does observation window terminate?** | March 31, 2017 |
| **Lookback Window(s)** | Five years (start January 1, 2006) |

| Variable Definitions (add additional rows as needed) |
| --- |
| **Main Exposure or Risk Factor** | No main exposure. |
| **Primary Outcome Definition** | Concurrent osteoporosis treatment (OP) - *ODB** Types:
	+ Denosumab
	+ Bisphosphonates, oral and IV
	+ Teriparatide
	+ Raloxifene
	+ Hormone-replacement therapy
* See **Appendix 3** for DIN list
* Obtain at the time of the index fracture. Check for medications during the index event (i.e. ED visit, hospitalization) and up to 7 days after discharge.
	+ Indicator variable for treatment for osteoporosis (Y/N)
	+ Indicator variable for each type of treatment (Y/N)
* Calculate as:
	+ Proportion, for any OP treatment and by treatment type

Bone mineral density (BMD) screening requisition - *OHIP** 1 OHIP billing code for BMD:
	+ X142, X145, X146, X148, X149, X152, X153, X155
* Check for BMD screening in Year 1, Year 2, and Year 3 and beyond (i.e. Year 3+) after the fracture.
* Create an indicator variable for BMD screening for Year 1, Year 2 and Year 3+ (Y/N). All individuals have at least one year of follow-up so everyone will have an indicator for Year 1 , but not necessarily for Year 2 and beyond.
* Calculate as (see **Statistical Model(s)** box).:
	+ Rate (1 year, 2 years, 3+ years)
	+ Proportion (1 year, 2 years, 3+ years)
* \***Note**: BMD results are not available, only the date of the BMD assessment

HRU costs * Types:
	+ Hospitalization
		- Consists of: Inpatient hospitalization (DAD), Same Day Surgery (SDS)
	+ Inpatient rehabilitation
		- Rehabilitation (NRS)
	+ Assisted devices
		- Assisted Device Program
	+ Prescription Drug costs (ODB)
	+ CCRS, home care, LTC
	+ Other health care services . Consists of:
		- ED visits (NACRS) – ED only; not including cancer and renal visits
		- Hospital outpatient clinc
		- OHIP Physician billings, including most of the shadow-billings
		- OHIP Lab claims (all OHIP billings having a feecode beginning with ‘L’)
		- OHIP non-physician billings
		- \***Note**: exclude FHO/FHN capitation costs
* Calculate HRU costs for Year 1, Year 2 and Year 3+ after the fracture. Calculate the total HRU costs and the costs by specific health service (listed above). All individuals have at least one year of follow-up so everyone will contribute costs for Year 1, but not necessarily for Year 2 and beyond. Year 1 costs include the ED/inpatient costs associated with the index fracture.
	+ Denominator is person-years iof follow-up
* Standardize the cost to 2017 dollars, or the most recent year if possible
* Calculate mean, standard deviation, quartile 1 and quartile 3.

\***Note**: Some of the costs might not be available for the most recent year, but we can let you know during the analysis phase. |
| **Secondary Outcome Definition(s)** | Subsequent fractures - *DAD / SDS / ED* databases* See **Appendix 1** for diagnostic codes
* Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up so all patients will contribute to Year 1, but not necessarily for Years 2 and beyond.
* Fractures of the same type that are dated within 91 days of one another are assumed to stem from the same fracture and will not be counted as a subsequent fracture
	+ If a patient has a diagnosis of a fracture in the DAD and then a diagnosis of the same type of fracture in NACRS within the next 91 days, the fracture in NACRS will not be counted as a second fracture – use DAD admdate date
* For “multiple fractures”, see appendix 8 for further details on how to exclude subsequent fractures within 91 days
* Calculate as (see **Statistical analyses** for more details):
	+ Rate (1 year, 2 years, 3+ years)
	+ Time-to-event (event is first subsequent fracture)
	+ Proportion (1 year, 2 years, 3+ years)
* \***Note**: do not consider trauma tractures when looking for subsequent fractures.

Fragility fracture-related surgical technique procedures (e.g. hip replacement, insertion of nails/plates, arthroplasty) – *DAD / SDS** 1 fragility fracture-related surgical procedure based on CCI codes. See **Appendix 4** for a list of CCI codes.
	+ The initial fragility fracture surgery/procedure is based on code from the intial surgery column that is not a revision (i.e. no R i*natstat*)
	+ Revision fragility fracture surgery/procedure is based on codes from the initial surgery column that is a revision (i.e. R *inatstat*) or codes from the revision surgery column
* Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up so all patients will contribute to Year 1, but not necessarily for Years 2 and beyond.
* Calculate as (see **Statistical analyses** for more details):
	+ Proportion (1 year, 2 years, 3+ years)

Complications* Types:
	+ Infections related to surgery – *DAD / SDS, NACRS, OHIP*
	+ Venous thromboembolism (VTE), includes DVT and PE – *DAD/SDS, NACRS*
	+ Pneumonia – *DAD/SDS, NACRS, OHIP and physician claims*
	+ Myocardial infarction – *DAD/SDS , NACRS*
	+ Complications related to prosthetic devices – *DAD/SDS, NACRS*
	+ Refracture due to the surgical procedure (see paper) – *DAD/SDS, NACRS*
* 1 pertinent ICD-9 or 10 code needed to identify the complication.‘See **Appendix 5** for a list of diagnosis codes for complications
* For each complication, check up to 30 days after the index fracture
* Calculate as (see **Statistical analyses** for more details):
	+ Proportion (1 year, 2 years, 3+ years)

Hospitalizations, all-cause – *DAD** Any hospitalization, including the index hospitalization associated with the index fracture
* Look at by unique episodes (*epi*)
* Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up so all patients will contribute to Year 1, but not necessarily for Years 2 and beyond.
* Calculate as:
	+ Proportion (1 year, 2 years, 3+ years)

Death - *RPDB** Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up so all patients will contribute to Year 1, but not necessarily for Years 2 and beyond.
* Calculate as (see **Statistical analyses** for more details):
	+ Time-to- event (event is death)
	+ Proportion (1 year, 2 years, 3+ years)

Knee and hip replacments - *CJRR** Use CJRR to note the number of hip and knee replacements for the cohort
* Report the number receiving a knee or hip replacement at any time after the fracture
 |
| **Exploratory Outcome definition(s):**  | Persistence to osteoporosis treatment – *ODB** Definition: Time on any OP treatment during the study period based on days supplied of medication. Allow switches between different treatment.
* Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up so all patients will contribute to Year 1, but not necessarily for Year 2.
* Allowable buffer time between dosing of next drug:
	+ Denosumab: dosing Q6 monthly: 60 day gap allowed
	+ Bisphosphonates, oral and IV: Dosing differs depending on drug. For Zoledronic Acid, dosing is yearly: allow 60 day gap. For all other BPs, dosing is daily, weekly or monthly: allow 30 day gap.
	+ Teriparatide: allow 30 day gap.
	+ Raloxifene: allow 30 day gap.
* No not count HRT when calculating persistence. Just calculate the proportion of people on HRT in 1-year, 2-years
* Calculate as (see **Statistical analyses** for more details):
	+ Time-to-event (event is non-persistence)
	+ Proportion (1 year, 2 years)

Subsequent OP treatment* OP treatments in **Appendix 3 (**Include HRT)
* Need a minimum of 1 Rx to count as an OP treatment in that year
* Calculate as (see **Statistical analyses** for more details):
	+ Proportion (Year 1, Year 2, etc…)
	+ \***Note**: For year 1, exclude the 7 days after discharge as this is counted in the concurrent OP treatment definition

Opioid use after fragility fracture - *ODB** Follow-up starting from the index fracture up until end of the study period. All patients will have a minimum of 1-year of follow-up up so all patients will contribute to Year 1, but not necessarily for Years 2 and beyond.
* Classify as high dose (>= 50 morphine milligram equivalents (MEE)), low dose (>0 and <50 MEEs), or no dose
	+ \***Note:** See table in baseline characteristics for more details on MEE
* Calculate as:
	+ Number of prescriptions filled
* See **Appendix 7** for DIN list of opiods
 |
| **Baseline Characteristics** | Age – *RPDB** 66-70, 71-75, 76-80, 81-85, 86+ years

Sex - *RPDB* Treatment location - *INST.AMINSTINST / INST.HOSP\_DB* * Thee treatment location of the index event is rural (Y/N)
	+ Use the postal code of the institution to define rurality

Type of hospital - *INST.TEACHINGINST / INST.AMINSTINST** Small community, large community, teaching

Comorbidities (identified at baseline) * Osteoarthritis – *OHIP, DAD/SDS, NACRS*
	+ 1 ICD-9 or ICD-10 code (see **Appendix** 6)
	+ Check within a year prior to the index event.
* Asthma - *ASTHMA* database
* COPD – *COPD*
* Rheumatoid arthritis - *ORAD*
* Psoriasis – *OHIP, DAD/SDS, NACRS*
	+ 1 ICD-9 or ICD-10 code (see **Appendix** 6)
	+ Check within a year prior to the index event.
* Spondyloarthropathies (SPA) – *OHIP, DAD/SDS, NACRS*
	+ 1 ICD-9 or ICD-10 code (see **Appendix** 6)
	+ Check within a year prior to the index event.
* Cancer – *OCR*
* Chronic Kidney Disease (CKD) - *ORRS*
* Diabetes mellitus - *ODD*
* Cerebrovascular events (including MI and stroke)- *OMID, DAD/SDS, NACRS, OHIP*
	+ Record in OMID or 1 ICD-9 or ICD-10 code
	+ Check within a year prior to the index event.
* Dementia – *DAD / OHIP / ODB*
	+ One hospitalization code OR (three physician claims codes at least 30 days apart in a two-year period) OR a prescription filled for an Alzheimer’s and related dementias specific medication
		- Based on: Jaakkimainen RL, Bronskill SE, Tierney MC, Herrmann N, Green D, Young J, Ivers N, Butt D, Widdifield K, Tu K. (2016) *Identification of Physician-Diagnosed Alzheimer's Disease and Related Dementias in Population-Based Administrative Data: A Validation Study Using Family Physicians' Electronic Medical Records.* J Alzheimers Dis. 51(1):337-49.
* See **Appendix 6** for a list of diagnosis codes for comorbidities

Prior medications* Steroid use - *ODB*
	+ 1-year lookback
	+ Steroid use to be quantified using 7.5mg prednisone equivalents, according to the following chart (last column). Low dose prescriptions do not count, and should not be averaged at all.
	+ Calculate the proportion of individuals with an average greater than 7.5mg predniose equivalents per day.The dosing period has to be at least 3 months in the year prior to index. The dosing period does not have to be continuous (i.e. there can be gaps).
	+ See **Appendix** **7** for DIN list of steroids

|  |  |  |
| --- | --- | --- |
| **Steroid** | **Equivalent milligram dosage** | **Equivalent to 7.5mg prednisone** |
| Cortisone (cortisone acetate) | 25 | 37.5 |
| Hydrocortisone | 20 | 30 |
| Prednisolone | 5 | 7.5 |
| **Prednisone** | **5** | **7.5** |
| Methylprednisolone | 4 | 6 |
| Triamcinolone | 4 | 6 |
| Betamethasone | 0.6 | 0.9 |
| Dexamethasone | 0.75 | 1.125 |
| Budesonide | 1.25 | 1.875 |

* Opioid use - *ODB*
	+ 1-year lookback
	+ Calculate the proportion of individuals as either:
		- High dose (>= 50 morphine milligram equivalents (MME))
		- Low dose (>0 and <50 MEEs), or
		- No dose
	+ 1 opoid prescription is sufficient to classify the patient as low dose or high dose
	+ See **Appendix** **7** for DIN list of opioids

|  |  |
| --- | --- |
| **OPIOID (doses in mg/day except where noted)**  | **CONVERSION FACTOR to MME** |
| Codeine  | 0.15 |
| Fentanyl transdermal (in mcg/hr)  | 2.4 |
| Hydrocodone | 1 |
| Hydromorphone | 4 |
| Methadone |  |
| 1-20 mg/day | 4 |
| 21-40 mg/day | 8 |
| 41-60 mg/day | 10 |
| . 61-80 mg/day | 12 |
| **Morphine** | **1** |
| Oxycodone | 1.5 |
| Oxymorphone | 3 |

 |
| **Other Variables** | BMD screening requisition – *OHIP** 5-year look back
* ! of the following OHIP billing codes:
	+ X142, X145, X146, X148, X149, X152, X153, X155
* Check for screening 0-1 year prior, 1-2 years prior, 2-3 years prior, and 3-5 years prior to the fracture (i.e. index event). Create indicator variable for screening for each year (Y/N).
* Calculate as:
	+ Proportion (5 year prior)

Prior treatment for OP - *ODB** 1-year look back
* Types:
	+ Denosumab
	+ Bisphosphonates, oral and IV
	+ Teriparatide
	+ Raloxifene
	+ Hormone-replacement therapy
* See **Appendix 3** for DIN list
* Indicator variable for treatment for osteoporosis 1-year prior (Y/N)
* Indicator variable for each type of treatment 1-year prior (Y/N)
* Calculate as:
	+ Proportion (1 year prior)
 |

| Analysis Plan and Dummy Tables (expand/modify as needed) |
| --- |
| **Descriptive Tables (insert or append dummy tables), e.g.:** |
|  **Table 1. Baseline characteristics of individuals with a first fragility fracture in Ontario, 2011 to 2015** |
|  **Table 2. Incidence of fractures and and proportion of fracture types, by age, 2011 to 2015** |
| **Table 3a: Incidence of first fracture, by type and split by men vs. women****Table 3b: Incidence of 2nd fracture, by type and split by men vs. women****Table 3c: Incidence of 3rd fracture, by type and split by men vs. women** |
| Table 4a. Health resource utilization costs of fracture patients in Ontario by year, 2011 to 2015**Table 4b: Health resource utilization costs of fracture patients who have had at least one subsequent fracture, in Ontario by year, 2011 to 2015** |
| Table 5: Mean annual cost by fracture type from index event by number of comorbidities, 2011 to 2015 |
| Table 6: Mean annual costs by fracture type relative to index fracture event, 2011 to 2015 |
| Table 7: Costs of 2nd fractures based on type of initial fracture – for fracture cohort patients |
| Table 8: Time to subsequent fracture by initial/index fracture type |
| Table 9: Percent of the second fracture type based on the first fracture type |
| Table 10: Mean annual costs by fracture type relative to index fracture event by age, 2011 to 2015 |
| Table 11: Baseline characteristics of patients, by number of fractures events, 2011 to 2015 |
| **Table 12: Subsequent outcomes based on Initial Fracture type** |
| **Table 13: BMD screening rates relative to incident fracture, by age and sex** |
| **Table 14: Treatments for fracture over time, by age and sex** |
| **Table 15: Fracture Rate per 100 Patient Years FOR SUBSEQUENT FRACTURES** |
| **Table 16: Subsequent Fracture Rate per 100 Patient Years for patients on OP treatment vs. not on OP treatment** |
| **Table 17. Mean total healthcare costs in the first year after index date in the matched fracture and non-fracture cohorts in Ontario, 2011 to 2015 (2018 Canadian dollars)** |
| **Table 18. Mortality after index date in the matched fracture and non-fracture cohorts in Ontario, 2011 to 2015** |
|  **Figure 1. Kaplan-Meier curve for the matched fracture and non-fracture cohorts, Ontario, 2011-2015** |
| **Statistical Analysis for Incident fracture (i.e. index event)**Yearly Incidence of (first) fracture:* Calculate for each year from 2011 to 2015
* The numerator is the number of people aged 66+ years and older with their first fragility fracture as of that year
* The denominator is the Ontario population aged 66+ years and older based on intercensal/postcensal estimates of the Ontario population as of July 1 of that year (*P*CP*OP*) without a previous fragility fracture in the past five years
	+ Need to subtract the people with a previous fragility fracture who are still alive
	+ For example: For 2013, need to subtract out the individuals who had a fracture during the study period (2011, 2012) who are still alive AND individuals excluded before the study period (2008 to 2010) who are still alive
	+ For “all years” column, select all unique individuals who were eligible during the entire study period as the denominator

Yearly incidence of 2nd and 3rd fracture:* Calculate for each year from 2011 – 2017
* The numerator is the number of people in the cohort with their 2nd and 3rd fracture as of that year
* The denominator is the Ontario population aged 66+ years and older based on intercensal/postcensal estimates of the Ontario population as of July 1 of that year (PCPOP)
	+ Need to subtract the people with a previous fragility fracture who are still alive
	+ For “all years” column, select all unique individuals who were eligible during the entire study period as the denominator

Incident Fracture type proportion:* Numerator is the number of fractures of a particular fracture type. The types are:
	+ Hip; Humerus; Vertebral; Wrist; Pelvis; Femur; Clavicle, ribs and sternum; Radius and ulna; Other (tibia, fibula, knee, foot)
	+ **\*Note**: individuals can have multiple fractures, so an individual can be counted in more than one fracture type
	+ Also calculate if the person had multiple fractures
* Denominator is the total number of individuals with any fracture type (\***Note:** a patient only is counted once in the denominator even if they had multiple fractures)
* Express as percentage
 |
| **Statistical Analysis for Outcomes (i.e. index event)**Rate* For the outcomes: BMD screening, subsequent fractures
* Definition:
	+ Year 1: Numerator: Numerator is the number of persons who had a BMD assessment in the first year after the fracture. Denominator is the amount of time at risk (i.e. time alive) in Year 1.
	+ Year 2 and beyond:Numerator is the number of persons who had a BMD assessment in the second year after the fracture. Denominator is the amount of time at risk (i.e. time alive) in that year

Proportion* For the outcomes: concurrent OP treatment, BMD screening, subsequent fracture, fragility fracture, complications, hospitalizations, death, subsequent OP treatment
* Definition:
	+ Year 1: Numerator is the number of persons who had a BMD assessment in the first year after the fracture. Denominator is the number of persons alive the beginning of the year (i.e. January1).
	+ Year 2 and beyond: Numerator is the number of persons who had a BMD assessment in th second year after the fracture. Denominator is the number of persons available for assessment at the beginning of that year (i.e. January 1).

Time-to-event* For the outcomes: subsequent fracture, death, OP treatment persistence
* Survival analysis using Kaplan-Meier and Cumulative Incidence Functions
* For cumulative incidence functions, consider death as a competing risk.
 |
| **Matching*** Persons in the fracture cohort will be matched 1:1 to persons without a fracture from RPDB (no replacement)
* Matching characteristics:
	+ Sex
	+ Age categories (66-70, 71-75, 76-80, 81-85, 86+ years)
	+ Geography (rural/urban)
	+ Comoribdities
		- Respiratory conditions: asthma, COPD
		- Inflammatory conditions: RA, psoriasis, SPA
		- Cancer (within 5 years)
		- CKD
		- Diabetes
		- Cerebrovascular events (MI, stroke)
		- Dementia
		- Osteoarthritis
	+ Month and year of index date - assign random index date to controls prior to matching
* Outcomes to compare in the matched cohort:
	+ Mortality
		- Time to death
			* Kaplan-Meier
		- Proportion of patients dead after 1 year, 2 years, 3+ years
	+ HRU costs
		- Similar to what’s described above
		- Calculate the cost attributable to fractures by comparing the total (and service-specific) costs of the fracture cohort to the matched, non-fracture cohort
 |
|  **Type of model** |  |
|  **Primary independent variable** |  |
|  **Dependent variable** |  |
|  **Covariates** |  |
| **Sensitivity Analyses** |  |
|  **Type of model** |  |
|  **Primary independent variable** |  |
|  **Dependent variable** |  |
|  **Covariates** |  |
|  |

| Quality Assurance Activities  |
| --- |
| **RAE Directory of SAS Programs** | /sasroot/users/ekim/projects/DAS/p0970.103.000 |
| **RAE Directory of Final Dataset(s)** | *The* *final analytic dataset for each cohort includes all the data required to create the baseline tables and run all the models. It should include all covariates for all models such as patient risk factors, hospital characteristics, physician characteristics, exposure measures (continuous, categorical) and outcomes. It should include covariates that were considered but didn’t make the final cut. This would permit an analyst to easily re-run the models in the future.* |
| /sasroot/projects/das/p0970.103.000/level1/ekim |
| **RAE README file available:** [x] Yes [ ] No |
| **Date results of quality assurance tools for final dataset shared with project team (where applicable):** |  |
|  | **%assign** | 2018-Apr-26 |
|  | **%evolution** | yyyy-mon-dd |
|  | **%dinexplore** | yyyy-mon-dd |
|  | **%track / %exclude** | 2018-Jul-17 |
|  | **%codebook** | yyyy-mon-dd |
| **Additional comments:** |  |

## Table 1: Baseline characteristics of individuals with a first fragility fracture in Ontario, 2011 to 2015

|  |  |  |  |
| --- | --- | --- | --- |
| **Baseline characteristic** | **Incident fragility fracture cohort** | **Fracture** | **Non-fracture** |
| **Matched cohort** | **Matched cohort** |
| n = | n= | n= |
|   |  |  |  |  |
| Sex |  |  |  |  |
|  | *Female* | n (%) | n (%) | n (%) |
|  | *Male* | n (%) | n (%) | n (%) |
| Age |  | mean +/- SD | mean +/- SD | mean +/- SD |
|  |  | median (Q1 to Q3) | median (Q1 to Q3) | median (Q1 to Q3) |
|  | *66-70 years* | n (%) | n (%) | n (%) |
|  | *71-75 years* | n (%) | n (%) | n (%) |
|  | *76-80 years* | n (%) | n (%) | n (%) |
|  | *81-85 years* | n (%) | n (%) | n (%) |
|  | *86+ years* | n (%) | n (%) | n (%) |
| Respiratory conditions |  |  |  |
|  | *Asthma* | n (%) | n (%) | n (%) |
|  | *COPD* | n (%) | n (%) | n (%) |
| Inflammatory conditions |  |  |  |
|  | *RA* | n (%) | n (%) | n (%) |
|  | *Psoriasis* | n (%) | n (%) | n (%) |
|  | *SPA* | n (%) | n (%) | n (%) |
| Cancer | n (%) | n (%) | n (%) |
| Chronic kidney disease | n (%) | n (%) | n (%) |
| Diabetes | n (%) | n (%) | n (%) |
| Cerebrovascular events |  |  |  |
|  | *MI* | n (%) | n (%) | n (%) |
|  | *Stroke* | n (%) | n (%) | n (%) |
| Dementia | n (%) | n (%) | n (%) |
| Treatment type |
|  | *Denosumab* | n (%) | n (%) | n (%) |
|  | *Biphosphonate* | n (%) | n (%) | n (%) |
|  | *Teriparatide* | n (%) | n (%) | n (%) |
|  | *Raloxifene* | n (%) | n (%) | n (%) |
|  | *Hormone-replacement therapy* | n (%) | n (%) | n (%) |
|  |  |  |  |  |
| Rural fragility fracture treatment location | n (%) | n (%) | N/A |
| Fragility fracture treatment location type |  |  |  |
|  | *Small community* | n (%) | n (%) | n (%) |
|  | *Large community* | n (%) | n (%) | n (%) |
|  | *Teaching* | n (%) | n (%) | n (%) |
| Prior steroid use |  |  |  |
| Prior opioid use |  |  |  |
|   |  |  |  |

## Table 2: Incidence of fractures and and proportion of fracture types, by age, 2011 to 2015

\***Note**: Include 95% confidence intervals

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Age group** | **2011** | **2012** | **2013** | **2014** | **2015\*** | **All years** |
| **All ages** | Incidence (per 1,000 persons) |   |   |   |   |   |  |
| Fracture type (%) |   |  |   |   |   |  |
|   | *Hip* |   |  |   |   |   |  |
|   | *Humerus* |   |  |   |   |   |  |
|   | *Vertebral* |   |  |   |   |   |  |
|   | *Wrist* |   |  |   |   |   |  |
|   | *Pelvis*  |   |  |   |   |   |  |
|  | *Femur* |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* |   |  |   |   |   |  |
|   | *Radius and ulna* |   |  |   |   |   |  |
|   | *Other (tibia, fibula, knee and foot)* |   |  |   |   |   |  |
|   | *Multiple fractures* |   |  |   |   |   |  |
| **66-70 years** | Incidence (per 1,000 persons) |   |   |   |   |   |  |
| Fracture type (%) |   |  |   |   |   |  |
|   | *Hip* |   |  |   |   |   |  |
|   | *Humerus* |   |  |   |   |   |  |
|   | *Vertebral* |   |  |   |   |   |  |
|   | *Wrist* |   |  |   |   |   |  |
|   | *Pelvis* |   |  |   |   |   |  |
|  | *Femur* |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* |   |  |   |   |   |  |
|   | *Radius and ulna* |   |  |   |   |   |  |
|   | *Other (tibia, fibula, knee and foot)* |   |  |   |   |   |  |
|   | *Multiple fractures* |   |  |   |   |   |  |
| **…** | Incidence (per 1,000 persons) |   |   |   |   |   |  |
| Fracture type (%) |   |  |   |   |   |  |
|   | *Hip* |   |  |   |   |   |  |
|   | *Humerus* |   |  |   |   |   |  |
|   | *Vertebral* |   |  |   |   |   |  |
|   | *Wrist* |   |  |   |   |   |  |
|   | *Pelvis* |   |  |   |   |   |  |
|  | *Femur* |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* |   |  |   |   |   |  |
|   | *Radius and ulna* |   |  |   |   |   |  |
|   | *Other (tibia, fibula, knee and foot)* |   |  |   |   |   |  |
|   | *Multiple fractures* |   |   |   |   |   |  |
| **86+ years** | Incidence (per 1,000 persons) |   |   |   |   |   |  |
| Fracture type (%) |   |  |   |   |   |  |
|   | *Hip* |   |  |   |   |   |  |
|   | *Humerus* |   |  |   |   |   |  |
|   | *Vertebral* |   |  |   |   |   |  |
|   | *Wrist* |   |  |   |   |   |  |
|   | *Pelvis* |   |  |   |   |   |  |
|  | *Femur* |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* |   |  |   |   |   |  |
|   | *Radius and ulna* |   |  |   |   |   |  |
|   | *Other (tibia, fibula, knee and foot)* |   |  |   |   |   |  |
|   | *Multiple fractures* |   |   |   |   |   |  |

\*Incident cases were calculated up to March 31, 2015, but were projected for the entire calendar year by multiplying by a factor of four

## Table 3a: Incidence of first fracture, by type and split by men vs. women

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **First Index fracture** | 2011 | 2012 | 2013 | 2014 | 2015\* | All years |
| Incidence (per 1,000 persons) |   |   |   |   |   |  |
| Fracture type (%) |   |  |   |   |   |  |
|   | *Hip* | N (men)N (women)N, total | … | … | … | … |  |
|   | *Humerus* | … |  |   |   |   |  |
|   | *Vertebral* | … |  |   |   |   |  |
|   | *Wrist* | … |  |   |   |   |  |
|   | *Pelvis* | … |  |   |   |   |  |
|  | *Femur* | … |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* | … |  |   |   |   |  |
|   | *Radius and ulna* | … |  |   |   |   |  |
|   | *Other (tibia, fibula, knee and foot)* | … |  |   |   |   |  |
|   | *Multiple fractures* | … |  |   |   |   |  |

\*Incident cases were calculated up to March 31, 2015, but were projected for the entire calendar year by multiplying by a factor of four

## Table 3b: Incidence of 2nd fracture, by type and split by men vs. women

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2nd fracture** | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017\* | All years |
| Incidence (per 1,000 persons) |   |   |   |   |   |  |  |  |
| Fracture type (%) |   |  |   |   |   |  |  |  |
|   | *Hip* | N (men)N (women)N, total | … | … | … | … |  |  |  |
|   | *Humerus* | … |  |   |   |   |  |  |  |
|   | *Vertebral* | … |  |   |   |   |  |  |  |
|   | *Wrist* | … |  |   |   |   |  |  |  |
|   | *Pelvis*  | … |  |   |   |   |  |  |  |
|  | *Femur* | … |  |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* | … |  |   |   |   |  |  |  |
|   | *Radius and ulna* | … |  |   |   |   |  |  |  |
|   | *Other (tibia, fibula, knee and foot)* | … |  |   |   |   |  |  |  |
|   | *Multiple fractures* | … |  |   |   |   |  |  |  |

\*Incident cases were calculated up to March 31, 2017, but were projected for the entire calendar year by multiplying by a factor of four

## Table 3c: Incidence of 3rd fracture, by type and split by men vs. women

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **3rd fracture** | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017\* | All years |
| Incidence (per 1,000 persons) |   |   |   |   |   |  |  |  |
| Fracture type (%) |   |  |   |   |   |  |  |  |
|   | *Hip* | N (men)N (women)N, total | … | … | … | … |  |  |  |
|   | *Humerus* | … |  |   |   |   |  |  |  |
|   | *Vertebral* | … |  |   |   |   |  |  |  |
|   | *Wrist* | … |  |   |   |   |  |  |  |
|   | *Pelvis*  | … |  |   |   |   |  |  |  |
|  | *Femur* | … |  |  |  |  |  |  |  |
|   | *Clavicle, ribs and sternum* | … |  |   |   |   |  |  |  |
|   | *Radius and ulna* | … |  |   |   |   |  |  |  |
|   | *Other (tibia, fibula, knee and foot)* | … |  |   |   |   |  |  |  |
|   | *Multiple fractures* | … |  |   |   |   |  |  |  |

\*Incident cases were calculated up to March 31, 2017, but were projected for the entire calendar year by multiplying by a factor of four

## Table 4a: Health resource utilization costs of fracture patients in 1 year post fracture in Ontario by year, 2011 to 2016

|  |  |
| --- | --- |
| **Year** | **Total costs ($) per patient** |
| **All fractures** | **Hip** | **Humerus** | **Vertebral** | **Wrist** | **Pelvis** | **Femur** | **Clavicle, ribs and sternum** | **Radius and ulna** | **Other (tibia, fibula, knee and foot)** | **Multiple** |
| 2011 | Nmean (SD)- quartile 1 and 3 | … | … | … | … | … | … | … | … | … | … |
| 2012 | … |  |  |  |  |  |  |  |  |  |  |
| 2013 | … |  |  |  |  |  |  |  |  |  |  |
| 2014 | … |  |  |  |  |  |  |  |  |  |  |
| 2015 | … |  |  |  |  |  |  |  |  |  |  |
| 2016\* | … |  |  |  |  |  |  |  |  |  |  |

\*Health resource utilization costs were calculated up to March 31, 2017, but were projected for the entire calendar year by multiplying by a factor of four

**Revised Table 4b: Health resource utilization cost of fracture patients with one or more fractures, by follow-up time periods after initial and subsequent fracture**

|  |  |
| --- | --- |
| **Follow-up period** | **Total costs ($) per person-year** |
| **All fractures** | **Hip** | **Humerus** | **Vertebral** | **Wrist** | **Pelvis**  | **Femur** | **Clavicle, ribs and sternum** | **Radius and ulna** | **Other (tibia, fibula, knee and foot)** | **Multiple** |
| **1 fracture** |
| First fracture to end of follow-up | Nmean (SD)quartile 1 and 3 | … | … | … | … | … | … | … | … | … | … |
| **2 fractures** |
| First fracture to second fracture | … |  |  |  |  |  |  |  |  |  |  |
| Second fracture to end of follow-up | … |  |  |  |  |  |  |  |  |  |  |
| **3+ fractures** |
| First fracture to second fracture | … |  |  |  |  |  |  |  |  |  |  |
| Second fracture to third fracture | … |  |  |  |  |  |  |  |  |  |  |
| Third fracture to end of follow-up | … |  |  |  |  |  |  |  |  |  |  |

\***Note**: End of follow-up is either death or end of study period.

\***Note**: Express the costs per person-year. This accounts for the varying follow-up periods between fractures.

## Table 5: Mean annual cost by fracture type from index event by number of comorbidities, 2011 to 2015

|  |  |  |
| --- | --- | --- |
| **Fracture type** | **Number of comorbidities** | **Mean patient cost by year since index event ($)** |
| **1** | **2** | **3** | **4** | **5** |
| **Hip** | 0123+ | NMean (SD)Q1 and Q3 | … | … | … | … |
| **Humerus** | 0123+ | … |  |  |  |  |
| **Vertebral** | 0123+ | … |  |  |  |  |
| **Wrist** | 0123+ | … |  |  |  |  |
| **Pelvis** | 0123+ | … |  |  |  |  |
| **Femur** | 0123+ | … |  |  |  |  |
| **Clavicle, ribs and sternum** | 0123+ | … |  |  |  |  |
| **Radius and Ulna** | 0123+ | … |  |  |  |  |
| **Other ( tibia, fibula, knee and foot)** | 0123+ | … |  |  |  |  |
| **Multiple** | 0123+ | … |  |  |  |  |

## Table 6: Mean annual costs by fracture type relative to index fracture event, by type of cost, 2011 to 2015

|  |  |  |  |
| --- | --- | --- | --- |
| **Fracture type** | **Type of cost ($)** | **Year** | **Total costs** |
| **1** | **2** | **3** | **4** | **5** |
| **Hip** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | n, Mean (SD)Q1 and Q3 | … | … | … | … | … |
| **Humerus** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Vertebral** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Wrist** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Pelvis** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Femur** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Clavicle, ribs and sternum** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Radius and ulna** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Other (tibia, fibula, knee and foot)** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |
| **Multiple** | Assisted devicesCCRS, home care, LTCHospitalizationInpatient rehabilitationPrescription drugsOther health care servicesAll health care services | … |  |  |  |  |  |

##  Table 7: Costs of 2nd fractures based on type of initial fracture – for fracture cohort patients

|  |  |
| --- | --- |
| **Type of Index Fracture** | **Subsequent (2nd) fracture type** |
| **All fractures** | **Hip** | **Humerus** | **Vertebral** | **Wrist** | **Pelvis** | **Femur** | **Clavicle, ribs and sternum** | **Radius and ulna** | **Other (tibia, fibula, knee and foot)** | **Multiple** |
| **Hip** | Costmean (SD)- quartile 1 and 3 | … | … | … | … | … |  | … | … | … | … |
| **Humerus** | … |  |  |  |  |  |  |  |  |  |  |
| **Vertebral** | … |  |  |  |  |  |  |  |  |  |  |
| **Wrist** | … |  |  |  |  |  |  |  |  |  |  |
| **Pelvis** | … |  |  |  |  |  |  |  |  |  |  |
| **Femur** | … |  |  |  |  |  |  |  |  |  |  |
| **Clavicle, ribs and sternum** | … |  |  |  |  |  |  |  |  |  |  |
| **Radius and ulna** | … |  |  |  |  |  |  |  |  |  |  |
| **Other (tibia, fibula, knee and foot)** | … |  |  |  |  |  |  |  |  |  |  |
| **Multiple** | … |  |  |  |  |  |  |  |  |  |  |

* Cost is total cost within 1-year of the 2nd fracture

**Table 8: Time to subsequent fracture by initial/index fracture type**

|  |  |
| --- | --- |
| **Type of Index Fracture** | **Time to subsequent fracture** |
| **2nd fracture** | **3rd fracture** |
| Hip | N patientsTime from previous fracture: Mean (SD), median,Q1 and Q3 | N patientsTime from previous fracture: Mean (SD), median,Q1 and Q3 |
| Humerus | … |  |
| Vertebral | … |  |
| Wrist | … |  |
| Pelvis | … |  |
| Femur | … |  |
| Clavicle, ribs and sternum | … |  |
| Radius and ulna | … |  |
| Other (tibia, fibula, knee and foot) | … |  |
| Multiple | … |  |

## Table 9: Percent of the second fracture type based on the first fracture type

|  |  |
| --- | --- |
| **1st (index) fracture (%)** | **Subsequent Fracture n (%)** |
| Hipn (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Humerusn (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Vertebraln (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Wristn (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Pelvisn (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Femurn (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Clavicle, ribs and sternum n (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Radius and Ulnan (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Other (tibia, fibula, knee and foot)n (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |
| Multiplen (%) | Hip | n (%) |
| Humerus | n (%) |
| Vertebral | n (%) |
| Wrist | n (%) |
| Pelvis | n (%) |
| Femur | n (%) |
| Clavicle, ribs and sternum | n (%) |
| Radius and ulna | n (%) |
| Other (tibia, fibula, knee and foot) | n (%) |
| Multiple | n (%) |

## Table 10: Mean annual costs by fracture type relative to index fracture event by age, 2011 to 2015

|  |  |  |
| --- | --- | --- |
| **Fracture type** | **Age group** | **Mean patient cost by year since index event ($)** |
| **1** | **2** | **3** | **4** | **5** |
| **Hip** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | n, Mean (SD)Q1 and Q3 | … | … | … | … |
| **Humerus** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Vertebral** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Wrist** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Pelvis**  | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Femur** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years |  |  |  |  |  |
| **Clavicle, ribs and sternum** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Radius and ulna** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Other (tibia, fibula, knee and foot)** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Multiple** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | … |  |  |  |  |
| **Total patients (all fracture types)** | 66-70 years 71-75 years 76-80 years 81-85 years 86+ years | …… |  |  |  |  |

## Table 11: Baseline characteristics of patients, by number of fractures events, 2011 to 2014

\*Include patients who had their index fracture up to March 31, 2014, and include 3 years of follow-up data for all patients (up to March 31, 2017).

|  |  |  |  |
| --- | --- | --- | --- |
| **Baseline characteristic** | **Only 1 fracture (no subsequent fractures within 3 years of index fracture)**  | **2 fractures (index fracture plus 1 more fracture within 3 years)** | **3+ fractures** **(index frature plus at least 2 more fractures within 3 years)** |
| **N=** | **N=** | **N=** |
| Sex |  |  |  |  |
|  | *Female* | n (%) | n (%) | n (%) |
|  | *Male* | n (%) | n (%) | n (%) |
| Age at time of index fracture | mean +/- SD | mean +/- SD | mean +/- SD |
|  |  | median (Q1 to Q3) | median (Q1 to Q3) | median (Q1 to Q3) |
|  | *66-70 years*  | n (%) | n (%) | n (%) |
|  | *71-75 years*  | n (%) | n (%) | n (%) |
|  | *76-80 years*  | n (%) | n (%) | n (%) |
|  | *81-85 years*  | n (%) | n (%) | n (%) |
|  | *86+ years* | n (%) | n (%) | n (%) |
| Prior concomitant therapies (at index) |
|  | *Steroids* | n (%) | n (%) | n (%) |
|  | *Opioids* | n (%) | n (%) | n (%) |
| Index Fracture type  |  |  |  |
|  | Hip | n (%) | n (%) | n (%) |
|  | Humerus  | n (%) | n (%) | n (%) |
|  | Vertebral  | n (%) | n (%) | n (%) |
|  | Wrist | n (%) | n (%) | n (%) |
|  | Pelvis | n (%) | n (%) | n (%) |
|  | Femur | n (%) | n (%) | n (%) |
|  | Clavicle, ribs and sternum | n (%) | n (%) | n (%) |
|  | Radius and ulna  | n (%) | n (%) | n (%) |
|  | Other (tibia, fibula, knee and foot) | n (%) | n (%) | n (%) |
|  | Multiple | n (%) | n (%) | n (%) |
| 2nd fracture type |  |  |  |
|  | Hip | -- | n (%) | n (%) |
|  | Humerus  | -- | n (%) | n (%) |
|  | Vertebral  | -- | n (%) | n (%) |
|  | Wrist | -- | n (%) | n (%) |
|  | Pelvis | -- | n (%) | n (%) |
|  | Femur | -- | n (%) | n (%) |
|  | Clavicle, ribs and sternum | -- | n (%) | n (%) |
|  | Radius and ulna  | -- | n (%) | n (%) |
|  | Other (tibia, fibula, knee and foot) | -- | n (%) | n (%) |
|  | Multiple | -- | n (%) | n (%) |
|  | Total patients (all fracture types) | -- | n (%) | n (%) |
| 3rd fracture type |  |  |  |  |
|  | Hip | -- | -- | n (%) |
|  | Humerus  | -- | -- | n (%) |
|  | Vertebral  | -- | -- | n (%) |
|  | Wrist | -- | -- | n (%) |
|  | Pelvis | -- | -- | n (%) |
|  | Femur | -- | -- | n (%) |
|  | Clavicle, ribs and sternum | -- | -- | n (%) |
|  | Radius and ulna  | -- | -- | n (%) |
|  | Other (tibia, fibula, knee and foot) | -- | -- | n (%) |
|  | Multiple | -- | -- | n (%) |
|  | Total patients (all fracture types) | -- | -- | n (%) |
| Death rate per person-year (within 3 years)  | Rate  | Rate | Rate |

\***Note**: for the death rate, calculate using follow-up time as follows-

* Use person years of follow-up from the date of fracture 1 (for patients with only 1 fracture)
* Use person years of follow-up from the date of fracture 2 (for patients with exactly 2 fractures)
* Use person years of follow-up from the date of fracture 3 (for patients with 3 or more fractures)

## Table 12: Subsequent outcomes based on Initial Fracture type

|  |  |
| --- | --- |
| **Fracture type** | **Subsequent Outcomes**  |
|  **Initial Replacement procedure**  | **Related Procedures****/Revision Surgery** | **Complications (at 30 days)** | **Hospitalizations****within 1 year of Index fracture** | **Mortality****At 1-year post-index fracture** |
| Hip | Number and proportion of Patients (from entire fracture cohort)  | Number and [roportion of Patients (of those that had Initial Replacement Procedure) | Number and Proportion of Patients (of those that had Initial Replacement Procedure)Note: Complication has to be within 30 days of Initial Replacement Procedure | Number and -proportion of Patients hospitalized within 1 year of Index fracture (from entire fracture cohort)  | Number and proportion of Patients who die within 1 year of Index Fracture (from entire fracture cohort)  |
| Humerus  |  |  |  |  |  |
| Vertebral  |  |  |  |  |  |
| Wrist |  |  |  |  |  |
| Pelvis |  |  |  |  |  |
| Femur |  |  |  |  |  |
| Clavicle, ribs, sternum |  |  |  |  |  |
| Radius and Ulna  |  |  |  |  |  |
| Other: tibia, fibula, knee, foot |  |  |  |  |  |
| Multiple |  |  |  |  |  |
| **Total patients (all fracture types)** |  |  |  |  |  |

**Table 13: BMD screening proportions relative to incident fracture, by age and sex**

|  |  |  |
| --- | --- | --- |
| **Fracture type** | **Age group**  | **BMD Screening proportions by year** |
| **-3+ years prior to index fracture** | **-2-3 years prior to the index fracture** | **-2 to -1 years prior to index fracture** | **Within 1 year prior to index fracture** | **Within 1-year post index fracture** | **1-2 years post** | **2-3 years post** | **3+ years post** |
| **Hip** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | Number and proportion of Patients | … | … | … | … | … | … | … |
| **Humerus**  | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Vertebral**  | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Wrist** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Pelvis**  | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Femur** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Clavicle, ribs, sternum** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Radius and Ulna**  | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Other: tibia, fibula, knee, foot** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Multiple** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |
| **Total patients (all fracture types)** | Both sexes, all ages66-70 years 71-75 years 76-80 years 81-85 years 86+ years-------------------Male, all agesFemale, all ages | … |  |  |  |  |  |  |  |

## Table 14: Treatments for fracture over time, by age and sex

|  |  |  |  |
| --- | --- | --- | --- |
| **Age** | **Treatments** |  | **Treatment over time (years pre- and post index fracture)** |
| **Within 1 year of the index fracture** | **Within 1 year post index fracture** | **1-2 years post** | **2-3 years post** | **3+ years post** | **% treated (any time post?)** |
|  | *Opioids (MME equivalents)**Steroids* | Number, Proportion of Patients | … | … | … | … | … |
| **Women <75 yrs** | Dmab | … |  |  |  |  |  |
| ALN | … |  |  |  |  |  |
| RIS (etc) |  |  |  |  |  |  |
| TPTD |  |  |  |  |  |  |
| Raloxifene-HRT |  |  |  |  |  |  |
| **Women ≥75yrs**  | Dmab |  |  |  |  |  |  |
| ALN |  |  |  |  |  |  |
| RIS(etc) |  |  |  |  |  |  |
| TPTD |  |  |  |  |  |  |
| Raloxifene-HRT |  |  |  |  |  |  |
| **Men <75 yrs** | Dmab |  |  |  |  |  |  |
| ALN |  |  |  |  |  |  |
| RIS(etc) |  |  |  |  |  |  |
| TPTD |  |  |  |  |  |  |
| Raloxifene-HRT |  |  |  |  |  |  |
| **Men ≥75yrs** | Dmab |  |  |  |  |  |  |
| ALN |  |  |  |  |  |  |
| RIS(etc) |  |  |  |  |  |  |
| TPTD |  |  |  |  |  |  |
| Raloxifene-HRT |  |  |  |  |  |  |

## Table 15: Fracture Rate per 100 Patient Years  FOR SUBSEQUENT FRACTURES

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Time period** | **All fractures** | **Hip** | **Humerus** | **Vertebral** | **Wrist** | **Pelvis** | **Femur** | **Clavicle, ribs, sternum** | **Radius and Ulna** | **Other: tibia, fibula, knee, foot** | **Multiple** |
| Within 1 year post index-fracture |  |  |  |  |  |  |  |  |  |  |  |
| 1-2 years post-Index fracture |  |  |  |  |  |  |  |  |  |  |  |
| 2-3 years post-Index fracture |  |  |  |  |  |  |  |  |  |  |  |
| 3-4 years post-Index fracture |   |  |   |  |  |  |  |  |  |  |    |
| 4-5 years post-Index fracture |  |  |  |  |  |  |  |  |  |  |  |
| 5+ years post-index fracture |  |  |  |  |  |  |  |  |  |  |  |

## Table 16: Subsequent Fracture Rate per 100 Patient Years for patients on OP treatment vs. not on OP treatment

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Fracture type** | **OP Treatment****(dmab, bps,****Teriparatide, raloxifene,****HRT)** | **2011\*** | **2012** | **2013** | **2014** | **2015** | **2016** | **All years** |
| **Hip** | *OP Treatment**No OP treatment* | n, %n, % | n, %n, % |  |  |  |  |  |
| **Humerus**  | *OP Treatment**No OP treatment*  | n, %n, % |  |  |  |  |  |  |
| **Vertebral**  | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Wrist** |  *OP Treatment**No OP treatment* |  |   |  |  |  |    |  |
| **Pelvis** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Femur** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Clavicle, ribs, sternum** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Radius and Ulna**  | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Other: tibia, fibula, knee, foot** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Multiple** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |
| **Total patients (all fracture types)** | *OP Treatment**No OP treatment* |  |  |  |  |  |  |  |

## *Note: not unique patients; patients can fracture twice at different timepoints within the same year, hence be counted twice*

## Table 17. Mean total healthcare costs in the first year after index date in the matched fracture and non-fracture cohorts in Ontario, 2011 to 2015 (2018 Canadian dollars)

|  |  |  |
| --- | --- | --- |
| **Resource Utilization** | **Matched fracture patients (fom incident fragility fracture cohort)** | **Matched controls** **(non-fracture patients)** |
| n = | n = |
| HospitalizationInpatient rehabilitationAssisted devicesPrescription drugsCCRS, home care, LTCOther health care services**Total** |  |  |

**Table 18. Mortality after index date in the matched fracture and non-fracture cohorts in Ontario, 2011 to 2015**

|  |  |  |
| --- | --- | --- |
|  | **Matched fracture patients (fom incident fragility fracture cohort)** | **Matched controls****(non-fracture patients)** |
|  | Malen = | Femalen = | Malen = | Femalen = |
| Mortality, n (%) In-hospital\* Within 30 days Within 1 year Within 2 years Within 3 years |  |  |  |  |

\*during index admission

**Figure 1. Kaplan-Meier curve for the matched fracture and non-fracture cohorts, Ontario, 2011-2015**

## Appendix 1: Diagnosis Codes for Fragility Fractures

|  |  |
| --- | --- |
| **Fracture type** | **ICD-10 Code** |
| Hip | S72.0 - Fracture of neck of femurS72.1 - Pertrochanteric fracture* Intertrochanteric fracture
* Trochanteric fracture

S72.2 - Subtrochanteric fracture |
| Radius and Ulna | S52.0 - Fracture of upper end of ulnaS52.1 - Fracture of upper end of radiusS52.2 - Fracture of shaft of ulnaS52.3 - Fracture of shaft of radiusS52.4 - Fracture of shafts of both ulna and radiusS52.7 - Multiple fractures of forearmS52.8 - Fracture of other parts of forearm* Lower end of ulna
* Head of ulna

S52.9 - Fracture of forearm, part unspecified |
| Wrist | S52.5 - Fracture of lower end of radiusS52.6 - Fracture of lower end of both ulna and radius |
| Humerus/ Shoulder | S42.2 - Fracture of upper end of humerusS42.3 - Fracture of shaft of humerusS42.4 - Fracture of lower end of humerusS42.8 - Fracture of other parts of shoulder and upper armS42.9 - Fracture of shoulder girdle, part unspecifiedFracture of shoulder NOS |
| Vertebral | S22.0 - Fracture of thoracic vertebra, Fracture of thoracic spine NOSS22.1 - Multiple fractures of thoracic spineS32.0 - Fracture of lumbar vertebra, fracture of lumbar spine |
| Femur | S72.3 - Fracture of shaft of femurS72.4 - Fracture of distal end of femurS72.7 - Multiple fractures of femurS72.8 - Fractures of other parts of femurS72.9 - Fracture of femur, part unspecified* Applicable To Fracture of thigh NOS Fracture of upper leg NOS
* Type 1 exclusion for fracture of hip NOS
 |
| Other (tibia, fibula, knee) | S82.0 - Fracture of patella* Knee cap

S82.1 - Fracture of upper end of tibia* With or without mention of fracture of fibula

S82.2 - Fracture of shaft of tibia* With or without mention of fracture of fibula

S82.3 - Fracture of lower end of tibia* With or without mention of fracture of fibula

S82.4 - Fracture of fibula aloneS82.5 - Fracture of medial malleolus* Tibia involving

S82.6 - Fracture of lateral malleolus * Fibula involving
 |
| Sternum, Clavicle and Ribs | S22.2 – Fracture of sternum S22.3 – Fracture of ribS22.4 – Multiple fractures of rib S42.0 - Fracture of clavicle |
| Pelvis | S32.1 - Fracture of sacrumS32.2 - Fracture of coccyxS32.3 - Fracture of iliumS32.4 - Fracture of acetabulumS32.5 - Fracture of pubisS32.7 - Multiple fractures of lumbar spine and pelvisS32.8 - Fracture of other and unspecified parts of lumbar spine and pelvis* Fracture of:
* ischium
* lumbosacral spine NOS
* pelvis NOS
 |
| Multiple Fracture | S42.7 - Multiple fractures of clavicle, scapula and humerusT02.1 - Fractures involving thorax with lower back and pelvisT02.2 - Fractures involving multiple regions of one upper limbT02.3 - Fractures involving multiple regions of one lower limbT02.4 - Fractures involving multiple regions of both upper limbsT02.5 - Fractures involving multiple regions of both lower limbsT02.6 - Fractures involving multiple regions of upper limb(s) with lower limb(s)T02.7 - Fractures involving thorax with lower back and pelvis with limb(s)T02.8 - Fractures involving other combinations of body regionsT02.9 - Multiple fractures, unspecified |

## Appendix 2: Diagnosis Codes for Trauma codes

|  |
| --- |
| **Appendix 2 Diagnosis Codes for Trauma codes** |
|  | ICD-10 Code |
| Accidents | * V01-V99
* X00-X58
* X59.9
* W20-W99
 |
| Injuries involving multiple body regions | * T00-T01
* T03-T07
 |
| Falls  | * W02-W04
* W09
* W11-W17
 |

## Appendix 3: DIN list for osteoporosis treatment

\***Note**: DIN list as been provided as an excel sheet as well. See T:\DAS\P0970 103 (Amgen) Cost of Osteoporosis Fractures\DCP\ Appendix 3- Osteoporosis Tx.xls

|  |  |
| --- | --- |
| **Treatment** | **DIN** |
| Denosumab | 2343541 |
| Bisphosphonates | **Alendronate:** 2401126, 2401134, 2381478, 2381486, 2381494, 2258102, 2258110, 2299712, 2302004, 2352966, 2303078, 2248727, 2248728, 2248730, 2454467, 2454475, 2388545, 2388553, 2282763, 2308398, 2201011, 2201038, 2233055, 2245329, 2248625, 2270110, 2385031, 2394863, 2394871, 2270129, 2286335, 2282771, 2273179, 2284006, 2372304, 2384698, 2384701, 2384728, 2275279, 2270889, 2288079, 2288087, 2288109, 2429160, 2247373, 2248251, 2261715, 2403633, 2403641, 2428717, 2428725, 2428733, 2276429, 2314940**Etidronate:** 2263866, 2248686, 2248687, 2276844, 2276852, 2176017, 1908480, 1997629, 2347989, 2353210, 2347962, 2347970, 2247323, 2245330, 2324199, 2358697, **Risedronate:** 2239146, 2242518, 2246896, 2297787, 2316838, 2370417, 2279657, 2353687, 2377721, 2406284, 2406292, 2406306, 2442760, 2309831, 2368552, 2357984, 2397773, 2358883, 2358891, 2358905, 2427354, 2309874, 2302209, 2424177, 2362414, 2377446, 2319861, 2347474, 2352141, 2370239, 2370247, 2370255, 2411407, 2341077, 2327295, 2298376, 2298384, 2298392, 2413809, 2285541**Zoledronic Acid:** 2269198, 2408449, 2408325, 2403056, 2415100, 2415186, 2426412, 2421720, 2401606, 2304007, 2424894, 2407639, 2421550, 2434458, 2444739, 2413701, 2420961, 2422425, 2408082, 2422433, 2248296, 2242725 |
| Teriparatide (Forteo) | 2254689 9857535 |
| Raloxifene (Evista) | 2358840, 2279215, 2239028, 2358921, 2415852, 2312298 |
| HRT | 798231, 798223, 798215, 798207, 798193, 265470, 265489, 2230891, 2230892, 830240, 830232, 830224, 830216, 830208, 587281, 587303, 2239654, 2239655, 2043394, 2043408, 2043424, 2414678, 2414686, 2414694, 2089, 2283, 2043386, 2569, 2577, 2043416, 2585, 2593, 2043432, 2043440, 2242878, 2242879, 2148587, 2148595, 2225190, 464791, 464805, 2231510, 2247499, 2231509, 2247500, 2250616, 2377098, 2424835, 2424843, 2424924, 2241835, 2241837, 2243529, 2243530, 2108186, 756792, 756849, 756857, 2244002, 2245676, 2243999, 2244000, 2244001, 2238704, 2403404, 2248297, 2246340, 2237807, 2237808, 2243722, 2243723, 2243724, 2243725, 2243726, 2246969, 2246967, 2246968, 2204444, 2204401, 2204428, 2204436, 2168898, 2253186, 2241332, 2325462, 727369, 2268825, 2249405, 2309009 |

## Appendix 4: CCI codes for fragility fracture-related surgical technique procedures

|  |  |  |
| --- | --- | --- |
|  | **Initial Surgeries (request R code status)**\*Must have no R attribute (*inatstat*) | **Revision Surgeries (request R code status)**\*\* surgeries listed below are revision surgeries; in addition, any “Initial Surgery” with an R attribute (*inatstat*) is also considered a revision surgery. |
| Spinal Vertebrae (1.SC) | 1.SC.74 - Fixation 1.SC.75 - Fusion1.SC.87 - Excision partial1.SC.89 - Excision total | 1.SC.54 - Management of internal device1.SC.55 - Removal of device or appliance1.SC.80 - Repair2 |
| Intervertebral Disc (1.SE.) | 1.SE.53 - Implantation of internal device1.SE.87 - Excision partial | 1.SE.55 - Removal of device |
| Sacrum and Coccyx (1.SF.) | 1.SF.73 - Reduction1.SF.74 - Fixation1.SF.87 - Excision partial1.SF.89 - Excision total1.SF.91 - Excision radical | 1.SF.55 - Removal of device1.SF.80 - Repair |
| Sacroiliac Joint (1.SI) | 1.SI.74 - Fixation 1.SI.75 - Fusion | none. |
| Sternum (1.SK.) | 1.SK.73 - Reduction1.SK.74 - Fixation1.SK.87 - Excision partial | 1.SK.55 - Removal of device1.SK.80 - Repair |
| Ribs (1.SL.) | 1.SK.58 - Procurement1.SK.73 - Reduction1.SK.74 - Fixation1.SK.87 - Excision partial1.SK.89 - Excision total1.SK.91 - Excision radical | 1.SK.54 - Management of internal device1.SK.55 - Removal of device or appliance1.SK.79 - Repair by increasing size1.SK.80 - Repair |
| Clavicle (1.SM.) | 1.SM.73 - Reduction1.SM.74 - Fixation1.SM.80 - Repair1.SM.87 - Excision partial | 1.SM.55 - Removal of device |
| Scapula (1.SN.) | 1.SN.58 - Procurement1.SN.72 - Release1.SN.73 - Reduction1.SN.74 - Fixation1.SN.75 - Fusion1.SN.87 - Excision partial1.SN.91 - Excision radical1.SN.93 - Amputation | 1.SN.55 - Removal of device |
| Pelvis (1.SQ.) | 1.SQ.53 - Implantation of internal device1.SQ.58 - Procurement1.SQ.73 - Reduction1.SQ.74 - Fixation1.SQ.83 - Transfer1.SQ.87 - Excision partial1.SQ.91 - Excision radical1.SQ.93 - Amputation | 1.SQ.55 - Removal of device1.SQ.80 - Repair |
| Pubis (1.SW.) | 1.SW.73 - Reduction1.SW.74 - Fixation1.SW.87 - Excision partial | 1.SW.55 - Removal of device |
| Shoulder Joint (1.TA.) | 1.TA.53 - Implantation of internal device1.TA.58 - Procurement1.TA.72 - Release1.TA.73 - Reduction1.TA.74 - Fixation1.TA.75 - Fusion1.TA.83 - Transfer1.TA.87 - Excision partial1.TA.93 - Amputation | 1.TA.55 - Removal of device1.TA.80 - Repair |
| Acromioclavicular and sternoclavicular joints (1.TB.) | 1.TB.72 - Release1.TB.73 - Reduction1.TB.74 - Fixation1.TB.87 - Excision partial | 1.TB.55 - Removal of device1.TB.80 - Repair |
| Humerus (1.TK.) | 1.TK.58 - Procurement1.TK.73 - Reduction1.TK.74 - Fixation1.TK.82 - Reattachment1.TK.83 - Transfer1.TK.87 - Excision partial1.TK.91 - Excision radical1.TK.93 - Amputation | 1.TK.55 - Removal of device1.TK.79 - Repair by increasing size1.TK.80 - Repair  |
| Radius and ulna (1.TV.) | 1.TV.58 - Procurement1.TV.73 - Reduction1.TV.74 - Fixation1.TV.82 - Reattachment1.TV.83 - Transfer1.TV.84 - Construction or Reconstruction1.TV.87 - Excision partial1.TV.91 - Excision radical1.TV.93 - Amputation  | 1.TV.55 - Removal of device1.TV.79 - Repair by increasing size1.TV.80 - Repair |
| Wrist joint (1.UB.) | 1.UB.53 - Implantation of internal device1.UB.58 - Procurement1.UB.72 - Release1.UB.73 - Reduction1.UB.74 - Fixation1.UB.75 - Fusion1.UB.83 - Transfer1.UB.87 - Excision partial 1.UB.93 - Amputation | 1.UB.55 - Removal of device1.UB.80 - Repair |
| Hip (1.VA.) | 1.VA.53 - Implantation of internal device1.VA.58 - Procurement1.VA.72 - Release1.VA.73 - Reduction1.VA.74 - Fixation1.VA.75 - Fusion1.VA.83 - Transfer1.VA.87 - Excision partial1.VA.93 - Amputation  | 1.VA.55 - Removal of device1.VA.80 - Repair |
| Femur (1.VC.) | 1.VC.58 - Procurement1.VC.73 - Reduction1.VC.74 - Fixation1.VC.82 - Reattachment1.VC.83 - Transfer1.VC.87 - Excision partial1.VC.91 - Excision radical1.VC.93 - Amputation | 1.VC.55 - Removal of device1.VC.79 - Repair by increasing size1.VC.80 - Repair |
| Knee joint (1.VG.) | 1.VG.53 - Implantation of internal device1.VG.58 - Procurement 1.VG.72 - Release1.VG.73 - Reduction1.VG.74 - Fixation1.VG.80 - Repair1.VG.83 - Transfer1.VG.87 - Excision partial1.VG.93 - Amputation | 1.VG.55 - Removal of device |
| Patella (1.VP.) | 1.VP.53 - Implantation of internal device1.VP.72 - Release1.VP.73 - Reduction1.VP.74 - Fixation1.VP.87 - Excision partial1.VP.89 - Excision total | 1.VP.55 - Removal of device1.VP.80 - Repair |
| Tibia and Fibula (1.VQ.) | 1.VQ.58 - Procurement1.VQ.73 - Reduction1.VQ.74 - Fixation1.VQ.82 - Reattachment1.VQ.83 - Transfer1.VQ.87 - Excision partial1.VQ.91 - Excision radical1.VQ.93 - Amputation | 1.VQ.55 - Removal of device1.VQ.79 - Repair by increasing size1.VQ.80 - Repair |
| Ankle joint (1.WA.) | 1.WA.53 - Implantation of internal device1.WA.58 - Procurement1.WA.72 - Release1.WA.73 - Reduction1.WA.74 - Fixation1.WA.75 - Fusion1.WA.83 - Transfer1.WA.87 - Excision partial1.WA.93 - Amputation | 1.WA.55 - Removal of device1.WA.80 - Repair |

## Appendix 5: Diagnosis codes for fragility fracture related complications

|  |  |  |
| --- | --- | --- |
| Complication | ICD-10 codes (DADSDS, NACRS) | DXCODE code (OHIP) |
| Infections related to surgery | T81.4 - Infection following a procedure, not elsewhere classifiedT84.5 - Infection and inflammatory reaction due to internal joint prosthesis T84.6 - Infection and inflammatory reaction due to internal fixation device [any site]T84.7 - Infection and inflammatory reaction due to other internal orthopaedic prosthetic devices, implants and graftsT85.7 - Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts | 998 – of surgical and medical care (e.g. wound infection, wound disruption, other iatrogenic disease) |
| Complications related to prosthetic devices | T84 - Complications of internal orthopaedic prosthetic devices, implants and grafts | None. |
| VTE (includes DVT and PE) | I26 - Pulmonary embolismI80 - Phlebitis and thrombophlebitisI81 - Portal Vein ThrombosisI82 - Other venous embolism and thrombosisI63.6 - Cerebral infarction due to cerebral venous thrombosis, nonpyogenicI67.6 - Nonpyogenic thrombosis of intracranial venous system | None. |
| Pneumonia | J12 - Viral pneumonia, not elsewhere classifiedJ13 - Pneumonia due to Streptococcus pneumoniaeJ14 - Pneumonia due to Haemophilus influenzaeJ15 - Bacterial pneumonia, not elsewhere classifiedJ16 - Pneumonia due to other infectious organisms, not elsewhere classifiedJ17 - Pneumonia in diseases classified elsewhereJ18 - Pneumonia, organism unspecifiedJ22 - Unspecified acute lower respiratory infectionJ95 - Postprocedural respiratory disorders, not elsewhere classified | 486 - Pneumonia, all types |
| Myocardial Infarction | I21 - Acute Myocardial InfarctionI22 - Subsequent Myocardial Infarction | None. |
| Fracture resulting from surgery/periprosthetic fracture | M96.6 - Fracture of bone following insertion of orthopaedic implant, joint prosthesis, or bone plate | None. |

|  |
| --- |
| **Revised - Appendix 6: Diagnosis codes for comorbidities** |
| **Comorbidity** | **ICD-9** | **ICD-10** |
| Osteoarthritis | ICD-9: 715 | ICD-10: M15-M19 |
| Asthma | 493- asthma | J45 - AsthmaJ46 - Status asthmaticusJ45-J4627 |
| COPD | 491,492,496 | J41-J44J40-J4721J41-J4424J41-J4426 |
| RA | 714 - Rheumatoid arthritis and other inflammatory polyarthropathies21 | M05 - Seropositive rheumatoid arthritis21M06 - Other rheumatoid arthritis21 |
| Psoriasis | 696 - Psoriasis and similar disorders | L4021 - Psoriasis |
| Spondyloarthropathies | 720. - Ankylosing spondylitis and other inflammatory spondylopathies | M45-M49 - Spondylopathies |
| Cancer | 140-208, 230–234 | C00-C97 - malignant neoplasms |
| CKD | 585 – Chronic Kidney Disease | N18 - chronic kidney disease |
| Diabetes (type 1 and 2) | 250 | E1021 - type 1 diabetes mellitusE11 - type 2 diabetes mellitus |
| Cerebrovascular Events (MI, stroke) | 430-438 | I60-I6921 - Cerebrovascular diseases |
| Dementia | 290.x331.0-331.2290.X, 294.1, 331.236290.X, 331.0-331.237 | F00 - Dementia in Alzheimer diseaseF01 - Vascular DementiaF02 - Dementia in other diseases classified elsewhereF03 - Unspecified dementiaG30 - Alzheimer’s diseaseF00.x–F03.x, F05.1, G30.x, G31.136F01, F03, G3038 |

## Appendix 7: DIN list for other medications

## DINS are provided in excel files

## Steroids

## File: Appendix 7 – Steroids

## Opioids

## File: Appendix 7 - Steroids

## Directory: T:\DAS\P0970 103 (Amgen) Cost of Osteoporosis Fractures\DCP

**Appendix 8: ICD10 codes for Multiple fractures with corresponding fracture types to be excluded**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Mutiple - ICD10** | **Description** | **Corresponding Fracture type 1** | **Corresponding Fracture type 2** | **Corresponding Fracture type 3** | **Corresponding Fracture type 4** | **Corresponding Fracture type 5** | **Corresponding Fracture type 6** | **Corresponding Fracture type 7** | **Corresponding Fracture type 8** |
| S42.7  |  Multiple fractures of clavicle, scapula and humerus | Humerus/shoulder | S42.0 Fracture of clavicle;S42.1 Fracture of scapula |   |   |   |   |   |   |
| T02.1  |  Fractures involving thorax with lower back and pelvis | Sternum, clavicle & ribs | Vertebral | Pelvis |   |   |   |   |   |
| T02.2  |  Fractures involving multiple regions of one upper limb | Humerus/shoulder | Radius & ulna | Wrist |   |   |   |   |   |
| T02.3  |  Fractures involving multiple regions of one lower limb | Femur | Other (tibia, fibula, knee) |   |   |   |   |   |   |
| T02.4  |  Fractures involving multiple regions of both upper limbs | Humerus/shoulder | Radius & ulna | Wrist |   |   |   |   |   |
| T02.5  |  Fractures involving multiple regions of both lower limbs | Femur | Other (tibia, fibula, knee) |   |   |   |   |   |   |
| T02.6  |  Fractures involving multiple regions of upper limb(s) with lower limb(s) | Humerus/shoulder | Radius & ulna | Wrist | Femur | Other (tibia, fibula, foot) |   |   |   |
| T02.7  |  Fractures involving thorax with lower back and pelvis with limb(s) | Sternum, clavicle & ribs | Vertebral | Pelvis | Humerus/shoulder | Radius & Ulna | Wrist | Femur | Other (tibia, fibula, foot) |
| T02.8  |  Fractures involving other combinations of body regions | Any of the diagnostic codes for fragility fracture | Any of the diagnostic codes for fragility fracture | Any of the diagnostic codes for fragility fracture |   |   |   |   |   |
| T02.9 |  Multiple fractures, unspecified | Any of the diagnostic codes for fragility fracture | Any of the diagnostic codes for fragility fracture | Any of the diagnostic codes for fragility fracture |   |   |   |   |   |